

STATE OF MAINE
Department of Transportation

MaineDOT
**Standard
Specifications**

March 2026

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Standard
Specifications

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DIVISION 100 - GENERAL CONDITIONS

- 100.1 **Replacement of Former Standard Specifications and Standard Details** - This 2025 edition of the Maine Department of Transportation's Standard Specifications and Standard Details for Construction (Standard Specifications) was drafted and adopted by the Department pursuant to the authority granted to it by 23 MRSA § 4243. These Standard Specifications replace and supersede all previous Standard Specifications and Standard Details. The Standard Specifications are Contract provisions issued by the Department that govern the relationship between the Department and the Department's Contractors. By virtue of submitting a Bid on a Project, each Bidder is bound by the terms of these Standard Specifications.

SECTION 101 - CONTRACT INTERPRETATION

Scope of Section This Section consists of abbreviations, definitions, and general rules of interpretation.

- 101.1 **Abbreviations** - Abbreviations are defined in the following list. Abbreviations not defined in this Section or otherwise in the Contract shall have the meaning that is commonly accepted in the engineering and construction industry.

AAN	American Association of Nurserymen, Incorporated
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
AGC	Associated General Contractors of America
AMPP	The Association for Materials Protection and Performance
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
ANLA	American Nursery & Landscape Association
ANSI	American National Standards Institute
ARA	American Railway Association
AREMA	American Railway Engineering and Maintenance-of-way Association
ARTBA	American Road & Transportation Builders Association
ASCE	American Society of Civil Engineers
ASD	Allowable Stress Design
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWWA	American Water Works Association

AWPA	American Wood Protection Association
AWS	American Welding Society
BMP	The Department's "Best Management Practices for Erosion and Sediment Control"
CFR	Code of Federal Regulations
DBE	Disadvantaged Business Enterprise
DREW	Daily Reports of Extra Work
DRB	Dispute Review Board
EIA	Electronic Industries Association
EEO	Equal Employment Opportunity
EMS	Emergency Medical Service
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FSS	Federal Specifications and Standards, General Services Administration
IES	Illuminating Engineering Society
IMSA	International Municipal Signal Association
IPCEA	Insulated Power Cable Engineers Association
ISEE	International Society of Explosives Engineers
ISO	Insurance Services Office
ITE	Institute of Transportation Engineers
LFD	Load Factor Design
LRFD	Load and Resistance Factor Design
LUPC	Land Use Planning Commission - Maine
MCTCB	Maine Concrete Technician Certification Board
MDEP	Maine Department of Environmental Protection
MaineDOT	Maine Department of Transportation
MIL	Military Specifications
MRSA	Maine Revised Statutes Annotated
MUTCD	Manual on Uniform Traffic Control Devices
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NEPCOAT	Northeast Protective Coating Committee
NESC	National Electric Safety Code
NETTCP	New England Transportation Technician Certification Program
NHS	National Highway System
NICET	National Institute for Certification in Engineering Technologies
OJT	On-The-Job Training
OSHA	Occupational Safety and Health Administration
PCI	Precast/Prestressed Concrete Institute
QA	Quality Assurance
QC	Quality Control

QCP	Quality Control Plan
QPL	Qualified Products List
RFI	Request for Information
SAE	Society of Automotive Engineers
SEWPCP	Soil Erosion and Water Pollution Control Plan
SHA	State Highway Agency (as used by FHWA, referring to the Department)
SPCCP	Spill Prevention Control and Countermeasure Plan
TAPPI	Technical Association of Pulp and Paper Industry
TCP	Traffic Control Plan
USC	United States Code
USDA	United States Department of Agriculture
UL	Underwriter's Laboratory
VECP	Value Engineering Change Proposal
WIN	Work Identification Number (sometimes referred to as "PIN" Project Identification Numbers)

101.2 **Definitions** - Certain words, terms, and phrases are defined below. Capitalized words in this Standard Specifications book are defined under this Section. Words, terms, or phrases that are not defined in this Section 101.2 or otherwise in the Contract shall have the meaning commonly accepted in the engineering and construction industry.

Acceptable Work	Work that Conforms or Substantially Conforms to the Contract and is satisfactory to the Department.
Acceptance	Consideration of operations, inspections, samples, tests, certifications, proper QCP implementation, and end product properties to determine whether the product will be accepted for payment, including any adjustments to compensation as provided in the Contract.
Acceptance Test	Test utilized by the Department to evaluate the quality of a Material or product.
Actual Costs	Direct, Project-specific, costs actually incurred by the Contractor in the performance of Work. Actual Costs consist of labor, Material, Equipment, and administrative overhead. For related provisions, see Section 109.7 - Equitable Adjustments to Compensation and Time and Section 109.7.2 - Basis of Payment.
Addendum	See Bid Amendment.
Aggregate	Inert Material such as sand, gravel, broken stone, crushed stone, or a combination of any of these Materials.

Agreement	Agreement means Contract Agreement.
Apparent Low Bidder	A Bidder that submits the lowest apparently responsive Bid. The Apparent Low Bidder may not be Awarded the Contract if: a) the Bid is later found to be non-responsive in accordance with Section 102.11, b) the Bidder is found to be not responsible, c) the Bidder fails to comply with all applicable pre-Award Conditions or other pre-execution requirements of the Contract, or d) the Department chooses not to Award a Contract.
Apparent Successful Bidder	The Bidder with the lowest responsive Bid as determined by the Department. A responsive responsible Bidder, usually the Apparent Low Bidder, that is Awarded the Contract. The Department may not execute the Contract with the Apparent Successful Bidder if: a) the Apparent Successful Bidder fails to comply with all applicable pre-Award conditions or other pre-execution requirements of the Contract or b) if the Department chooses not to Award a Contract.
Award	The execution of the Contract by the Department, conditioned upon the Successful Bidder's performance of all pre-execution requirements of the Bid Documents.
Award Conditions	Pre-Award or pre-execution requirements that the Contractor must meet before Contract Execution, including bonding and insurance. For a related provision, see Section 103.5 - Award Conditions.
Best Value Procurement Process Using a Request for Proposals	A process for procuring contractual services in which price is only one of several factors used in determining the successful Proposer. See Proposer, Request for Proposals, and Design-Build Contract.
Bid	The offer by a Bidder on forms prescribed by the Department to perform the Work in Conformity with all provisions of the Bid Documents for the price(s) set forth.

Bid Amendment	A written change to the Bid Documents issued by the Department after advertisement and before the Bid Opening.
Bid Bond	A bond furnished with a Bid by a Bidder and its Surety in the amount set forth in the Notice to Contractors or elsewhere in the Bid Documents. The Bid Bond is forfeited if the Apparent Low Bidder refuses to enter into a Contract with the Department.
Bid Contact Person	The person identified in the advertised Notice to Contractors, usually the Project Manager, as the person to whom the Bidder must refer technical or Engineering questions from the time of advertisement through Contract Execution, said person being duly authorized by the Commissioner. The Contracts Engineer may be contacted regarding Bidding and contracting procedures. If no one is so identified, the Bidder must refer questions to the Contracts Engineer. All technical or Project specific questions must be submitted as described in the Notice to Contractors.
Bidder	An individual, firm, corporation, limited liability company, partnership, joint venture, sole proprietorship, or other entity that submits a Bid. Upon Contract Execution, the successful Bidder becomes the Contractor.
Bid Documents	Documents issued by the Department to solicit Bids from Contractors. Bid Documents generally include the Project Specific Bid Book, Notice to Contractors, Plans and Specifications (including these Standard Specifications), Standard Details, Special Provisions, Bidding instructions, and any Bid Amendments issued by the Department. Documents attached to or referenced in the Bid Documents are part of the Bid Documents. Contrast “Bid Documents” with “Bid Escrow Documentation” as may be defined by Special Provision.
Bid Escrow Documentation	All writings, working papers, computer printouts, charts, schedules of prices, and data compilation that contain or reflect information, quantities, unit costs, data, or calculations used by the Bidder to determine the Bid price, or technical and price proposal in the case of a Design-Build or Best Value Procurement type

of Contract, shall be submitted, including but not limited to material relating to the determination and application of:

- Design Costs
- Equipment rates
- Overhead rates and related time schedules
- Labor rates
- Arithmetic extensions
- Subcontractor and Material Supplier Quotations

Any manuals standard to the industry used by the Bidder in determining the Bid are also considered Bid Escrow Documentation. These manuals may be included in the Bid Escrow Documentation by reference and shall show the name and date of the publication and the publisher. Bid Escrow Documentation need not include Bid Documents provided by the Department to all Bidders.

Bid Guaranty

A bond or other acceptable security specified in the Notice to Contractors or elsewhere in the Bid Documents that is forfeited if the Apparent Low Bidder refuses to enter into a Contract with the Department. For a related provision, see Section 102.6 - Bid Guaranty.

Bid Opening

The date and precise time by which the Bidder must Deliver its Bid to be publicly opened and read as specified in the Notice to Contractors or any applicable Bid Amendment. For related provisions, see Sections 102.7 - Delivery of Bids and 102.9 - Bid Opening.

Blue Book

The edition of publications entitled “Rental Rate Blue Book for Construction Equipment” or “Rental Rate Blue Book for Older Construction Equipment,” as applicable, published by Primedia Information Inc., that was current when the Work being priced was performed.

Bridge

A structure that is erected over a depression or an obstruction, such as water, a highway or a railway, and has an opening measured along the centerline of the Roadway of more than 20 ft between: the faces of abutments; spring line of arches; extreme ends of openings of box culverts, pipes or pipe arches; or the

extreme ends of openings for multiple box culverts, pipes, or pipe arches.

- A. **Length** - The length of a Bridge structure is the overall length measured along the construction centerline back to back of backwalls of abutments, if present; otherwise end to end of the Bridge floor; but in no case less than the total opening of the structure.
- B. **Roadway Width** - The width measured at right angles to the longitudinal centerline of the Bridge between the bottom of curbs or guard timbers or in case of multiple heights of curbs, between the bottoms of the lower risers.

Business Day	Every Calendar Day other than Saturdays, Sundays, and Holidays.
Calendar Day	Every day shown on the calendar, beginning at 12:01 a.m. and ending at midnight.
Change Order	See Contract Modification.
Chief Engineer	The Chief Engineer of the Department.
Closeout Documentation	All documentation required by the Department to finish the Project in accordance with State, federal, and other requirements. These documents include: • Letter “All Bills Paid” on Contractor’s letterhead • Request for Final Payment on Contractor’s letterhead • “Buy America” Statement • Certificate of Materials • DBE Goal Attainment Verification Form • Agreement with Final Quantities on Contractor’s letterhead • Testing Compliance Letter The Department reserves the right to amend this list of required Closeout Documentation
Commissioner	The Commissioner of Transportation established by 23 MRSA § 4205.
Compensable Delay	See Section 109.5.1 - Definitions - Types of Delays.
Completion	Completion occurs when the Contractor has finished all Work pursuant to the Contract, including Delivery of all Closeout Documentation. Completion does not

mean substantial Completion. Unless the context indicates otherwise, Completion also does not mean Completion of Physical Work.

Completion of Physical Work

Completion of Physical Work occurs when the Work is complete and has undergone a successful final inspection.

Conduit

A pipe used for receiving and protecting wires or cable.

Conform or Conformity

The performance of an item of Work in strict compliance with all applicable provisions of the Contract. For a related definition, see Substantially Conform.

Construction Easement

A right acquired by the Department for a specific use of private property outside of the established Right-of-Way. Examples include but are not limited to Drainage Easements, Construction and Maintenance Easements, and Slope Easements. Construction Easement areas, including Temporary Construction Limits and Temporary Road Limits, outside of the Right-of-Way remain private property. No use other than to access and perform the specified work activity is permitted without written permission of the owner.

Contract

All documents affecting the respective rights and responsibilities of the Department and the Contractor. These documents include, but are not limited to, the Contract Agreement, Project Specific Bid Book, the Notice to Contractors, Plans, the Department's Standard Specifications and Standard Details, Special Provisions, Bid Amendments, Contract Modifications, Geotechnical Information, Permits, Bid Escrow Documentation (if any), the Contractor's Bid prices (as corrected mathematically pursuant to Section 103.1.1 - Unit Prices Govern, if necessary), and all documents incorporated by reference.

Contract Bonds

The forms of security approved by the Department, executed by the Contractor and its Surety or Sureties, guaranteeing performance of the Work, and the payment of all obligations pertaining to the Work. For related provisions, see the definitions of Bid Guaranty, Performance Bond, and Payment Bond.

Contract Completion Time

Length of time allowed under the Contract to complete the Work pursuant to the terms of the Contract.

Contract Completion Date

The required completion date of all Work pursuant to the Contract, except the landscape establishment period and warranty work. The Contract Completion Date is usually included in Special Provision 107 and on the Contract Agreement, Offer, & Award form.

Contract Documents

Contract Documents are all documents, whether physically attached or incorporated by reference, which make up the Contract.

Contract Execution

Execution of the Contract by the Commissioner or his or her authorized agent by signing the Contract Agreement, Offer, & Award form, which action, upon written notification to the Contractor, forms a Contract as provided in Section 103.8 - Execution of Contract by Department.

Contract Modification

A general term describing a formal change to a Contract. Types of Contract Modifications include: change orders, extra work orders, resident work orders, and supplemental agreements. For a related provision, see Section 109.8 - Contract Modification.

Contract Time

See Contract Completion Time and Section 107.1 - Contract Time and Completion Date.

Contractor

After the Department has executed the Contract by cosigning the "Contract Agreement, Offer, & Award" form provided in the Bid Documents, previously signed by the successful Bidder, the Successful Bidder in a low Bid process or the successful Proposer in a best value type of Contract becomes the Contractor. The Contractor will be the single point of responsibility for all Contract obligations to the Department. The Contractor shall be an independent Contractor with respect to the Department and shall not be an employee, agent, or representative of the Department.

Critical Path

The sequence of activities from the Project start to its Completion having the greatest cumulative elapsed time, thereby determining the minimum time duration of the entire Project. The Critical Path is identified by the sequence of those activities with the least float.

Critical Rock Slopes	Critical rock slopes shall be rock slopes higher than 6 ft with an overburden slope steeper than 3H:1V and all rock slopes greater than 10 ft high.
Culvert	Any structure not defined as a Large Culvert, Bridge, or Minor Span that provides a Drainage opening less than 5 ft, under the Roadway or approaches to the Roadway.
Day or Days	See Calendar Days.
Default	See Section 112.1 - Default.
Defects or Defective Work	Work that is unsatisfactory, faulty, or deficient in that it is not in Conformity with the Contract or with prevailing industry standards applicable to the Work at the time of submission of the Bid as determined by the Department or its agents. For related provisions, see the definition of Acceptable Work and Section - 101.3.1 Meaning of "Approved," etc.
Delay	To cause to be late. See Section 109.5 - Adjustments for Delay.
Deliver	To cause Receipt by a means set forth in the definition of Received or Receipt.
Department	The Department of Transportation of the State of Maine, as established by 23 MRSA § 4205, et seq., for the administration of Highway, Bridge, and other public Works, acting through the Commissioner and his/her duly authorized representatives. For related provisions, see definitions of Project Manager and Resident.
Design-Build Contract	A Contract in which the Contractor is responsible for both design and construction requirements under the Contract. In a Design-Build Contract, the Contractor maybe procured through a Best-Value Procurement process using a Request for Proposals and evaluation of submitted Proposals using price as one of several evaluation factors as outlined in 23 MRSA § 4244.
Differing Site Conditions	See Section 109.4 - Differing Site Conditions.
Disadvantaged Business Enterprise	A business that is at least 51% owned and controlled by a woman, minority, or economically disadvantaged person and certified as such by the Department.

Disputes	Disagreements, claims, counterclaims, matters in question, and differences of opinion between the Department and the Contractor and those Working for or through the Contractor regarding matters related to the Work that arise after Contract Execution. These include, but are not limited to, interpretation of the Contract, compensation and costs, time for performance, and quality.
Drainage	The system of pipes, Drainage ways, ditches, and Structures by which surface or subsurface waters are collected and conducted from the Highway area.
Drawings	See Plans.
Dredge Material (Dredge Spoils)	Sand, silt, mud, gravel, rock or other sediment or material removed from beneath any surface water. The term, “beneath any surface water,” has been interpreted by the MDEP to mean that area that falls beneath the plane bounded by the normal high water line of any stream, river, brook, pond, lake, vernal pool, etc. Note that the entire area of Dredge Material removal could be dry at the time of excavation.
Environmental Information	Hazardous waste assessments, dredge material test results, boring logs, geophysical studies, and other records and reports of the environmental conditions. For a related provision, see Section 104.3.14 - Interpretation and Interpolation.
Equipment	All machinery, supplies for repair and maintenance of such machinery, tools, and other apparatus necessary or appropriate for Completion of the Work in Conformity with the Contract.
Equitable Adjustment	An adjustment to compensation and time due to a change in the nature or scope of the Work made a part of a Contract by a formal Contract Modification. For a related provision, see Section 109.7 - Equitable Adjustments to Compensation and Time.
Excusable Delay	See Section 109.5.1 - Definitions - Types of Delays.
Extra Work	Work that is outside the scope of the Contract and that the Department determines is necessary.
Extra Work Order	See Contract Modification.

Fabrication Engineer	The Department's representative responsible for Quality Assurance of pre-fabricated products that are produced off-site.
Federal Contract Provisions Supplement	Appendix A of the Standard Specifications and the Project Specific Bid Book, which sets forth additional provisions that apply to federally funded Contracts.
Final Acceptance	Acceptance by the Department for all Work and responsibility for the Project from the Contractor, except for any Contractor warranty obligations.
Force Account Work	Prescribed Work paid on the basis of Actual Costs and additives as set forth in Section 109.7.5 - Force Account Work.
Geometrics	The physical location (horizontally and vertically) and shape of the object under consideration.
Geotechnical Information	Boring logs, soil reports, geotechnical design reports, ground penetrating radar evaluations, seismic refraction studies, and other records of subsurface conditions. For a related provision, see Section 104.3.14 - Interpretation and Interpolation.
Haul Road	A private way leading to a public way that is used by the Contractor to move Equipment and Materials related to the Work.
Hearing	Unless otherwise specified by the Department in writing, a Hearing is a review of a decision that includes a review of existing documentation on file with the Department and any additional documentation, including written arguments and supporting exhibits that may be submitted by any interested party. Unless the context clearly indicates otherwise, a Hearing need not include an evidentiary Hearing for the oral presentation of evidence if such an evidentiary Hearing is not requested or if the Department reasonably determines that such an evidentiary Hearing is not necessary to adequately review the matter at issue. Unless the context clearly indicates otherwise, a Hearing shall not be construed as an adjudicatory proceeding within the meaning of the Maine Administrative Procedure Act.

Highway	A general term denoting a public way for purposes of vehicular travel, including the entire area within the Right-of-Way.
Holidays	New Years Day, Martin Luther King Day, Presidents Day, Patriots Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Indigenous Peoples Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. For a related provision, see Section 107.3.3 - Sundays and Holidays.
Incentive/Disincentive Payment	An adjustment to the Contract price of a predetermined amount for each Day the Work is completed ahead of or behind the Contract Time, Contract Completion Date, or some specified intermediary milestone. A disincentive is not a penalty, but an estimate of user and other costs incurred by the people of the State of Maine.
Incidentals	The terms “Incidentals” and “Incidental to the Contract” mean items that are accessory to or incorporated into the Work and that have no separate Pay Item. Unless otherwise provided in the Contract, the cost of Incidentals shall be included in the Contractor’s prices for the Pay Items. There will be no separate payment for Incidentals.
Incomplete	Not complete, as defined above by Completion.
Independent Assurance (IA)	Independent assessment of the reliability of test results obtained from Acceptance Testing.
Inexcusable Delay	See Section 109.5.1 - Definitions - Types of Delays.
Inspector	An authorized representative of the Resident assigned to make detailed inspections of the Work to determine compliance with the Contract.
In Stream Work	Any activities conducted in the water (see permits in individual Contract documents.)
Laboratory	Unless the context indicates otherwise, the testing laboratory of the Department or its designee.
Landscape Establishment Period	The period of time commencing at initial Acceptance of each planting and extending for 2 years, unless

otherwise provided in the Contract. For a related provision, see Section 621 - Landscaping.

Landscape Establishment Period Obligations

The obligations of the Landscape Subcontractor during the Landscape Establishment Period. Unless otherwise provided in the Contract, these obligations consist of monthly inspection and reporting from March through November of the condition of all plants installed and replacing plants that are not in a healthy, vigorous growing condition. For a related provision, see Section 621 - Landscaping.

Landscape Items Items starting with the number “621” in the Schedule of Items.

Landscape Subcontractor

The individual or firm performing Landscape Items, generally a Subcontractor.

Lane A strip of Roadway intended to accommodate a single line of vehicles.

Large Culvert Any structure not defined as a Culvert or Bridge that provides a drainage or non-drainage opening under the Roadway or Approaches to the Roadway, with an opening that is at least 5 ft but less than 10 ft.

Liquidated Damages An amount due and payable to the Department by the Contractor, normally realized through a reduction of amounts to be paid to the Contractor. Liquidated Damages are calculated by multiplying a daily amount set forth in the Contract by the number of Days the Work remains Incomplete after the Contract Completion Time has expired.

Major Item An individual Pay Item that constitutes 10% or more of the amount of the Awarded Contract, calculated using the Contractor's Bid prices and the estimated quantities contained in the Bid Documents.

Material Any substance specified for use in the construction of the Project and related approaches.

Minor Item All Pay Items that are not Major Items.

Minor Span Same definition as Bridge, except having an opening of between 10 ft and 20 ft, inclusive.

Modification See Contract Modification.

National Highway System (NHS)

A system of Interstate Highways and major collectors specifically designated by the Federal Highway Administration. It includes the Interstate System, other urban and rural principal arterials, highways that provide motor vehicle access between the NHS and major intermodal transportation facilities, the defense strategic highway network, and strategic highway network connectors.

Non-conforming Work All Defective, Unauthorized, or Uninspected Work.

Notice of Award A written notice to the Contractor stating that the Contract has been executed.

Notice of Intent to Award A written notice to the Successful Bidder stating that the Department has conditionally accepted its offer and upon receipt of a payment bond, performance bond, insurance certificate and the fulfillment of any other pre-award conditions, the Contract will be signed (executed) by the Department. For a related provision, see Section 103.4 - Notice of Award.

Notice to Contractors The advertisement or invitation for Bids published in accordance with Maine law, including electronic advertising, applicable to the Department.

Offer A response to a solicitation that, if accepted, would bind the offeror to perform the resultant Contract. Submission of a Bid constitutes an Offer by the Bidder.

Order A directive from the Department requiring compliance by the Contractor.

Owner The legal or record Owner of the building or Premises on which the Project is to be constructed, generally the State of Maine acting by and through the Department.

Partnering See Section 104.4.1 - Partnering.

Pavement Structure	The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed. A. Base Course - One or more layers of specified Material thickness placed on a subbase or a subgrade to support a surface course. B. Subbase - Layers of specified Material thickness placed on a subgrade to support a base course. C. Surface Course - The top layer(s) of a Pavement Structure designed to accommodate the traffic load, resist skidding, traffic abrasion, and the disintegrating effects of climate. This layer is sometimes called the “Wearing Course.”
Pay Item	An item of Work set forth in the Schedule of Items for which the Contractor must provide a price.
Payment Bond	The security furnished by the Contractor and its Surety to guarantee payment of all obligations incurred by the Contractor related to the Contract. For a related provision, see Section 110.2.1 - Bonds.
Performance Bond	The security furnished by the Contractor and its Surety to guarantee performance of the Work in Conformity with the Contract. For a related provision, see Section 110.2.1 - Bonds.
Permits	Permits granted to the Department for the Project. Permits often required include: (a) environmental Permits, including Natural Resources Protection Act (NRPA) Permits from MDEP, and the Army Corps of Engineers, and (b) a U.S. Coast Guard Permit.
Physical Work	All Work specified in the Contract that affects the physical environment, including all Work within the Project Limits, final cleaning up and finishing, and Completion of Punch List Items as provided in Section 107.9 - Project Closeout, and removal of traffic control devices.
Plans	When the context so indicates, “Plans” mean applicable construction drawings, including plan, profile, typical cross sections, Working Drawings, and supplemental Drawings or exact reproductions thereof or electronically displayed equivalents, that show the location, character, dimensions, and details of the

Work. Where the context so indicates, “Plan” may also mean a detailed process, program, or method worked out beforehand for the accomplishment of an objective. Examples include QCP, the SEWPCP, the TCP, Safety Plan, and Project specific emergency planning.

Premises Land of the Owner on which the building or buildings now stand or to which they are to be moved.

Prequalification Application

The Contractor’s Prequalification Application form submitted by the Contractor, which is to be used to request prequalification and provide information that the Department will rely upon to determine the responsibility and qualifications of a Contractor. Said form is available through the Department’s Contracts Section and the Departmental webpage.

Prequalification Procedure

The current procedure and requirements contained in the Contractor’s Prequalification Procedure first adopted by the Department in April 1998 and administered through the Department’s Contracts Section.

Process Control Test Test performed at the source of supply of Material to determine whether the Material meets the Specification prior to Delivery.

Profile Grade The trace of a vertical plane intersecting the top of the wearing surface, usually along the longitudinal centerline of the roadbed. Profile Grade means either elevation or gradient of such trace, according to the context.

Program The specific working unit within the Department’s Bureaus of Project Development and Maintenance & Operations within which a particular Department Project is developed, designed, constructed and administered. Such Programs include the Highway Program, Bridge Program, Multimodal Program and other similar Units.

Progress Meeting See Section 104.4.3 - Progress Meetings.

Project The Bridge, Highway, railroad, pier, airport, building, bike path, pedestrian path, or other infrastructure improvement being constructed, rehabilitated, or

	repaired, together with all appurtenances and Incidentals.
Project Limits	Areas within the Right-of-Way, Construction Easements, or Temporary Construction Limits shown on the Plans or otherwise indicated in the Contract. If no Project Limits are indicated in the Contract, the Project Limits shall be determined by the Department. For a related Maine statute, see 23 MRSA § 653.
Project Manager	The Department's duly authorized representative for overall coordination of the Project.
Project Records	Records or data of any type on any media, including those produced by the Contractor or its consultants, Subcontractors, suppliers, or manufacturers that are related to the Project. Project Records include, but are not limited to, Plans, Working Drawings, Specifications, manufacturer's recommendations, catalog cuts, daily time reports, records of Force Account Work, schedules and scheduled updates or revisions, quality control Plans and related documentation, inspectors' reports, traffic control Plans and log, safety program and incident reports, soil erosion and water pollution control Plans and log, employment records, payrolls, internal accounting records, equal opportunity and affirmative action records, on-the-job and Disadvantaged Business Enterprise reports, preconstruction conference records, Progress Meeting records, Partnering records, correspondence, e-mails, and any other documents related to the Work.
Proposal	The response to a Request for Proposals. Proposals will normally be requested for anticipated Best Value procurements. See Design-Build, Request for Proposal and Best Value Procurement. In another context, sometimes the Department's solicitation for bids is called a Bid Proposal.
Proposer	The entity submitting a Proposal.
Punch List	See Sections 107.9.2 - Notice/Inspection/Punch List and 107.9.3 - Notices/ Final Inspections/Physical Work Completion.

Quality Assurance (QA) All planned and systematic operations to ensure that the operation, material, and/or end product meets Specifications. Quality Assurance includes:

- A. approval and oversight of the Contractor's Quality Control Plan
- B. review of inspector, sampler, tester, and Laboratory qualifications
- C. inspection for Conformity with Contract requirements
- D. Contractor Quality Control
- E. Acceptance Testing
- F. Independent Assurance

Quality Control (QC) Planned and specified actions or operations necessary to produce an end product that Conforms to the quality requirements of the Contract. Unless otherwise specified, QC includes inspection and testing for process control to the extent determined necessary by the Contractor. Quality Control is also referred to as Process Control.

Quality Control Plan (QCP)

The program and documentation of that program, approved by the Department, which specify the actions, inspection, sampling, and testing necessary to keep production and placement operations within Specifications, including provisions to quickly determine when an operation becomes out of control and those actions that the Contractor will take to restore compliance.

Receipted Bill

Written Evidence provided by the Contractor that the cost of materials has actually been paid by the Contractor. This could take the form of a copy of a cancelled check, a copy of an invoice with written verification from the Subcontractor that the bill has been paid, or a written declaration from the Subcontractor, on its letterhead, that the bill has been paid.

Received or Receipt	Unless specified otherwise, Receipt by regular US mail, overnight courier, service in hand, by fax, or electronic transmission with confirmation of Receipt originating from the recipient (which may be a telephone confirmation) will be considered Received. If delivered by regular US mail, notices that are properly addressed will be deemed Received 3 Days after mailing, unless the recipient admits earlier Receipt, in which case Receipt will be the date admitted.
Reference Stake	A stake set beyond the proposed grading areas for use as a control for the new construction.
Related Entities	All general partners, joint venturers, parent firms, subsidiaries, or sister firms that are owned or controlled by the Bidder or other entity under consideration.
Request for Proposal	The Department's solicitation in a Best Value Procurement Process for Proposals, such as when soliciting for an anticipated Design-Build Contract. See Proposal and Best Value Procurement Process.
Resident	The Department's on-site representative.
Resident Work Order	See Contract Modification.
Right-of-Way	The area of land, property, or interest therein, acquired for or devoted to the Project or other purposes. Portions of the Right-of-Way may be used for storage of materials and equipment and the location of engineering facilities, subject to written approval by the Department.
Road	A general term denoting a public way for purposes of vehicular travel, including the entire area within the Right-of-Way.
Roadbed	The graded portion of a Highway within top and side slopes, prepared as a foundation for the Pavement Structure and Shoulders.
Roadside	A general term denoting the area adjoining the outer edge of the Roadway. Extensive areas between the Roadways of a divided Highway may also be considered Roadside.

Roadside Development	Those items necessary to complete the Highway that provide for the preservation of landscape Materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching, and the placing of other ground covers; and such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the Highway.
Roadway	The portion of a Highway, including Shoulders, for vehicular use. A divided Highway has two or more Roadways.
Schedule of Items	A document containing the list of items of Work provided in the Bid Documents on which the Contractor provides prices. The Schedule of Items is a Special Provision.
Schedule of Work	A written Work schedule submitted and maintained by the Contractor by which the Contractor Plans and prosecutes the Work. The Schedule of Work contains dates of commencement and Completion of various items of Work within the Contract Time and all authorized extensions. For a related provision, see Section 107.4.2 - Schedule of Work Required.
Shop Drawings	See Working Drawings.
Shoulder	The portion of the Road or Roadway that is contiguous with the traveled Way and that is provided for accommodation of stopped vehicles, emergency use, and lateral support of base and surface courses.
Sidewalk	A way constructed primarily for the use of pedestrians.
Skew or Skew Angle	The acute angle formed by the intersection of the line normal to the centerline of the Roadway or the Working line of the Superstructure with a line parallel to the face of the Substructure or, in the case of structural plate units and Culverts, with the centerline of the structural plate units and Culverts.
Special Provision	Revisions to the Standard and/or Supplemental Specifications applicable to an individual Project or Contract.
Specifications	A written or electronic textual compilation of provisions and requirements for the performance of the Work, including incorporations by reference.

Standard Details	Detailed Drawings published and approved by the Department for general application and repetitive use.
Standard Specifications	Maine Department of Transportation Standard Specifications and Standard Details for Construction Revision of 2020, which were published and approved by the Department pursuant to 23 MRSA § 4243 for general application and repetitive use on Projects.
State	The State of Maine acting through its authorized agencies and representatives.
Street	A general term denoting a public way for purposes of vehicular travel, including the entire area within the Right-of-Way.
Structures	Bridges, Culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, endwalls, buildings, sewers, services pipes, underdrains, foundation drains, and other manufactured features.
Strut	See Large Culvert.
Subcontractor	An individual, firm, corporation, limited liability company, partnership, joint venture, sole proprietorship, or any other entity to whom the Contractor Subcontracts a portion of the Work. A Subcontracting arrangement shall be considered to exist when a person or firm assumes obligation through a written Contract with the Contractor for performing part of the Work using its own Equipment and workers, procuring its own Materials and supplies, and furnishing its own supervision with only general overall supervision being exercised by the Contractor or higher tier Subcontractors. Unless the context indicates otherwise, Subcontractors include suppliers, vendors, fabricators, and any other entities with which the Contractor contracts to perform any portion of the Work.
Subgrade	The top surface of a Roadbed upon which the Pavement Structure, Shoulders, and curbs are constructed.
Subgrade Treatment	Modification of Roadbed Material by stabilization.
Substantially Conform or Substantial Conformity	Substantially Conform or Substantial Conformity means that the Work at issue, though not in strict accordance with the Plans, Specifications, or other

	Contract requirements, Conforms sufficiently to the applicable standard such that it may be acceptable to the Department (possibly with a credit to the Department) and not require removal, as determined by the Department. For a related definition, see Conformity. For a related provision, see Section 106.8.1 - Substantially Conforming Work.
Substructure	All of that part of the Structure below the bearings of simple and continuous spans, skewbacks of arches, and tops of footings of rigid frames, together with the backwalls, parapets, and wingwalls of abutments.
Successful Bidder	The low, responsive, responsible Bidder to whom the Department intends to award the Contract. This status is evidenced by a "Notice of Intent to Award" Letter sent to the Successful Bidder.
Superintendent	The Contractor's authorized on-site representative who is in charge of and responsible for the Work.
Superstructure	Excluding backwalls, wingwalls, and wing protection railing, the portion of the Structure above the bearings of simple and continuous spans, the skewbacks of arches, and the top of footings of rigid frames.
Supplemental Liquidated Damages	Liquidated Damages for additional costs resulting from Contractor's failure to complete a specific Work item, phase, or milestone within the time specified in the Contract for that item. Supplemental Liquidated Damages are in addition to and separate and distinct from Liquidated Damages.
Supplemental Specifications	Approved additions or modifications to the Standard Specifications.
Supplemental Standard Details	Approved additions or modifications to the Standard Details.
Surety	The corporation, limited liability company, partnership, or individual, or other entity, other than the Contractor, that executes or is obligated under a Contract Bond or Bid Bond.

Temporary Construction

The area within which the Contractor may access and perform the Physical Work and outside of which Work may not be performed without written authorization by the property owner.

Temporary Road Limits The area within which the Contractor may construct and maintain a temporary detour for maintenance of traffic.

Traveled Way The portion of the Roadway that is intended for the movement of vehicles, exclusive of Shoulders and auxiliary Lanes.

Unacceptable Work All Work that does not Substantially Conform to the Contract as determined by the Department.

Unauthorized Work Work performed without providing the Resident with reasonable notice of the date and time that the Work is to be performed, Work performed contrary to the instructions of the Department, or any Extra Work performed without written Contract Modification or Agreement. For a related provision, see Section 106.8.3 - Unauthorized Work.

Uncontrollable Events Events or acts that were unforeseeable at the time of Bid submission and that were beyond the Contractor's control in that the risk of the event or act could not have been prevented or managed by the Contractor with proper planning, coordination, Subcontractor management, insurance, bonding, maintenance, erosion control, traffic control, security precautions, workers or Equipment. Uncontrollable Events are of two types:

- A. severe weather events that meet the requirements of the first sentence of this definition and/or
- B. non-weather events that meet the requirements of the first sentence of this definition which might include acts by foreign enemy, quarantine restrictions, strikes not involving the Contractor, action or inaction by governmental authorities, action or inaction by Utility Companies or other third parties (not Subcontractors) working on Project related Work within the Project Limits, and freight embargoes. Uncontrollable Events specifically do not include: fires (unless caused

by a weather event described in this definition above), acts by other third parties, including vandals and members of the traveling public, non-performance of Subcontractors (except in cases of unforeseeable, permanent, and complete cessation of all operations by the Subcontractor for reasons unrelated to the Contractor), and difficult, but foreseeable weather for the location and time of the Work, including but not limited to cold, snow, and ice in the winter, flooding caused by snow melt and rain in the spring, rain in the fall, and thunderstorms in the summer.

Uninspected Work	Work that was performed without inspection by the Department.
Unit Price	The price for one unit of Work submitted by the Bidder in its Bid.
Utility Companies	All persons or entities set forth in 35-A MRSA § 2501(2).
Utility Facilities	All Structures, facilities, Equipment, and all appurtenances thereto used by Utility Companies, including, but not limited to, poles, wires, support poles, guys, anchors, water pipelines, sewer pipelines, gas pipelines, all other pipelines, fire alarms, service connections, meter boxes, valve boxes, light standards, cableways, Conduits, signals, and manholes.
Value Engineering Change Proposal	See Section 109.6 - Value Engineering.
Wetlands	Areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.
Winter Suspensions	See Section 107.5.1 - Winter Suspensions.
Work	All labor, services, personnel, Materials, Equipment, tools, supplies, and Incidentals required or indicated by the Contract in Conformity with the same. For a related provision, see Section 105.1 - Intent of the Contract.

Weather Event Any precipitation, such as rain, sleet, snow, or fog that causes wet pavement that prevents the Contractor from completing work within the Construction Limits as determined by the Department. This excludes ambient air temperatures below Specification.

Weather Dependent Activities

Contractor scheduled work that cannot be completed should a Weather Event occur. Paving or other activities as determined by the Department will be considered Weather Dependent Activities.

Working Day

Any Calendar Day except:

- Identified non-Work Days in the Contract Special Provision 107
- Saturdays, Sundays and Holidays – as outlined in Section 107.3.3
- The period from November 15th to April 15th, inclusive

Any Day a Weather Event prevents the Contractor from performing at least 7 hours of weather dependent activities, as determined by the Department. Up to a 3 hour hold prior to the start of work may be required if weather conditions are uncertain.

The Contractor may request, in writing, a non-Working Day due to a Weather Event up to 16 hours in advance of the normal start time. The Department may approve this request depending on the certainty of the forecast.

If the Contractor elects to work a Saturday, an allowable Holiday, or receives approval to work Sunday, the same process will be utilized to determine if it is a Working Day.

If the Contractor requests approval to work Saturday and does not cancel their request by Thursday at the end of shift, that Saturday will be considered a Working Day regardless of the actual weather conditions and whether work occurred.

Working Drawings

Plans, sketches, or Drawings provided by the Contractor, or its Subcontractors, vendors, or fabricators for the purpose of supplementing the Plans provided in the Bid Documents and being necessary to demonstrate that the Work will comply with the Contract and meet the intent of the Contract. Working

Drawings shall be of sufficient detail to meet the purpose set forth in the preceding sentence. Examples include Shop drawings, erection Plans, falsework Plans, cofferdam Plans, and bending diagrams for reinforcing steel.

Work Order See Contract Modification.

101.3 **General Rules of Interpretation**

- 101.3.1 **Meaning of “Approved,” Etc.** - Unless the Contract clearly indicates otherwise, whenever anything is to be done or is not to be done unless “approved,” “accepted,” “authorized,” “ordered,” “required,” “determined,” “directed,” “specified,” “designated,” “established,” “suitable,” “satisfactory,” “sufficient,” “unacceptable,” or a similar word or phrase, the word or phrase shall be interpreted as if it were followed by the words “by the Department” or “to the Department” as applicable.
- 101.3.2 **Referenced Publications** - The Contractor is responsible for obtaining all manuals, Specifications, reference guides, or other publications referenced or indicated by the Contract and performing the Work in Conformity with the same. Unless a specific date or version is specified, the Contractor shall use the most recent version of such publication that existed at the time the Bid was submitted.
- 101.3.3 **Cross References** - Cross-references are sometimes provided in the Contract. (Example: “For a related provision, see Section ___”). These cross-references are provided for convenience only and are not a comprehensive listing of related Sections. The lack of a cross-reference or an incorrect reference shall not be interpreted as indicating that there are no related provisions and does not relieve the parties of the obligation to read the Contract as a whole.
- 101.3.4 **Headings and Tables of Contents** - All headings, indices, titles, and tables of contents are for convenience only. They do not control interpretation and do not relieve the parties of the obligation to read the Bid Documents or Contract as a whole.
- 101.3.5 **Calculated Dimensions Control** - In the case of discrepancy between calculated dimensions and scaled dimensions, calculated dimensions shall control.
- 101.3.6 **Priority of Conflicting Contract Documents** - If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy (“ambiguity, etc.”) related to the Contract Documents that may significantly affect the cost, quality, Conformity, or timeliness of the Work, The Contractor must comply with Section 104.3.3 - Duty to Notify Department If Ambiguities Discovered. In the case of ambiguity,

etc., the following components of the Contract Documents shall control in the following descending order of priority:

- Bid Amendments (most recent to least recent)
- Project Specific Permit Requirements
- Special Provisions
- Notes on Plans
- Plans
- Supplemental Specifications
- Supplemental Standard Details
- Standard Specifications
- Standard Details

101.3.7 **Multiple Pay Items** - When there is more than one Pay Item for similar Work governed by one Specification, the item number in the Specification may be appended with additional digits to differentiate such multiple Pay Items. For example, Specification item 900.06 also covers Pay Items 900.061, 900.062, 900.0601, and 900.0602, etc. unless the context clearly indicates otherwise.

SECTION 102 - BIDDING

Scope of Section This Section includes requirements related to eligibility to Bid and the Bidding process from advertisement for Bids, through Bid Opening, to the analysis of Bids.

102.1 Eligibility to Bid

102.1.1 **Basic Requirements** - To be eligible to Bid, prospective Bidders must (A) not have been debarred or suspended from Bidding, and (B) not be in Default with respect to any outstanding Contract with the Department, unless the Department grants written permission to Bid despite such Default. For related provisions, see Sections 102.9 - Bid Opening and 103.3 - Post-Bid Qualification.

102.1.2 **Suspension from Bidding** - The Department may suspend the right of a Contractor to submit Bids as the general Contractor on construction Projects being developed by the Department's Bureau of Project Development for up to 2 years pursuant to Department's "Rules Regarding Suspension from Bidding."

102.1.3 **Debarment** - The Department may debar a Contractor from Bidding, Subcontracting, or being employed in any capacity regarding any Project administered by the Department pursuant to "Rules Regarding Debarment of Contractors", Department Register 17-229, Chapter 102 (October 2, 1985).

- 102.2 **Advertisement - Notice to Contractors** - A Notice to Contractors will provide a solicitation or an invitation to bid and be advertised in printed or electronic media pursuant to Maine law. Such Notice will contain a brief and general description of the nature and location of the Work and information about how to Bid and how to provide any prequalification requirements.
- 102.3 **Examinations of Documents, Site and Other Information** - Before submitting a Bid, the Bidder is responsible for:
- (A) obtaining and examining the Plans, Specifications, all Bid Amendments, and all other Bid Documents;
 - (B) examining the Geotechnical Information and all other information provided or referenced in the Bid Documents;
 - (C) examining the site(s) of Work and making other examinations and investigations that are needed to Make the Bidder fully aware of the conditions that would be encountered in performing the Work, and
 - (D) communicating with the Department as provided in Section 102.5 - Communication Before Bid Opening. For a related provision, see Section 102.7.2 - Effects of Signing and Delivery of Bid.
- 102.3.1 **Geotechnical Information** - Bidders and Contractors are obligated to examine and, if necessary, obtain any additional available geotechnical information. If one is available, the Project geotechnical report may be accessed at the Department's web site.
- The Department shall not be responsible for the Bidders' and Contractors' interpretations of or estimates or conclusions drawn from the Geotechnical Information. Data provided may not be representative of the subsurface conditions between the boring locations.
- This section does not diminish the duties imposed upon parties in Section 102 or in any other sections.
- 102.4 **Estimated Quantities** - Quantities shown in the Bid Documents are estimates, only to be used for the preparation and comparison of Bids. For related provisions, see Sections 109.1- Changes in Quantities and 109.2 - Elimination of Items.
- 102.5 **Communication Before Bid Opening**
- 102.5.1 **Questions from Bidders** - Bidders shall direct all technical or engineering questions, including requests for explanations or interpretation, in writing to the Bid Contact Person noted in the Notice to Contractors, typically the Project Manager. All questions must be transmitted as described in the Notice to Contractors and must be received by the Department at least 48 hours before Bid Opening. General questions relating to the Bidding process may be referred to

the Department's Contracts Section. For a related provision, see Section 102.5.3 - Bid Amendments.

102.5.2 ***Bidder's Duty To Notify Department If Ambiguities Discovered*** - Bidders shall not take advantage of any ambiguity, error, omission, conflict, or discrepancy ("ambiguity, etc.") relating to the Bid Documents, Geotechnical Information, site conditions, or any other information that may significantly affect the cost, quality, Conformity, or timeliness of the Work. If a Bidder discovers any such ambiguity, etc., it must notify the Bid Contact Person immediately in writing. Failure to provide such notice constitutes a waiver of any claim for entitlement for additional compensation or time related to such ambiguity, etc.

102.5.3 ***Bid Amendment*** - The Department will interpret or modify the Bid Documents only by written Bid Amendment or other writing issued by the Department's Contracts Section. The Department is not bound by any other oral or written representations, including information exchanged verbally at pre-Bid meetings. The Department will issue written Bid Amendment in response to questions from Bidders when the answers:

- (A) relate to ambiguous, incorrect, or missing information in the Bid Documents;
- (B) are not apparent to Contractors experienced in the type of Work covered by the potential Contract; and
- (C) could have a significant impact on the cost, quality, Conformity or timeliness of the Work. For a related provision, see Section 102.5.1 - Questions From Bidders.

102.6 ***Bid Guaranty*** - Bids must be accompanied by a Bid Guaranty that complies with all the requirements of this Section, unless noted otherwise in the Notice to Contractors and the Bid Documents.

The Bid Guaranty must be:

- (A) in the amount specified in the Notice to Contractors and the Bid Documents;
- (B) made payable to the "Treasurer - State of Maine"; and
- (C) one of the following types: a Bid Bond Conforming to the next paragraph, a cashier's check, a certified check, or a United States Postal money order.

Bid Bonds must be:

- (A) issued by an insurance company licensed or approved by the State of Maine, Department of Business Regulation, Bureau of Insurance, to do business in the State of Maine;

- (B) properly signed by the Bidder (as Principal) and a duly authorized representative of the insurance company referenced above, and
- (C) on the Department's Bid Bond form (or an exact copy thereof) OR must not contain any significant variations from said form as determined in the sole discretion of the Department.

Bid Bonds for electronic Bids must be delivered, received, or faxed to the number in the Notice to Contractors before the Bid Opening time. Original Bid Bonds must be received within 72 hours for faxed submittals. Electronic Bid Bonds that accompany electronic Bids are acceptable.

102.7 ***Delivery of Bids***

102.7.1 ***Location and Time*** - The Bidder must Deliver its Bid and Bid Guaranty in a sealed envelope to the exact location and before the precise time (as determined by the Department) specified in the Notice to Contractors or any applicable Bid Amendment. The Bid and Bid Guaranty must be signed by duly authorized individuals. The sealed envelope must be labeled with the Bidder's name, the Project location, WIN, and the words "Bid Enclosed." As a minimum, the Bidder will submit a Bid Package consisting of the Notice to Contractors, the completed Acknowledgement of Bid Amendments form, the completed Schedule of Items, 2 copies of the completed Agreement, Offer, & Award form, a Bid Bond or Bid Guarantee, and any other Certifications or Bid Requirements listed in the Project Specific Bid Book. For a related provision, see Section 102.11 – Bid Responsiveness.

Electronic Bids must be submitted to the appropriate electronic bid system before the precise time (as determined by the Department) specified in the Notice to Contractors or any applicable Bid Amendment.

102.7.2 ***Effects of Signing and Delivery of Bids***

- A. ***Offer and Agreement to Pre-execution Terms*** - The signing and Delivery of a Bid represents:
 - (1) an offer by the Bidder to perform the Work for the price(s) submitted within the time(s) specified and in Conformity with all provisions of the Bid Documents; and
 - (2) the Bidder's Agreement to all the provisions of the Bid Documents governing requirements and procedures applicable before Contract Execution. The Bidder's offer shall be irrevocable until the expiration of the time for Contract Execution by the Department set forth in Section 103.8, except as provided in Sections 102.8 and 102.10 regarding withdrawal of Bids.

- B. ***Bidder Representations*** - By signing and Delivering a Bid, the Bidder represents that:
- (1) the Bidder has performed the examinations required by Section 102.3 - Examinations of Documents, Site and Other Information;
 - (2) the Bidder has given the Department written notice of all ambiguities, etc. discovered by the Bidder as required by Section 102.5.2 - Bidder's Duty to Notify Department if Ambiguities Discovered; and
 - (3) the Bidder has sufficient knowledge of the Bid Documents, Geotechnical Information, the site, and other conditions to properly price, schedule, plan, and perform the Work.
- C. ***Certifications*** - By signing and Delivering a Bid on federally funded or partially federally funded Contract, the Bidder certifies as provided in all federal certifications set forth in the Project Specific Bid Book, including those set forth in Section 1 thereof. By signing and Delivering a Bid, the Bidder further certifies as provided in Section 105.10.2(F) - Certification of Continuing EEO Efforts.

102.8 ***Withdrawal of Bids Before the Time Specified for Bid Opening*** - A Bidder may withdraw a Bid after Delivery, provided the request for such withdrawal is made in writing or in person before the time set for Bid Opening in the Notice to Contractors. The Bidder may revise and resubmit a Bid so withdrawn before the time specified for Bid Opening.

102.9 ***Bid Opening*** - Bids will be opened and publicly read at the time and place specified in the Notice to Contractors or any applicable Bid Amendments. The Department will normally read publicly only the total Bid Price of each Bid. Unit and lump sum prices are available for inspection by the Bidders immediately after the Bid Opening process.

The public reading of a Bid does not constitute a determination by the Department of whether the Bid is responsive or of whether the Bidder is responsible, though the Department may refuse to read Bids that are obviously non-responsive. Accordingly, the Department may reject a Bid as non-responsive and/or determine a Bidder is not responsible or ineligible to Bid even if that Bidder's Bid is read at Bid Opening.

102.10 ***Withdrawal of Bids in Multiple Bid Context*** - Bids may not be withdrawn after the time of Bid Opening, except under the limited circumstance set forth in this Section 102.10.

If a Bidder has submitted Bids on multiple Projects that have the same Bid Opening time, and if after the reading of Bids the Bidder has submitted the

apparent low Bid on one Project, then the Bidder may withdraw any Bids on other Projects for which no Bids have yet been read. Such a request for withdrawal must be made in person or in writing. Bids withdrawn will not be considered. The Bidder assumes sole responsibility for the risk that the Bidder's apparent low Bid is rejected as non-responsive or that the Bidder is determined to be not responsible.

102.11 ***Bid Responsiveness***

102.11.1 ***Non-curable Bid Defects*** - The Department **WILL REJECT** Bids as non-responsive if ANY ONE of the following occurs:

- The Bid and Bid Guaranty are not Delivered to the precise location and by the precise time set forth in the Notice to Contractors or any applicable Bid Amendment.
- The Bidder is not eligible to Bid as set forth in Section 102.1 - Eligibility to Bid.
- The Bid is not signed by a duly authorized representative of the Bidder.
- Properly submitted electronic bids meet this requirement.
- Paper bids must include at least one signed copy of the Contract Agreement Offer & Award form.
- A Bid Guaranty Conforming to Section 102.6 - Bid Guaranty is not submitted.
- The unit price and bid amount is not provided or a lump sum price is not provided or is illegible as determined by the Department.
- The Bidder fails to indicate the Bidder's choice where the Bid Documents clearly require a choice.
- The Bid contains any conditional or alternate Bidding language, including the right to accept or reject an Award of the Contract.
- The Bidder submits more than one Bid for the same Contract, or the Bidder and any Related Entity each submit a Bid for the same Contract.
- The Department has substantial evidence of collusion by the Bidder.
- The Bidder fails to comply with any provision in the Bid Documents that expressly indicates that such non-compliance will cause Bid rejection.

- When A plus B bidding is specified, the bid does not contain the number of Calendar Days bid to complete the work
- The Bid is not submitted on the most current forms provided by the Department or identical copies thereof.
- The Bidder will have no opportunity to cure the above Non-curable Bid Defects.

102.11.2 **Curable Bid Defects** - Unless the Department waives a curable Bid defect, the Bidder must cure, within the time stated in the written notice by the Department, but not less than 24 hours, all other Bid Defects not listed in Section 102.11.1 - Non-curable Bid Defects that are identified by the Department. Failure to cure such Defects within said time may result in forfeiture of the Bidder's Bid Guaranty. Upon such failure, the Department may take any action in the best interests of the Department, including those set forth in Section 103.6 - Failure to Fulfill Award Conditions.

Such curable Bid Defects include, but are not limited to, the following:

- The Bidder signs only one of the Contract Agreement Offer & Award forms.
- Missing total sum of the items provided in the Schedule of Items.
- The prices or signatures on the Bid or Bid Guaranty are not in ink or other non-erasable substance.
- Failure to acknowledge Receipt and consideration of all Bid Amendments.

All other Defects that do not create a significant question as to the Bidder's total Bid amount or the Bidder's ability to complete the Work within the Contract Time or by the Contract Completion Date as determined by the Department.

Materially unbalanced Bids may create a significant question as to the Bidder's ability or will to complete the Work within the Contract Time in accordance with the requirements of the Contract; see Section 103.1.2 - Unbalanced Bids.

Contractors prequalified for the general category stated in the Notice to Contractors may be determined non-responsive by the Department based on recent or new data provided since the last determination of prequalification for that Contractor.

SECTION 103 - AWARD AND CONTRACTING

Scope of Section This Section includes requirements related to the final determination of Bid responsiveness and Award and execution of the Contract.

103.1 ***Analysis of Bids***

103.1.0 ***Tie Bids*** - In the case where two responsive bids from responsible Bidders are equal monetarily, the Department shall determine the apparent low Bidder by flipping a coin. The coin shall have sides clearly marked as heads and tails. The Contractor whose first letter in its official company name that comes first in the alphabet shall be heads.

If there are three bids, each Bidder will flip the coin and the Bidder with the odd toss will be the winner. (i.e. if the results are two heads and a tails, the Bidder who had tails is the winner). For a three way tie, Bidders may flip their own coin or have the Contracts Engineer flip for them.

The coin flip will occur at the next bid opening by the Contracts and Specifications Engineer or a designee. The tied Bidders may attend the coin flip in person or watch on the internet as they choose.

103.1.1 ***Unit Prices Govern*** - After Bid Opening, the Department will review the mathematics of all apparently responsive Bids. In the event of a discrepancy between (A) unit and lump prices and (B) extensions and/or the total Bid Price, the unit and lumps sum prices shall govern and the total Bid Price will be adjusted accordingly.

103.1.2 ***Unbalanced Bids***

- A. ***Definitions*** - An Unbalanced Bid is a Bid that is Mathematically Unbalanced and that may also be Materially Unbalanced. Mathematically Unbalanced means a Bid containing lump sum or Unit Prices that do not reflect reasonable direct costs plus a reasonable proportionate share of the Bidder's anticipated profit, overhead costs, and other indirect costs. Materially Unbalanced means a Mathematically Unbalanced Bid that generates a reasonable doubt that said Bid will represent the lowest ultimate cost to the Department.
- B. ***Comparison and Possible Bid Rejection*** - The Department will compare the price of items contained in the Bid of the Apparent Successful Bidder with the estimate prepared by the Department. If the Bid is Mathematically Unbalanced, the Department may, in its discretion, notify the Apparent Successful Bidder and request an explanation. There shall be

no negotiation or changes in prices. If the Bidder fails to provide a reasonable explanation, and if the Department finds the Bid is Materially Unbalanced, the Department may reject the Bid as non-responsive and may take any action that is in the best interests of the Department, including those set forth in Section 103.6 - Failure to Fulfill Award Conditions.

103.1.3 ***Waiver of Defects and Technicalities; Right to Reject Bids*** - The Department reserves the right to reject any or all Bids and to advertise for new Bids if doing so is in the best interest of the Department. The Department reserves the right to waive curable Bid Defects and other technicalities without notice to any party. Refer to Section 102.11.2 for Curable Bid Defects.

103.2 ***Return of Bid Guaranty*** - Bid Bonds will not be returned unless so requested. Bid Guaranties other than bonds will be returned within 7 Days following Bid Opening, except that the Bid Guaranties from two lowest responsive Bids from responsible Bidders will be retained until Contract Execution or rejection of all Bids.

103.3 ***Post-Bid Qualification***

103.3.1 ***Qualification Requirement for Award*** - If the Notice to Contractors lists a Prequalification requirement, the Apparent Successful Bidder must successfully complete the Prequalification process as a condition of Award. The Apparent Successful Bidder who does not already hold an Annual Prequalification shall have 21 Days to provide the Department with their Prequal documents or the Department may move on to the next low Bidder.

103.3.1.1 ***Notice and Information Gathering*** - After Bid Opening and as a condition for Award of a Contract, the Department may require an Apparent Successful Bidder to demonstrate to the Department's satisfaction that the Bidder is responsible and qualified to perform the Work.

If such qualification is required, the Department will provide the Bidder with written notice to that effect. Such notice will include a brief description of the reasons why such qualifications is required, and may require the Bidder to provide any information requested in the "Contractor's Prequalification Application" form adopted by the Department.

If requested by the Bidder, the Department shall provide an opportunity for the Bidder to present evidence of qualifications at a reasonable time and place.

103.3.2 **Notice of Determination** - After the Bidder's presentation of evidence of qualifications (if required), the Department will notify the Bidder of its determination in writing. If a determination of "Not Qualified" is rendered, the Department's Chief Engineer will send the notice, which will set forth the specific reasons therefore to the extent practical.

Such reasons include the following:

- (A) Default(s) or termination(s) on past or current Contracts.
- (B) Failure on past or current Contracts to pay or settle all bills for labor, Materials or services; to comply with directives of the Department, to fulfill warranty obligations, or to provide Closeout Documentation.
- (C) "Below Standard" performance as determined from the Department's Contractor's Performance Rating process.
- (D) Insufficient bonding capability or Inability of the Contractor to obtain or retain Performance or Payment Bonds meeting Department requirements, or a pattern of unsupported Claims.
- (E) Failure to accept an Award of a Contract made by the Department.
- (F) Failure to provide information requested by the Department in a timely manner.
- (G) Debarment, suspension or a denial of Prequalification or Award of Contract by any Federal, State, or local governmental procurement agency or the Contractor's Agreement to refrain from Bidding as part of the settlement with any such agencies or any of the reasons contained in Section 102.02 of the "Rules Regarding Debarment of Contractors," Maine Department of Transportation Register 17-229, Chapter 102 (October 2, 1985).
- (H) Failure to demonstrate ability to do work to the satisfaction and at the sole discretion of the Department.
- (I) Number of personnel working directly for the Contractor with applicable knowledge and experience is significantly below industry standards.
- (J) Safety Record, Environmental Record, Civil Rights, or Equal Opportunity Record significantly below industry standards.
- (K) Serious misconduct that the Department reasonably determines will substantially and adversely affect the cost, quality, or timeliness of Work, or the safety of workers or the public, any deceptive, evasive, or fraudulent statements or

omissions contained in the Application, made or omitted at any interview or hearing, or otherwise made to or omitted from the Department; or any other substantial deficiencies in experience or conduct that are clearly below industry standards and that clearly demonstrate in the sole discretion of the Department that the Contractor is “Not Qualified.”

- 103.3.3 ***Appeal*** - To appeal a “Not Qualified” determination, the Bidder must Deliver a written “Request for Appeal of Qualification Determination” to the Commissioner within 48 hours of Receipt of such determination. The Commissioner or the Commissioner's designee will grant such Requests for Appeal unless the Department reasonably determines that Delay of Award pending appeal is likely to cause substantial harm to the interests of the Department. If the Request for Appeal is denied, the determination of “Not Qualified” is upheld and the Award process will proceed without the unqualified Bidder.

If the Request for Appeal is granted, the Bidder and the Chief Engineer must Deliver to the Commissioner or the Commissioner’s designee any information or arguments that the parties want considered within 14 Days of Receipt of a “Not Qualified” determination.

Within 14 Days of Receipt of such information and arguments, the Commissioner or the Commissioner’s designee will notify the Bidder in writing as to whether:

- (A) the determination of “Not Qualified” is upheld, modified or reversed; or
- (B) the Commissioner or the Commissioner’s designee elects to submit the issue to binding or non-binding alternative Dispute resolution.

After a final determination of “Not Qualified,” the Bidder’s Bid Guaranty will be returned and the Bidder will be ineligible for Award of future Department Contracts until the Bidder is prequalified pursuant to the Department’s Prequalification Procedure.

- 103.4 ***Notice of Intent to Award*** - The Department has 30 Days following Bid Opening to Deliver a written Notice of Intent to Award and request a Payment Bond, Performance Bond, insurance bond, special certifications, and other information from the Apparent Low Bidder. If a notice of Intent to Award is not sent within 30 Days of receipt of the Bid Opening, the Apparent Successful Bidder may withdraw its Bid without forfeiture of its Bid Guaranty or Bidding eligibility. If the Department and the Apparent Successful Bidder agree, an extension beyond the 30 Days of the Bid and Bid prices may occur and the Bid remains viable. For a related provision, see Section 103.5 - Award Conditions.

- 103.5 **Award Conditions** - The Apparent Successful Bidder must provide and/or perform all of the items listed in this Section 103.5 within 14 Days of Receipt of the Notice of Intent to Award. Unless indicated otherwise, all items must be Delivered to the Department's Contracts Engineer.
- 103.5.1 **Performance and Payment Bonds** - Performance and Payment Bonds complying with Section 110.2.1 - Bonds.
- 103.5.2 **Insurance Certificates** - Certificates of Insurance complying with Section 110.3 - Insurance.
- 103.5.3 **Non-Resident Contractor Requirements**
- A. **Definition** - A Non-Resident Contractor is defined as a Contractor that is:
 - (A) any individual who is not a resident of the State of Maine, or
 - (B) any firm, corporation, limited liability company, partnership, joint venture, sole proprietorship, or other entity that:
 - (i) is not licensed to do business within the State of Maine, or
 - (ii) does not have a principal place of business within the State of Maine.
 - B. **Requirements** - If a Non-Resident Contractor, the Apparent Successful Bidder must file with the Department a copy of a written appointment of an attorney admitted to practice in the State of Maine having a place of business within the State. The appointment must:
 - (A) set forth the attorney's business and personal addresses, and business telephone and fax numbers,
 - (B) name said attorney to be the true and lawful attorney of the Non-Resident Contractor,
 - (C) set forth that the Contractor agrees that any lawful process that is served on said attorney shall have the same legal force and validity as if served on the Contractor,
 - (D) set forth that the appointment shall continue in force as long as any potential liability in any way related to the Work or the Contract remains or until the Department receives written notice of a change of appointment Conforming to this paragraph,

- (E) provide that service of such process may be made by leaving a copy of the process in the hands or in the office of the Resident attorney and that such service will be effective upon the Non-Resident Contractor, as if service were made in accordance with Rule 4 of the Maine Rules of Civil Procedure, and
- (F) provide that the Contractor expressly waives any and all defenses regarding service of process under Rule 12 of said Civil Rules or otherwise. The appointment shall be filed in the office of the Maine Secretary of State.

103.5.4 **Execution of Contract By Bidder** - The properly completed and signed Contract Agreement, Offer, & Award form provided with the Bid constitutes the Bidder's offer. Once the Department has received the bonds, insurance, and any other pre-award items required, the Department will sign the Contract Agreement, Offer, & Award form and execute the Contract. The point of Contract execution is when the Contractor receives the written Notice of Award.

103.5.5 **Bid Escrow** - If required by Special Provision, the Apparent Successful Bidder must provide a legible copy of Bid Escrow Documentation and a related Affidavit Conforming to said Special Provision. Failure to provide Conforming Bid Escrow Documentation or the Affidavit constitutes a refusal to enter into the Contract and will result in the Bidder's forfeiture of its Bid Guaranty.

103.5.6 **Other Conditions** - The Apparent Successful Bidder must comply with all other conditions set forth or referenced in the Notice of Intent to Award.

103.6 **Failure to Fulfill Award Conditions** - Failure of the Apparent Successful Bidder to fulfill all conditions of Award within the time provided or to otherwise accept Award will result in forfeiture of the Award to the Apparent Successful Bidder and the forfeiture of the Bid Guaranty. Such Bidder will be prohibited from submitting a Bid for the Work in the event that the Work is re-advertised. Further, the Department may refuse to accept any Bid from the Bidder on any Project for a period of 2 years from the date of such refusal.

The Department may then take any action that the Department determines is in the best interest of the Department, including Awarding the Contract to the responsible Bidder with the next lowest responsive Bid, rejecting all Bids, and/or re-advertising the Work.

103.7 **Forfeiture of Award** - The Department reserves the right to stop the Award of any Contract at any time before the Contract Execution without liability if doing so is in the best interest of the Department. Any costs incurred by the Bidder before Contract Execution shall be the sole responsibility of the Bidder.

103.8 ***Award of Contract by Department*** - Once the Contractor has met the requirements of the Notice of Intent to Award letter, the Department has 14 Days to execute the Contract and notify the Contractor of the award with a written Notice of Award. If a Notice of Award is not sent within 14 Days, the Apparent Successful Bidder may withdraw its Bid without forfeiture of its Bid Guaranty or Bidding eligibility. For a related provision, see Section 107.2 - Commencement of Contract Time.

103.9 ***Computation and Extension of Time*** - In the event that a time period provided in this Section 103 concludes on a Holiday, Saturday, or Sunday, said time period shall be extended to the next Business Day.

The Department and Apparent Successful Bidder may extend the time for the Award process, fulfillment of Award Conditions, or execution of the Contract by mutual Agreement. Unless specifically and mutually agreed to in writing, such extensions shall not extend the Contract Time or the Contract Completion Date.

SECTION 104 - GENERAL RIGHTS AND RESPONSIBILITIES

Scope of Section This Section sets forth certain rights and responsibilities of the Department and the Contractor that are generally applicable to all Contracts. This Section is not all inclusive, and additional rights and responsibilities are set forth elsewhere in the Contract.

104.1 *General*

104.1.1 ***Basic Roles of the Parties*** - The Contractor has the authority and responsibility to perform all Work in Conformity with the Contract. The Department has the authority and responsibility to assure that the Contractor does so.

104.1.2 ***Joint Covenants of Good Faith and Fairness*** - This Contract imposes an obligation of good faith and fair dealing on both parties in the execution, performance, interpretation, and enforcement of the Contract. With a positive commitment to honesty and integrity, the Contractor and the Department agree to do the following: function within all applicable laws, statutes, regulations, and Contract provisions; avoid hindering each other's performance; fulfill all Contract obligations diligently; and cooperate in achievement of the terms of the Contract. Nothing in this subsection nullifies or supersedes the express provisions of the Contract and the Standard Specifications.

104.2 *Department's General Authority and Responsibilities*

104.2.1 ***Furnishing of Property Rights*** - The Department will secure all necessary rights to real property within the Project Limits shown on the Right-of-Way Plans that are provided with the Bid Documents. For related provisions, see Sections 104.3.2 – Furnishing of Other Property

Rights, Licenses and Permits and 105.4.5 - Maintenance of Existing Structures. For related definitions, see Construction Easements and Right-of-Way.

- 104.2.2 ***Furnishing of Permits*** - Except as provided otherwise in the Contract, the Department will furnish Permits required to perform the Work within the Project Limits. For related provisions, see Sections 101.2, Definition of Permits, 104.3.2 - Furnishing of Other Property Rights, Licenses, and Permits and 105.8.2 - Permit Requirements.
- 104.2.3 ***Authority of the Resident*** - After Contract Execution, the Resident has the authority to take all actions needed to assure that the Contractor is performing the Work in Conformity with the Contract. Except as provided elsewhere in the Contract, the Resident will decide all questions regarding the quality and acceptability of Materials furnished, Work performed, suspension of Work, and the interpretation of the Contract. The Resident has the authority to reject Unacceptable or Unauthorized Work and refuse to approve Progress and Final Payments until the Unacceptable or Unauthorized Work is corrected. For related provisions, see Sections 106.8 - Non-conforming Work and 109.8 - Contract Modification.
- 104.2.4 ***Authority of Residents and Inspectors*** - Residents, inspectors, and other Departmental employees or representatives working for the Department have the authority to make initial determinations regarding the Conformity of the Work. Unless authorized by the Program Manager, Residents or inspectors are not authorized to alter or waive the provisions of the Contract or to issue instructions contrary to the Contract. They may not act as a supervisor for the Contractor.
- 104.2.5 ***Right to Inspect Work*** - The Department has the authority to inspect all Materials and every detail of the Work. For a related provision, see Section 104.3.5 - Duties Regarding Inspection of Work.
- 104.2.6 ***Right to Suspend Work*** - The Department has the right to suspend any or all Work at any time for any reason. For related provisions, see Sections 105.4.4 - Maintenance During Suspension of Work and 107.5 - Suspension of Work.
- 104.2.7 ***Damage to Project Caused by Uncontrollable Events*** - All repairs to the Project or temporary structures that are required because of property damage that is directly caused by an Uncontrollable Event may entitle the Contractor to an Equitable Adjustment if the Contractor complies with the notification, documentation, and procedural requirements set forth in the Contract. Delays resulting from an Uncontrollable Event will be analyzed in accordance with Section 109.5 - Adjustments for Delay. For related provisions, see

Sections 101.2 - Definition of Uncontrollable Event, 104.3.10 - Responsibility for Damage to Work, 109.3 - Extra Work, 109.5 - Adjustments for Delay, 109.7 - Equitable Adjustments to Compensation and Time, and 109.8 - Contract Modification.

- 104.2.8 **No Personal Liability** - The Department's employees and other representatives act solely as representatives of the Department when conducting and exercising authority granted to them under the Contract. Such persons have no liability to the Contractor or any Subcontractor either personally or as Department employees.

104.3 **Contractor's General Authority and Responsibilities**

- 104.3.1 **General Duty to Cooperate** - The Contractor shall cooperate with the Departmental personnel, Utility Companies, railroad personnel, marine traffic personnel, regulating agencies with jurisdiction, other Contractors, municipalities, and the public in every reasonable way possible. For a related provision, see Section 104.4 - Communication and Coordination.
- 104.3.2 **Furnishing of Other Property Rights, Licenses, and Permits** - The Contractor shall acquire, at its sole expense, all property rights outside the Project Limits needed for construction staging, yarding, construction, waste disposal, or other Project-related purpose. The Contractor shall also acquire, at its sole expense, all licenses and Permits necessary to perform the Work that are not furnished by the Department. For related provisions, see Sections 104.2.1 - Furnishing of Property Rights, 104.2.2 - Furnishing of Permits, 104.3.11 - Responsibility for Property of Others, and 105.8.2(B) - Permit Requirements, All Other Permits.
- 104.3.3 **Duty to Notify Department If Ambiguities Discovered** - The Contractor shall not take advantage of any ambiguity, error, omission, conflict, or discrepancy contained in the Contract. If the Contractor discovers any such ambiguity, etc. for which the Contractor may seek adjustments to compensation, time, or other Contract requirements, the Contractor shall provide a written notice within 48 hours and before performing any Work related to the ambiguity, etc., as provided in Section 104.4.5 - Early Negotiation. Failure to provide such notice in compliance with the Contract shall constitute a waiver of all claims related to the ambiguity, etc.
- 104.3.4 **Workers and Equipment** - The Contractor shall at all times provide all superintendents, forepersons, laborers, inspectors, Subcontractors, subconsultants, Equipment, Materials, and Incidentals needed to perform the Work in Conformance with the Contractor's Schedule of Work and within the Contract Time.

Any person employed by the Contractor or by any Subcontractor or any officer or representative or agent of the Subcontractor, who, in the opinion of the Resident, is intemperate or disorderly, shall be removed immediately by the Contractor or Subcontractor employing such person. The employee shall not be employed again in any portion of the Work without prior approval from the Resident.

Should the Contractor fail to remove such person or persons as required above or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work, the Resident may suspend the Work by written notice until such orders are complied with.

During all hours of on-site activity, the Contractor shall provide an on-site, competent, English-speaking Superintendent experienced in the type of Work being performed. The Superintendent shall be capable of reading and understanding the Plans and Specifications, providing and receiving communications, and scheduling and coordinating the Work. The Superintendent shall have full authority to manage the Work in accordance with the Contract. Such superintendence must be provided regardless of the amount of Work being done by the Contractor or any of its Subcontractors.

All persons employed by or through the Contractor, except for registered trainees, shall have sufficient skill and experience to perform the Work properly. The Department may require that the Contractor discharge any such person who the Department determines jeopardizes the safety of any person or the Project, without cost or liability to the Department. If the Department determines that such person's performance jeopardizes the intent of the Contract otherwise, the Department may, but is not required, to notify the Contractor of such a determination. Such notice, or lack thereof, does not affect the Contractor's duties regarding workers. Upon receipt of such notice, the Contractor shall take any action it determines necessary to fulfill its obligations under the Contract. For related provisions, see Sections 104.5.4 - Discharge of Subcontractors, 105.1 - Intent of the Contract, and 105.2 - Health and Safety.

104.3.5 ***Duties Regarding Inspection of Work***

- A. ***Safe Access*** - The Contractor shall provide the Department with safe access to all portions of the Work in Conformity with all applicable OSHA requirements. The Contractor shall furnish the Department with all information and assistance required to make a detailed inspection. For a related provision, see Section 104.2.5 - Right to Inspect Work.
- B. ***Inspection by Others*** - If any other governmental entity, Utility Company, or railroad is to pay for a portion of the Work or is

otherwise authorized to inspect Work, then the Contractor must provide its representatives with safe access that Conforms to this Section 104.3.5.

- 104.3.6 **Project Records** - Upon request by the Department, the Contractor or any other person Working for the Contractor possessing Project Records must provide the Department with copies of Project Records at all reasonable times without cost or liability to the Department. Unless the context clearly indicates otherwise, Project Records are the property of the Department. The Contractor must retain Project Records for at least 3 years after Final Acceptance or for any applicable warranty period, whichever is longer. For related provisions, see Sections 101.2 - Definition of Project Records and 111.1.6 - Contractor's Obligation to Keep Records.
- 104.3.7 **Laws To Be Observed** - The Contractor shall keep itself informed of and comply with all applicable laws, rules, regulations, orders, and decrees ("Law") affecting the Work, including all environmental, wage, labor, equal opportunity, safety, patent, copyright, or trademark laws. The Contractor agrees to indemnify, defend, and hold harmless the Department against any and all claims or liabilities arising from or based upon the violation or alleged violation of any such Law caused directly or indirectly by or through the Contractor.
- 104.3.8 **Wage Rates and Labor Laws**
- A. **Federal Wage Rates and Labor Laws** - Federal wage rates apply, unless expressly stated otherwise by Special Provision. The classification of construction type and related wage rates by the U.S. Department of Labor will be provided by Special Provision. If not provided, the Contractor must contact the Department before Bidding to determine the applicable wage rates in accordance with Section 102.5.2 - Bidder's Duty to Notify Department if Ambiguities Discovered. The Contractor must pay according to said rates and must otherwise comply with all applicable federal and State labor laws, rules, and regulations. Persons registered with the Department as trainees must be paid at least at the prevailing wage for laborer, and upon completion of their program, trainees shall be paid the prevailing wage for the skill and classification trained.
 - B. **State Wage Rates and Labor Laws** - Maine State wage rates apply only if provided expressly by Special Provision. If so provided, the classification of construction type and related wage rates established by the Maine Department of Labor will be set forth by Special Provision. If not so set forth, the

Contractor shall contact the Department before Bidding to determine the applicable wage rates in accordance with Section 102.5.2 - Bidder's Duty to Notify Department if Ambiguities Discovered. The Contractor shall pay according to said rates and shall otherwise comply with all applicable federal and State labor laws, rules, and regulations. Title 26 MRSA § 1303 set forth various requirements about preference to Maine workers that apply to State funded Contracts. However, if a Contract is Federally funded or partially Federally funded, Federal law governs and Title 26 MRSA § 1303 does not apply. For a related provision, see 23 CFR § 635.117.

- 104.3.8.1 **Electronic Payroll Submission** - On federally funded Projects the Contractor, all Subcontractors, and lower-tier Subcontractors will submit their certified payrolls electronically utilizing the Elations system. There is no charge to the contracting community for the use of this service. The submission of paper payrolls will not be allowed or accepted. Additional information can be found at <http://www.maine.gov/mainedot/contractors/> under the "Bidder Info" go to "Electronic Payroll System."
- 104.3.8.2 **Payment Tracking** - On federally funded Projects the Contractor and all Subcontractors and lower-tier Subcontractors will track and confirm the delivery and receipt of all payments through the Elation System
- 104.3.9 **Patents and Copyrights** - The Contractor must provide proof of a legal Agreement with the holder of any patent, trademark, or copyright, or the Owner, if necessary, for use of any of the following: design(s), process(es), device(s), trademark(s), Material(s), and copyright(s). The Contractor agrees to indemnify, defend, and hold harmless the Department and any affected third party or political subdivision from all claims of infringement that arise from use of any item listed in this paragraph.
- 104.3.10 **Responsibility for Damage to Work** - Except as provided in Section 104.2.7 - Damage to Project Caused by Uncontrollable Events, the Contractor shall bear all risk of loss relating to the Work until Final Acceptance, regardless of cause, including completed Work, temporary Structures, and all other items or Materials not yet incorporated into the Work. For a related provision, see Section 110.3.6 - Builders Risk.

The Contractor shall, at its sole expense, rebuild, repair, restore, or replace such damaged Work or otherwise make good any losses that

arise from such damage (“rebuilding, etc.”). If the Contractor fails to promptly commence and continue such rebuilding, etc., the Department may, upon 48 hours advance written notice, commence rebuilding, etc. of the damaged property without liability to the Department with its own forces or with Contracted forces and all costs will be deducted from amounts otherwise due the Contractor. For the Contractor’s responsibilities for the Work after Final Acceptance, see Section 106.9 - Warranty Provisions.

- 104.3.11 **Responsibility for Property of Others** - The Contractor and its Subcontractors shall not enter private property outside the Project Limits without first obtaining permission from the Owners.

The Contractor shall be responsible for all damage to public or private property of any kind resulting from any act, omission, neglect, or misconduct of the Contractor and its Subcontractors. The preceding sentence includes damage to vehicles passing through the Work area.

The Contractor shall, at its sole expense, rebuild, repair, restore, or replace such damaged property and otherwise make good any losses that arise from such damage. If the Contractor fails to completely remedy the damage in a timely manner, the Department may, upon 48 hours advance written notice, rebuild, repair, restore or replace the damaged property without liability to the Department with its own forces or with contracted forces. All costs will be deducted from amounts otherwise due the Contractor.

- 104.3.12 **Forest Protection and Laws** - The Contractor shall obey all laws and regulations that govern Work within or adjacent to State or National Forests, keep the Project site orderly and clean, obtain all required Permits, prevent and assist with the suppression of forest fires, and cooperate with authorized forestry officials.

Pursuant to State law, the sale of harvested forest products must be reported to the Maine Forest Service at the end of each year. The Contractor is hereby designated as the Department’s agent for reporting of any such harvesting.

- 104.3.13 **Materials and Items Found on the Project** - With the Department’s approval, the Contractor may use suitable excavated Material in the Work and be paid for both the excavation and the placement of such Materials at the corresponding Contract Unit Prices. Except for Material used for riprap, stone ditch protection, and loam, the Contractor shall replace such excavated Material with other approved Material and properly compact it at no cost to the Department. The Contractor shall obtain written permission from the Department before performing any excavation outside the Project Limits.

Unless expressly provided otherwise, the Contractor shall remove and assume Ownership of all Incidental Structures and Materials to be removed such as guardrail, drainage pipe, culverts, curbing, bridges, and other manufactured Materials. Utility Facilities, traffic control devices, and lights, together with all supporting Structures, are excluded from the provisions of this Section 104.3.13. The cost of removal of such Structures and Materials is Incidental to the Contract unless expressly provided otherwise.

104.3.14 ***Interpretation and Interpolation*** - The Contractor is responsible for all interpretations and interpolations made from information provided in the Bid Documents and Contract, including data and test results related to location, survey, hydrology, hydraulics, soils, ledge quality, existing Structures, Environmental Information, and Geotechnical Information. For related provisions, see Sections 102.3 - Examination of Documents, Site, and Other Information; 102.5.2 - Bidder's Duty To Notify Department If Ambiguities Discovered; 104.3.3 - Duty to Notify Department If Ambiguities Discovered; and 105.6 - Construction Surveying.

104.4 ***Communication and Coordination***

104.4.1 ***Partnering***

A. ***Definition, Purpose, and Applicability*** - Partnering is a process of voluntary structured communication between the Department, the Contractor, its principal Subcontractors and suppliers, and other Project stakeholders for the purpose of improving efficiency and minimizing Disputes. Partnering, including the establishment of a partnership charter, does not in any way waive, alter, or otherwise affect any provision of the Contract. For a related provision, see Section 111.1.3 - Relationship to Partnering.

Participation in Partnering is voluntary; either party may elect to not participate in Partnering for any reason. The associated costs of Partnering will be agreed to mutually and shared equally.

B. ***Initial Partnering Workshop*** - If the Contractor and the Department elect to participate in Partnering, representatives of both parties will arrange a facilitated initial Partnering Workshop, which should be held before the start of on-site construction. The Project Manager, Resident or both and the superintendent will determine Workshop attendees, the facilitator, agenda, duration, and location. Key Project level supervisory personnel, corporate/State level management personnel, and key Project personnel of the Contractor's

principal Subcontractors and suppliers should attend. Project design Engineers, FHWA, local government representatives, environmental regulators, emergency service personnel, Utility Companies, impacted business and/or landowners, and other stakeholders may also be invited to attend. The product of the initial Partnering Workshop will be a partnership charter. This charter will include mutually agreed upon Project goals and communication escalation procedures.

- C. **Follow-Up Workshops** - The Contractor and the Department may agree to hold follow-up Partnering Workshops periodically throughout the duration of the Contract.

104.4.2 **Preconstruction Meeting** - After the Contract has been executed and before the start of on-site construction by the Contractor, the Resident will schedule a Preconstruction Meeting that must be attended by the Contractor's Project Manager and Superintendent. Notification of the meeting shall be sent to the following personnel, agencies, and organizations as required by the Contract and deemed essential to the Work outlined in the Contract:

- Project Manager, Program Manager, and Area Construction Manager
- Engineer of Record and Project Designer Engineers
- Utility Coordinator and Utility Companies
- Property Officer, Town Representatives, and Major Stakeholders
- Environmental Officer and Agencies
- Safety Officer, Fire Department, and Police Department
- Civil Rights Officer
- Communications Representative
- FHWA Representative
- Regional Office including Manager, Engineer, and Maintenance

The agenda of the Preconstruction Meeting, at a minimum, shall include the following items that pertain to the Contract:

- Attendee List with contact information
- Project Description
- Contract
- Bid Amendments
- Project Specific Permit Requirements
- Review of Special Provisions
- Contractor's General Authority and Responsibilities – 104.3

- Utility Coordination – 104.4.6
- Road/Bridge Closure/Restriction Notifications – 104.4.10
- Traffic Management – 105.3
- Environmental Requirements – 105.8
- Time – 107
- Additional Special Provisions as required by the Contract
- Review of Plans
- Review of Submittals
- Review of Requirements prior to Start of Work
- Communications

The Resident will prepare minutes of the Preconstruction Meeting and distribute them to all attendees and invitees. Any requests to revise the minutes must be made to the preparer within 7 Days of Receipt. These minutes will constitute the final record of the Preconstruction Meeting.

The Resident will prepare minutes of the Preconstruction Meeting and distribute them to all attendees and invitees. Any requests to revise the minutes must be made to the preparer within 7 Days of Receipt. These minutes will constitute the final record of the Preconstruction Meeting.

For related provisions, see Sections 104.4.6(A) - Preconstruction Utility Meeting; 652 - Implementation of Traffic Control Plan, Preconstruction Field Review (if required); 656.4.1 - Temporary Soil Erosion and Water Pollution Control, Preconstruction Field Review; and 106.4 - Quality Control.

- 104.4.3 ***Progress Meetings*** - Except as provided otherwise in this Section 104.4.3 - Progress Meetings shall be held at regular intervals, but at least monthly, throughout the duration of the Contract. All personnel of the Department and the Contractor who have significant information relevant to agenda items shall attend. Additional personnel, as included in the invitee list of the Pre-construction Meeting and as merited, may be invited to attend.

The agenda for each Progress Meeting at a minimum, shall include the following items that pertain to the Contract:

- Review and Approval of Previous Progress Meeting Minutes
- Review of Action Items from Previous Meeting
- Review of Progress from Last Progress Meeting
- Review of Work Planned to Prior to Next Progress Meeting
- Contractor's Schedule of Work
- Material Testing and Work Inspection Schedule
- Progress Payments

- Civil Rights
- Contractor's Quality Control
- Contractor's Safety Practices
- Contractor's Environmental Control
- Contractor's Traffic Control
- Onsite Utility Coordination
- Review of Outstanding Submittals and Long Lead Items
- Request for Information
- Contract Modifications
- Material and Equipment Deliveries
- Issues, Disputes, Claims, and Resolutions
- Review of New Action Items

The Resident will prepare minutes of these meetings and distribute them to all attendees. Any requests to revise the minutes must be made to the Resident within 7 Days of Receipt. These minutes will constitute the final record of the Progress Meeting.

In lieu of a Progress Meeting, the Resident and the Superintendent may exchange written communication before or on the scheduled Progress Meeting date that indicates there is no need for the meeting because the Work is on schedule, compensation is current, communication is ongoing, and there are no significant outstanding or anticipated issues, Disputes or claims. The Superintendent's written communication shall also contain a description of (A) progress of the Project since the last Progress Meeting or communication in lieu thereof and (B) expected activities before the next scheduled Progress Meeting. All invitees to the Progress Meeting must be notified of canceled or postponed meetings.

104.4.4 ***Requests for Information*** - Either the Department or the Contractor may request that the other party provide information that the requesting party needs to fulfill its Contract obligations by Delivering a written Request for Information (RFI). The Department may require that RFIs be on forms and media approved by the Department. The request must:

- (A) be of reasonable scope,
- (B) explain why such information is necessary to fulfill Contract obligations, and
- (C) provide a requested response time, which must be reasonable in relation to its scope (at least 72 hours).

The party receiving an RFI shall use its best effort to respond to the RFI within the time requested. The response shall be in writing. The status of outstanding RFIs shall be discussed at each Progress Meeting.

104.4.5 **Early Negotiation**

- A. **Notice Required** - When the Contractor becomes aware of facts or circumstances that may cause the Contractor to seek additional compensation, time, or any other change in Contract requirements (“Issue”), then the Contractor shall notify the Resident within 48 hours and before commencing any part of the Work relating to the Issue. The notice must describe the basic nature and extent of the Issue.

Such notice may be verbal only if confirmed in writing in one of the two following ways:

- (A) if a Progress Meeting is held within 14 Days of the date that the Issue became known, such Notice may be confirmed with an entry in the Progress Meeting minutes. Such entry must describe the basic nature and extent of the Issue.
- (B) Otherwise, the Contractor shall confirm a verbal notice by Delivering to the Resident, within 14 Days of the date the Issue arose, a written notice that describes the basic nature and extent of the Issue.

The written notice or confirmation will be known as a “Notice of Issue for Consideration.” The Contractor will not be entitled to any additional compensation, time, or any other change to Contract requirements without a timely Notice of Issue for Consideration.

- B. **Negotiation** - When the Resident receives the Notice of an Issue for Consideration Conforming to Section 104.4.5(A) - Notice Required, the Resident and the Contractor will negotiate to attempt to resolve the Issue. Any resolution will be noted in the Progress Meeting minutes or confirmed otherwise in writing by the Department. Any changes to the Contract that affect compensation, time, quality, or other Contract requirements shall be by written Contract Modification as provided by Section 109.8 - Contract Modifications.

For related provisions, see Sections 109.5 - Adjustments for Delay and 109.7 - Equitable Adjustments to Compensation and Time.

- C. **Additional Consideration** - If negotiation fails to resolve the Issue within 45 Days of the date the Resident receives the Notice of Issue for Consideration, and if the Contractor desires additional consideration by the Department, then the

Contractor must comply with Section 111.2 - Detailed Notice of Dispute and all other requirements of Section 111 - Resolution of Disputes.

104.4.6 **Utility Coordination**

- A. **Pre-construction Utility Meeting** - A Pre-construction Utility Meeting will be held to coordinate the Work of the Contractor and the Work of affected Utility Companies. Usually this meeting will be held on the same Day as and immediately before the Pre-construction Meeting provided by Section 104.4.2 - Pre-construction Meeting but, in any event, will be held before the start of on-site construction by the Contractor that affects Utility Facilities. The Department's Utility Coordinator, the Project Manager, Resident, the Contractor's Superintendent, and a representative of each affected Utility Company will attend. The Department's Utility Coordinator will prepare minutes of the Pre-construction Utility meeting and distribute them to all attendees. Any requests to revise the minutes must be made to the Department's Utility Coordinator within 7 Days of distribution. These minutes will constitute the final record of the meeting. For a related provision, see Section 104.4.2 - Pre-construction Meeting(s).
- B. **Utilities within Right-of-Way** - Except as provided otherwise in the Contract, including subsection E - Temporary Relocations below, all Utility Facilities of all Utility Companies within the Right-of-Way will be relocated and adjusted as provided in the Contract by and at the expense of the affected Utility Company, provided, however, that the Contractor is responsible for scheduling its Work in accordance with the time allowed for utility relocation as provided in the Contract. Utility relocation Work may not proceed without authorization from the Department.
- C. **Contractor's Responsibilities**
 - 1) **Utility Coordination** - The Contractor has primary responsibility for coordinating its work with utilities after Contract award. The Contractor shall communicate directly with the utilities regarding any utility work necessary to maintain the Contractor's schedule and prevent Project construction delays. The Contractor shall notify the Resident of any issues. The Contractor shall plan and conduct its work accordingly.
 - 2) The Contractor must exercise every reasonable precaution to prevent damage to Utility Facilities or

interruption to utility services known to or discovered by the Contractor, whether or not shown on the Plans. Such precautions must include notice to Utility Companies before undertaking Work that could damage Utility Facilities. The Contractor must provide each Utility Company with notice at least 3 Business Days before the date a Utility Company will have to support any pole.

- 3) The Contractor must take all reasonable precautions to determine the presence of underground Utility Facilities before commencing any excavation Work and must provide all affected Utility Companies with at least 72 hour prior notice of the proposed excavation. The Contractor must comply with 23 MRSA § 3360-A, entitled “Protection of Underground Facilities,” Maine’s “Dig Safe” statute, and also contact the non-member underground facility operators in the Maine Public Utilities Commission’s “OK-TO-DIG” directory.
- 4) The Contractor must maintain initial markings (spray paint, stakes, etc.) made by the authorized representative of a Utility Company to indicate the location of underground Utility Facilities and otherwise comply with 23 MRSA § 3360-A(4).
- 5) The Contractor must cooperate with Utility Companies in its relocation or operations so that these operations proceed in a logical sequence, minimize duplication of Work, and avoid unnecessary interruptions to utility service.
- 6) If utility services are interrupted as a result of the Contractor’s Work, the Contractor must promptly notify the appropriate Utility Company and must cooperate fully in the restoration of service. If service is interrupted, repair Work will be continuous until the service is restored. No Work can be undertaken around fire hydrants until the local fire authority has approved provisions for continued services.
- 7) The Contractor must schedule its Work so as to provide for all Utility Company Work and to complete the Work within the Contract Time. The estimated number of workdays required by each Utility Company to perform its relocation Work contained in the Contract is provided by the Utility Companies and are estimates only. Such Utility Facility relocation times assume normal Working times

(Monday through Friday, 8 hours per Day), and are dependent upon normal weather, normal Working conditions, and freedom from emergencies. The Department is not responsible for the accuracy of these estimates. If a Utility Company fails to perform its Work within the time frames set forth in the Contract or in the minutes of the Pre-construction Utility Meeting, and such failure affects the Contractor's Critical Path, the Contractor may request a suspension of Work pursuant to Section 107.5.2 and such Delay will be analyzed in accordance with Section 109.5 - Adjustments for Delay.

- 8) Any clearing and tree removal that is a part of the Contract and that must be done in areas where Utility Companies are involved must be completed by the Contractor before the Utility Company can relocate its Utility Facilities. Any clearing, cutting of single trees, or limbing required for the temporary or permanent Utility Facility location must be approved by the Department. The Contractor must provide the Department with prior notice of at least 4 Days before removing or trimming any trees or other vegetation.
- 9) If blasting occurs on the Project, the Contractor must provide each Utility Company having Utility Facilities that could be damaged by the blast with at least 24 hour prior notice that includes the anticipated time of the initial blast.
- 10) If the Contractor observes a Utility Company Working within the Project Limits in a manner that (A) violates the MUTCD, the Contractor's Traffic Control Plan, or an applicable OSHA requirement or commonly accepted safety practices, and (B) represents a clear and immediate risk of significant bodily injury to any person within the Project Limits, then the Contractor must notify the Resident and the Utility Company immediately.
- 11) The Contractor agrees to indemnify, defend, and hold harmless the Department from and against any and all claims or causes of action arising from any act or omission of the Contractor, the Subcontractors, or their respective agents, representatives, or employees for failure to comply with this Section 104.4.6.

D. **Temporary Relocations** - The Contractor may request temporary changes of location of Utility Facilities for the

Contractor's convenience. The Contractor must satisfy the Department that the proposed temporary change will not interfere with the Work, the Work of Utility Companies, or the Work of other Contractors and will not impede the free and safe flow of traffic. If acceptable to the Department, the Contractor may make its own request to the Utility Company or other party affected by such temporary changes. The expense and risk of temporary changes will be borne solely by the Contractor; no changes to compensation or time will be made.

- E. **Unforeseeable Utility Relocations** - The Department may order utility adjustments in accordance with Section 109.4 - Differing Site Conditions.
- F. **Cost** - The cost of all Work related to utility coordination is Incidental to the Contract.

- 104.4.7 **Cooperation with Other Contractors** - The Department reserves the right to Contract for, perform, or allow other Work to be performed within or near the Project Limits. The Contractor must take all reasonable steps to avoid interfering or hindering such other Work. The Contractor must cooperate with Contractors or others performing such other Work as directed by the Department.

If the basic nature and scope of such other Work are provided or referenced in the Bid Documents or are otherwise known or foreseeable to the Contractor, then the Contractor assumes all risks and liability associated with such other Work and agrees to indemnify, defend, and hold harmless the Department from all claims related to such other Work that arise from the Contractor's acts or omissions.

- 104.4.8 **Coordination with Railroads** - The Contractor shall (A) perform Work within a railroad Right-of-Way without interfering with trains or railroad company traffic and (B) coordinate all Work crews and the Contractor's Schedule of Work to accommodate the railroad company Work. If the Bid Documents show that Materials must be hauled across railroad tracks, the Department will make preliminary arrangements with the railroad to permit such hauling. The Contractor shall, at its expense, negotiate and enter into any other Agreements with the railroad.

Special Provision will provide any additional conditions or requirements regarding railroad coordination.

- 104.4.9 **Coordination with Marine Traffic** - The Contractor shall not interfere with free and safe navigation of navigable waters except as provided by permit issued by the US Coast Guard and other applicable regulatory agencies. All Work must comply with all US Coast Guard

permit conditions and all applicable Federal regulations affecting navigation.

When the basic nature and scope of marine traffic requirements are provided or referenced in the Bid Documents or are otherwise known or foreseeable to the Contractor, then the Contractor assumes all risks and liability associated with said requirements, and the Contractor shall indemnify, defend, and hold harmless the Department from all claims related to the maintenance or obstruction of marine traffic that arise from the Contractor's acts or omissions.

104.4.10 **Coordination of Road Closure/Bridge Closure/Bridge Width Restriction Notification** - When a road closure, bridge closure, or width restriction is allowed by the Contract, prior to a closure or a width restriction to a single lane of less than 15 ft, the Contractor shall notify affected public officials, agencies, other entities, and the public of the date on which the closure/width restriction will begin and the anticipated duration of the closure/restriction, as indicated below.

The closure shall be announced on a minimum of two portable/changeable message signs, placed in approved locations, beginning at least 10 Days prior to the closure. A public notice shall also be published in a local newspaper 10 Days prior to the closure.

Advance warning signs shall be placed so the traveling public is aware of the restrictions in place. They shall be placed at enough distance from the restriction so vehicular traffic can be rerouted to an alternate route.

The Contractor shall notify the following public officials, agencies, and organizations 10 Days prior to, and again the Day before, the date that the closure/restriction begins and the anticipated length of the closure/restriction. When the road/bridge is reopened/unrestricted to traffic, the following list will again be notified. The Contractor shall provide the Department with documentation that the listed public officials, agencies, and organizations received the notification at least 10 Days prior to the closure/restriction or with proof that the notification was mailed 15 Days prior to the closure/restriction.

- Town Officials (Manager or First Selectperson)
- Representative or County Commissioners (If Unorganized Townships)
- County Sheriff's Department
- Fire Department
- Police Department
- State Police
- Emergency Service
- School Department

- Post Office
- Chamber of Commerce
- Any Large Employers
- Mobile Home Movers, Manufacturers and Dealers
- Bureau of Maine Vehicles – Over Size/Over Weight Permits
- MaineDOT Radio Room
- Maine DOT Regional Office

All notifications will be subject to the approval of the Resident. All costs not covered by Pay Items will be considered incidental to the Contract.

104.5 ***Subcontracting***

- 104.5.1 ***Limits on Subcontracting*** - The Contractor shall perform at least 30% of the value of the Work with its own Work force, excluding any specialty items as designated in the Contract documents by the Department.

The Contractor shall not carry the workers of another recognized Contractor or firm on its payroll or a Subcontractor's payroll. The Contractor shall not use any Subcontractors that are debarred from Bidding by the Federal Government or any agency of the State of Maine.

- 104.5.2 ***Contractor's Duties Regarding Subcontractors*** - Subcontractors are solely the responsibility of the Contractor. The Contractor is responsible for assuring that its Subcontractors have sufficient skill and experience to perform the Work properly and for coordinating and managing its Subcontractors to achieve the intent of the Contract. The Contractor agrees to indemnify, defend, and hold harmless the Department from and against all claims and causes of action arising out of any act or omission of Subcontractors, their agents, representatives, and employees. The Contractor agrees to indemnify, defend, and hold harmless the Department from any claims asserted by its Subcontractors, including any claims to recover losses allegedly suffered by a Subcontractor. Subcontracting does not alter or diminish the Contractor's obligations under the Contract. For a related provision, see Section 105.1 - Intent of the Contract.

- 104.5.3 ***Documentation Regarding Subcontracting*** - Before any Work is performed by a Subcontractor, the Contractor shall provide the Department a Subcontract approval package which shall include:

A list of all Subcontractors that the Contractor anticipates will be providing Work within the Project Limits.

If requested by the Department, the Contractor shall provide the Department with copies of any Subcontract or other document that

establishes the relationship of the Contractor and any Subcontractors.

- 104.5.4 ***Discharge of Subcontractors*** - The Department, upon written notice to the Contractor, may require that the Contractor discharge any Subcontractor without cost or liability to the Department. If the Department determines that a Subcontractor's performance jeopardizes the intent of the Contract otherwise, the Department may, but is not required, to notify the Contractor of such a determination. Such notice, or lack thereof, does not affect the Contractor's duties regarding Subcontractors. Upon Receipt of such notice, the Contractor shall take any action it determines is necessary to fulfill its obligations under the Contract. For related provisions, see Sections 104.3.4 - Workers and Equipment, 104.5.2 - Contractor's Duties Regarding Subcontractors, 105.1 - Intent of the Contract, and 105.2 - Health and Safety.

Prompt Payment of Subcontractors

Pay When Paid - The Contractor shall pay Subcontractors in full for all Work satisfactorily performed and Invoiced by the Subcontractor no later than 30 Days from the date the Contractor receives payment from the Department for such Subcontractor's Work. Contractor will insure that its Subcontractors pay all Sub-Subcontractors, including suppliers and materialmen, no later than 30 Days from the date that they receive payment from the Contractor.

Retainage - The Contractor shall return to the Subcontractor all retainage withheld from the Subcontractor within 30 Days after the date the Subcontractor's Work is satisfactorily completed. If there is a Delay in such return of retainage, the Subcontractor may pursue all rights it may have under the claims procedure referenced in Section 104.5.6 - Subcontractor Claims for Payment.

Payment Tracking Federal Projects - On federally funded Projects, the Contractor, Subcontractors, and lower-tier Subcontractors will track and confirm the delivery and receipt of all payments through the Elation System. They will be responsible for entering all payments to all Subcontractors and lower-tier Subcontractors. The Department will run a query monthly to ensure that Contractors are complying and generate an e-mail to Contractors who have not responded to confirm receipt of Department payment or Contractor payment to Subcontractors and lower-tier Subcontractors.

- 104.5.6 ***Subcontractor Claims for Payment*** - The Contractor agrees to notify all Subcontractors of the claim filing procedure of Payment and

Performance Bonds required by 110.2.1. The Department may use retainage and other remaining Project funds to pay outstanding claims for Accepted Work.

- 104.5.7 **Flow Down** - All Subcontracts of the Contractor, and all lower tier Subcontracts, shall contain or reference all applicable provisions of the Contract, including all safety, wage, Prompt Payment, labor, environmental, and equal opportunity provisions. The Contractor shall indemnify, defend, and hold harmless the Department against any and all claims or liabilities arising from the failure to include such flow down provisions and agrees that any such claims and liabilities may be paid by the Department using retainage on other Project funds.
- 104.5.8 **No Third Party Beneficiaries** - The Contractor and the Department agree that this Contract is not intended to create any third-party beneficiaries or to authorize anyone not a party to the Contract to maintain an action under Contract provisions.
- 104.5.10 **Warranty and Maintenance Bonds** - Warranty and Maintenance Bonds may be required of the Contractor or the Subcontractor for specified items that the Department deems appropriate. Specific requirements will be given via Special Provision. These bonds may be for specified items in the Contract Schedule of Items. The Bond must name the "Treasurer-State of Maine" as an obligee. The Contractor shall provide a copy of said bond to the Department before the performance of any affected on-site Work. Should the Subcontractor be required by special provision to provide a Warranty or Maintenance Bond, the Contractor hereby authorizes the Department to directly contact the Landscape Subcontractor and/or its Surety in the event of a failure of the bonded item to perform as specified.

SECTION 105 - GENERAL SCOPE OF WORK

Scope of Section This Section contains Work requirements that are generally within the scope of all Projects. These include provisions related to health and safety, traffic control, maintenance of Work, hauling of Materials and Equipment, construction surveying, Working Drawings, the environment, historic and archeological considerations, equal opportunity and civil rights, and other federal requirements. This Section is not all-inclusive. The scope of these items is often described more specifically and fully elsewhere in the Contract and in other specific items that appear elsewhere.

This Contract is federally funded, unless expressly provided otherwise in the Bid Documents. As a federally funded Contract, it includes all federal requirements set forth in the Project Specific Bid Book.

- 105.1 ***Intent of the Contract*** - The intent of the Contract is to provide for the construction and Completion of a functionally complete Project in Conformity with the Contract. The Contractor shall furnish all Work to achieve this intent, including all Work that may be reasonably inferred to be required from the Contract or from prevailing industry or trade custom, whether or not specifically called for.
- 105.2 ***Health and Safety***
- 105.2.1 ***Safety Responsibility*** - The Contractor has the overall authority and responsibility to maintain safety of its employees and of all other persons in the work area or on the worksite. The Contractor shall provide all safeguards, safety devices, and protective Equipment and take all other action that is necessary to continuously and effectively protect the safety and health of all persons from hazards related to the Work. Such safeguards include providing a sufficient number of security guards.
- 105.2.2 ***Health and Safety Plan*** - A copy of the Contractor's Health and Safety Plan must be on file with the Contracts Section of the Department as a condition of Prequalification to be awarded a Construction Contract. A copy of the Safety Plan will be provided to the Department's Contracts Section in an electronic media format prior to Contract award. The Contractor shall designate which portions such submissions it considers confidential business information. If such program is revised during the Contract Time, the Contractor shall provide the updated program to the Department. The Contractor shall comply with its safety program and this Section 105.2 - Health and Safety. The Contractor shall be responsible for all claims or damages arising from failure to so comply and to indemnify, defend, and hold harmless the Department from all claims and damages arising from such non-compliance.
- 105.2.3 ***Project Specific Emergency Planning*** - Unless the Contract provides for closure of an existing facility, the Contractor shall ensure that essential police, fire, rescue, and ambulance services have reasonable and timely access to and through the Project Limits. The Contractor shall contact all emergency service providers in the area, discuss potential impacts on emergency operations (including water supply for fire suppression), and minimize any negative impacts. Fire hydrants within or adjacent to the Project Limits shall be kept accessible to fire apparatus at all times, unless the fire department agrees otherwise in writing. For a related provision, see Section 104.3.12 - Forest Protection and Laws.

If the nature of the Work involves deep trenching, confined spaces, toxic chemicals, or any other unusual hazards that could require

specialized rescue, the Contractor shall inform and cooperate with the appropriate fire department, rescue service, or EMS.

The Contractor shall provide the Resident with, and post and maintain in conspicuous places within the Project Limits, a list containing

- (A) emergency response numbers with the names and telephone numbers (including cellular phone and pager numbers, if applicable) of local ambulance, police, fire, rescue, and hospitals,
- (B) emergency response numbers for hazardous Materials spills as required by Section 656.3.4(f) - Spill Prevention,
- (C) the Contractor's personnel with phone numbers who may be reached in case of emergency, and
- (D) the Department's personnel with phone numbers who may be reached in case of emergency.

105.2.4 **Unsafe Conditions** - The Contractor will immediately eliminate all unsafe conditions brought to the Contractor's attention by the Department Resident or any other Department staff. If the Contractor or the Department actually observes any person(s) performing Work in a manner that (A) the observing party actually knows is not in compliance with the MUTCD, the Contractor's TCP, an applicable OSHA requirement, or commonly accepted safety practices, and (B) creates a clear and immediate risk of significant bodily injury to any person, then the observing party shall immediately notify such person(s) Working in an unsafe manner and the other party to the Contract. The Contractor and the Department agree to cooperate in eliminating all such unsafe conditions. For related provisions, see Sections 104.3.4 - Workers and Equipment, 104.4.6 - Utility Coordination, 105.3 - Traffic Control and Management, and 105.4 - Maintenance of Work.

105.2.5 **Compliance with Health and Safety Laws** - The Contractor has the authority and responsibility to ensure compliance with all applicable federal, State, and local laws governing safety, health, and sanitation, including all applicable laws and regulations of OSHA. The Contractor shall comply with these laws and regulations and ensure compliance by its Subcontractors. The Contractor is responsible for correcting any health and safety violations.

For related provisions, see Sections 105.2.3 – Project Specific Emergency Planning, 105.3 – Traffic Control and Management and 105.4 – Maintenance of Work.

105.2.6 **Convenience of the Public** - At all times the Contractor shall perform the Work to minimize obstructions to pedestrian, vehicular, railroad,

and marine traffic. All temporary and permanent pedestrian access ways must comply with the Americans with Disabilities Act (ADA). Footways, gutters, sewers, inlets, and portions of the Highway adjacent to the Work must not be obstructed unless allowed by the Contract.

If the Contractor receives notice from the Department that the Contractor has failed to comply with the provisions of this Section 105.2 - Health and Safety, the Contractor shall remedy such non-compliance immediately. If the Contractor fails to do so, the Department may remedy such non-compliance by any means and deduct the cost of the remedy from amounts otherwise due the Contractor.

105.2.7 ***Use of Explosives***

- A. ***Standards*** - When using explosives, the Contractor shall use the utmost care to protect life and property. Explosives must be transported, stored, and used in compliance with this Contract, in compliance with all applicable federal, State, and local laws, rules and regulations, and in accordance with all applicable provisions of the latest version of the Blasters' Handbook published by the International Society of Explosives Engineers (ISEE) of Cleveland, Ohio. In any case, the Contractor shall comply with the recommendations contained in Chapter 13 - "Blasting Safety" of said Blasters' Handbook, unless a qualified person conducting the blasting operations for the Contractor certifies to the Department in writing that certain provisions of said Chapter 13 are not necessary to protect life and property.
- B. ***Blasting Zone - Signage and Flaggers*** - The Contractor shall define a blasting zone. When using electric detonators, the blasting zone must allow safe distances from radio transmitters based upon their power output frequency. The blasting zone must include all areas within which people could be injured or property could be damaged by the blast. The Contractor shall mark Highways conspicuously at the perimeter of the blasting zone with signs in accordance with MUTCD. If applicable, the Contractor shall place signage along railroads and appropriate notice shall be provided to marine traffic. The Contractor shall provide a sufficient number of flaggers stationed outside the blasting zone to stop all approaching traffic during blasting operations.
- C. ***Other Requirements*** - The Contractor shall provide to the Department general liability insurance coverage covering use

of explosives in accordance with Section 110.3.2 - Commercial General Liability. Immediately after the blast, the Contractor shall remove any debris that is obstructing Highway, pedestrian, railroad, or marine traffic flow. . The Contractor shall not use perchlorate in its blasting operations. For related provisions, see Sections 104.4.6(C)(9) - Blasting Notice, 104.3.11 - Responsibility for Property of Others, and 110.1 – Indemnification , 110.3.2 - Commercial General Liability and Spec 203.042 - Rock Excavation and Blasting.

105.3 ***Traffic Control and Management*** - The Contractor shall provide continuous and effective traffic control in compliance with Section 652 - Maintenance of Traffic.

105.3.1 ***Notices Required*** - The Contractor shall plan paving operations so that the Resident will have sufficient advance notification to provide the necessary inspection and testing. Sufficient notification will be considered 48 hours. In the event that paving is suspended, the 48 hour advance notification shall be required again before restarting the paving operations unless otherwise agreed by the Resident. A verbal warning will be given before starting the offense process for paving notification.

The Contractor shall plan granular material operations so that the Resident will have sufficient advance notification to provide a proctor for the material to be placed. Sufficient notification will be considered 7 Days. Changes in source will also require this notification.

Failure to provide the above notifications will result in the following actions:

- ***First offense*** – verbal warning
- ***Second offense*** - written warning
- ***Third and subsequent offense*** - liquidated damages will be charged for 1 Calendar Day

105.4 ***Maintenance of Work***

105.4.1 ***Maintenance During Construction*** - The Contractor shall maintain the Project and all related Work in a safe and satisfactory condition until Final Acceptance. Such maintenance requires continuous and effective Work conducted daily.

Trenches - Where existing pavement carries traffic and is removed, the pavement shall be replaced daily with a temporary pavement consisting of a minimum of 3" of acceptable hot or cold bituminous mixture. Cold bituminous mixture shall contain Aggregates, asphalt cutbacks, liquefiers and wetting agents. No separate payment will be made for furnishing, placing, maintaining, and removing temporary

pavement, and all cost of such work will be considered Incidental to the Contract.

Before placing any permanent pavement over backfilled trenches, the edge of the adjoining existing pavement shall be cut even and vertical, and coated with tack coat to form a tight joint between the new and the existing pavements. The permanent pavement depth and type (HMA or PCC) will match the existing roadway structure. No separate payment will be made for cutting and tack coating the joint.

If the Contractor fails to meet the conditions of Section 105.4.1, the Department will notify the Contractor of such failure. The Contractor shall remedy such failure within 4 hours after receiving such notice. If the Contractor fails to do so, this may be considered a traffic control violation in accordance with Section 652 and the Department may remedy the situation with its own or Contracted forces without liability to the Department and all costs will be deducted from amounts otherwise due the Contractor. When the Contract involves placing material on, or use of previously constructed subgrade, base course, pavement, or structure, the Contractor shall maintain such previously constructed Work in a safe and satisfactory condition until Final Acceptance.

Except as expressly provided otherwise in the Contract, the cost of complying with this Section 105.4.1 is Incidental to the Contract.

- 105.4.2 ***Use of Granular Materials*** - The Department may authorize and pay for granular Materials that are capable of supporting traffic and necessary to maintain the specified traffic Lane widths upon the following conditions.
- A. The Contractor must prepare the area where the granular Materials are to be used by eliminating objectionable Material and providing adequate temporary Drainage before the granular Material is placed.
 - B. Quantities of granular Materials will be determined by the most appropriate method of measurement that applies at the time the Material is placed and that is in accordance with the Specifications for the particular type of granular Material authorized for use. For a related provision, see Section 108.1 - Measurement of Quantities for Payment.
 - C. Payment for granular Material will be made at the Unit Price for the Material authorized for use.
 - D. Payment as Common Excavation will be made when Material for maintenance of traffic is removed.

- 105.4.3 **Maintenance During Winter Construction** - Except as provided in the following paragraph, when the Contractor performs Work during winter weather conditions, the Contractor shall plow snow from the portions of a Project that carry vehicular or pedestrian traffic, including all Bridges and Sidewalks, so as to allow the free and safe flow of such traffic. The State or local governmental agency that would otherwise be responsible for winter maintenance will sand and salt such portions of a Project.

The State or local governmental agency responsible for winter maintenance will plow, sand, and salt such portions of a Project that

- (A) have been untouched or left by the Contractor in a suitable condition to carry traffic as determined by the Department and
- (B) are unaffected by the construction operations.

105.4.4 **Maintenance During Suspension of Work**

- A. **Work Responsibilities** - Prior to suspension, the Contractor must make the Project suitable for the free and safe flow of traffic as determined by the Department, including covering or removal of signs. To provide space for snow removal, all areas to be used by traffic must be clear for the entire usable Roadway, including Shoulders, or curb-to-curb, including Sidewalks.

During an approved suspension, the Department will maintain the temporary Roads and Project sections by plowing snow, controlling ice, and patching or retreating the surface. During suspension, the Contractor must

- (1) take precautions necessary to prevent damage to the Work and to allow the Department to provide such maintenance (such precautions include providing Drainage and erecting any necessary Structures, signs, or other facilities);
- (2) maintain all temporary Structures and traffic control devices; and
- (3) continuously maintain, in an acceptable growing condition, all living plant Material, including newly established seedings and soddings furnished under the Contract and take precautions to protect vegetative growth from damage.

After suspension, the Contractor must clean up all evidence of the snow and ice control at its expense, including removing

excess sand and debris from the Roadway and replacing all base or subbase Material that was lost as a result of maintenance activity.

If a Work suspension is not approved, the Contractor will remain responsible for maintaining the Project, including plowing snow, controlling ice, and patching or retreating the surface.

- B. **Cost Responsibility** - All costs related to suspending and resuming Work related to approved suspensions will be considered Incidental to the Contract. For related provisions, see Sections 104.2.6 - Right to Suspend Work and 107.5 - Suspension of Work.

- 105.4.5 **Maintenance of Existing Structures** - When a new Bridge or Minor Span is being installed on a new alignment and the existing structure is to remain in service, the Department will maintain the existing structure and the portions of the roadway required for maintaining traffic until such time that the new structure is opened to traffic and the existing structure is taken out of service. A similar situation exists when a new Bridge or Minor Span is being installed on the same alignment as the existing structure, requiring a temporary detour to be installed by the Contractor per Section 510 - Special Detours, prior to removal of the existing structure. In this case, the Department will maintain the existing structure and the portions of the existing roadway required for maintaining traffic until such time that either the temporary detour is opened to traffic or the Contractor begins any work on the existing structure, including, but not limited to, repairs, modifications, moving, demolition, or removal. In either case, once the new structure or temporary detour is opened to traffic, or the Contractor begins any work on the existing structure, the Contractor shall be solely responsible for all maintenance of the existing structure and the portions of the existing approaches that lie outside the new roadway or the temporary detour, respectively. This specification is not intended to supersede Standard Specification Section 104.3.11 - Responsibility for Property of Others.

105.5 **Hauling of Materials and Equipment**

- 105.5.1 **General Requirements** - Except as provided otherwise and limited in this Contract, the Contractor may use any public Road or Bridge for the hauling of Materials and Equipment in legally registered vehicles that are carrying legal loads and operating otherwise in accordance with all applicable State or federal laws. If the Contractor violates such laws or the terms of this Contract relating to hauling, the Contractor shall, at its expense, repair damage to any Road or Bridge

that the Department determines was caused by the Contractor to the satisfaction of the governmental entity that maintains the Road or Bridge.

The Contractor must abate any dust nuisances caused by such hauling. For a related provision, see Section 637 - Dust Control and Section 656 - Temporary Soil Erosion and Water Pollution Control.

- 105.5.2 **Bond for Use of Municipal Roads** - If the Contractor wants to use Roads maintained by a municipality for hauling, the municipality may require the Contractor to purchase a bond for each mile of traveled length. The face value for such bond shall not exceed \$50,000/mile. The cost of said bond shall be Incidental to the Contract.
- 105.5.3 **Posted Roads or Bridges** - The Contractor must comply with all restrictions set forth pursuant to 29-A MRSA § 2395, including springtime posting of load restrictions. An overlimit movement permit pursuant to 29-A MRSA § 2382 will not relieve the Contractor of its obligation to repair damage to such posted Roads or Bridges. For a related provision, see Section 104.3.2 - Furnishing of Other Property Rights, Licenses, and Permits.
- 105.5.4 **Narrow Roads** - The Contractor shall not haul on Roads having a bituminous surface width of less than 20 ft unless there is no practical alternative.
- 105.5.5 **Overlimit Loads**
- A. **Within Project Limits** - Within the Project Limits, the Contractor shall not haul over the base courses, surface course, or accepted subgrades with loads that exceed legal limits, except for Equipment used in grading operations, including the preparation of the subgrade.
 - B. **Outside Project Limits** - Outside the Project Limits, the Contractor must comply with 29-A MRSA § 2382 - Overlimit Movement Permits before moving vehicles or hauling loads in excess of legal limits. The Contractor is responsible for all damage caused by the movement of loads in excess of legal limits whether under permit or not.
- 105.5.6 **Restrictions on Movement and Storage of Heavy Loads and Equipment on Bridges** - The Contractor shall comply with legal load restrictions and with special restrictions required by the Contract when hauling or storing materials, including demolition debris, and moving or storing equipment on Bridges within the Project Limits that are under construction or completed but not yet open to traffic.
- The Contractor shall not operate equipment mounted on crawler tracks or steel-tired wheels on or across concrete or bituminous

surfaces, unless otherwise approved by the Resident. The Contract requirements may impose special restrictions on speed, load distribution, surface protection, or other precautions.

When construction operations require crossing an existing Bridge with otherwise prohibited equipment or loads, the Contractor shall use Department approved methods of load distribution or bridging, at no additional cost to the Department.

The Contractor will not be relieved of liability for damages resulting from the operation and movement of construction equipment because it has been issued a special permit, or it has adhered to any other restrictions imposed.

Unless otherwise allowed by the Contract or approved by the Department, the Contractor shall temporarily store construction materials, including demolition debris, or park equipment on a Bridge deck during construction in accordance with the following limits, which have been established to reflect typical design live loads:

- Stockpiles shall not weigh more than 65,000 lb per 1,000 square feet,
- Individual stockpiles of Materials (including pallets of products, reinforcing steel bundles and Aggregate stockpiles) shall not weigh more than 25,000 lb per 100 square feet, or
- No single vehicle or piece of Equipment shall weigh more than 80,000 lb and no combination of vehicles, Materials, and other Equipment shall weigh more than 200,000 lb per span, for span lengths greater than 40 ft.
- The Contractor may submit alternate loadings with calculations stamped by a licensed Professional Engineer, within 30 Days prior to placement of the load(s).

105.6 **Construction Surveying**

105.6.1 **Department Provided Services** - The Department will provide the Contractor with the descriptions and coordinates of a sufficient number of vertical and horizontal control points, set by the Department, throughout the Project, for full construction Projects and other Projects where survey control is necessary. For Projects of 1,000 ft in length or less, the Department will provide a minimum of three points. For Projects between 1,000 and 5,000 ft in length, the Department will provide a minimum of five points. For Projects in excess of 5,000 ft in length, the Department will provide at a minimum, one set of two points at each end of the Project, plus one additional set of two points for each mile of Project length. For non-full construction Projects and other Projects where survey control is not

necessary, the Department will not set any control points and, therefore, will not provide descriptions and coordinates of any control points. Upon request, the Department will provide its Survey Manual to the Contractor, or its survey Subcontractor.

- 105.6.2 **Contractor Provided Services** - Using the survey information and points provided by the Department, described in Subsection 105.6.1 - Department Provided Services, the Contractor shall provide all additional survey layout necessary to complete the Work. This may include, but not be limited to, re-establishing all points provided by the Department, establishing additional control points, running axis lines, providing layout and maintenance of all other lines, grades, or points, and survey quality control to ensure conformance with the Contract. The Contractor is also responsible for providing construction centerline, or close reference points, for all Utility Facilities relocations and adjustments as necessary to complete the Work. When the Work is to connect with existing Structures, the Contractor shall verify all dimensions before proceeding with the Work. The Contractor shall employ or retain competent engineering and/or surveying personnel to fulfill these responsibilities.

The Contractor must notify the Department of any errors or inconsistencies regarding the data and layout provided by the Department as provided by Section 104.3.3 - Duty to Notify Department If Ambiguities Discovered.

- 105.6.2.1 **Survey Quality Control and Construction Layout** - The Contractor is responsible for all construction survey quality control. Construction survey quality control is generally defined as, first, performing initial field survey layout of the Work and, second, performing an independent check of the initial layout using independent survey data to assure the accuracy of the initial layout; additional iterations of checks may be required if significant discrepancies are discovered in this process. Construction survey layout quality control also requires written documentation of the layout process such that the process can be followed and repeated, if necessary, by an independent survey crew.

- 105.6.2.2 **Electronic Design and Model Data**- Any electronic Project design and model data provided by the Department will not be deemed a part of the Contract and is supplied as a courtesy by the Department. The Contractor shall not take advantage of any ambiguity or error contained in said data, and upon discovery of any ambiguity or error shall notify the Department before

proceeding. The Contractor may convert any electronic data provided by the Department into a format required by the Contractor's system and equipment at the Contractor's expense. Any electronic model data to be used for construction shall be submitted to the Department in a format pre-approved by the Department at least 14 Days prior to the pre-construction meeting. No changes shall be made to the Contractor's electronic model data after submittal without prior written consent by the Project Resident. The Department will review and provide comments to the Contractor within 14 Days of receipt of the electronic model data submittal.

105.6.2.3 **Survey Work Plan** - The Contractor shall provide a Survey Work Plan to the Department prior to, or at, the preconstruction meeting.

The Survey Work Plan shall include:

- A. Make and model of equipment and software used for Project layout.
- B. Make and model of equipment and software used for machine guidance and control.
- C. Manufacturer-stated specifications for vertical and horizontal accuracy attainable by the equipment.
- D. Equipment calibration procedures and date of last calibration.
- E. Narrative of methodology used to establish any additional horizontal or vertical Project control points. Field notes for new vertical control shall be submitted to the Department.
- F. Site Calibration (Localization) and control verification procedures, including a timetable and tolerances. A Site Calibration report shall be submitted to the Department, including the values of calculated residuals of each point used in the calibration.
- G. Type and locations of base stations to be used, including methodology for establishing on-site base broadcast positions and localization procedures used for off-site bases.
- H. Describe methodology used to overcome Real Time Kinematic (RTK) signal losses in a portion or

portions of the Project, and methodology to ensure signals for both inspection operation areas and construction operation areas (i.e. multiple bases operating simultaneously)

- I. Describe procedures used to integrate vertical refinement equipment (i.e. laser); including the process of determining and verifying transmitter set-up location and communicating any necessary adjustments to the machine control equipment.
- J. Name(s) and qualifications of the Contractor's designated on-site surveyor(s) or engineer(s) responsible for performing the Project layout.
- K. Design software and version used to develop the Contractor's electronic model data.

The Department will review and provide comments to the Contractor within 7 Days of receipt of the Survey Work Plan.

105.6.2.4 **Department Verification** - The Contractor shall furnish a Global Navigation Satellite System (GNSS) or Global Positioning System (GPS) Rover and/or Robotic Total Station (RTS) equipment to the Department with the same capabilities as those used by the Contractor or other approved method, such as reference staking, to allow the Department to independently verify the accuracy of the work, as approved by the Department.

This equipment referred to above shall be compatible with the system(s) used by the Contractor and be provided to the Project Resident prior to the Contractor commences Work using electronic layout methods. This equipment shall stay in the possession of the Department for the duration of the Project and shall be returned, in good condition, to the Contractor upon final acceptance of the field work. Any augmented features (such as laser refinement) used by the Contractor shall be included in the features available on the equipment provided to the Department.

The Contractor shall provide manufacturer-certified training on the use of the GNSS, GPS, and/or RTS equipment and the Contractor's systems to Department Project personnel prior to beginning any Work. This training is for the purpose of providing Department Project personnel with an understanding of the equipment,

software, and electronic data being used by the Contractor.

105.6.2.5 **Field Layout Specifications** - All Work accomplished through electronic layout methods and/or machine control must meet the same accuracy requirements as the conventional grading construction standards detailed in the Standard Specifications. The Contractor shall not use GNSS, GPS, or RTS equipment for a construction activity that requires a greater precision than the machine's capability as per the manufacturer's recommendation.

105.6.2.6 **Basis of Payment** - No payment shall be made by the Department for the Contractor's elected use of electronic methods of Project location layout and control. Any delays arising from the operation of GNSS, GPS, or RTS layout or machine control systems will not result in adjustment to the bid price or quantity of any construction items or be justification for granting any type of Contract extension. Any costs incurred through incorrect use of GNSS, GPS, or RTS layout or machine control systems or re-work necessary through their use are the sole responsibility of the Contractor. Training of Department Project personnel in the use of GNSS, GPS, or RTS will be paid on a reimbursable basis based on submitted invoices, without Contractor markup.

105.6.3 **Survey Quality Assurance** - It is the Department's prerogative to perform construction survey quality assurance. Construction survey quality assurance is generally defined as an independent check of the Contractor's construction survey quality control. The construction survey quality assurance process may involve physically checking the Contractor's construction survey layout using independent survey data, or may involve reviewing the construction survey quality control written documentation. If the Department elects to physically check the Contractor's survey layout, the Contractor's designated surveyor may be required to be present. The Department will provide a minimum notice of 48 hours to the Contractor, whenever possible, if the Contractor's designated surveyor's presence is required. Any errors discovered through the quality assurance process shall be corrected by the Contractor, at no additional cost to the Department.

105.6.4 **Boundary Markers** - The Contractor shall preserve and protect from damage all monuments or other points that mark the boundaries of the Right-of-Way or abutting parcels that are outside the area that must be disturbed to perform the Work. The Contractor shall

indemnify, defend, and hold harmless the Department from all claims to re-establish the former location of all such monuments or points, including claims arising from 14 MRSA § 7554-A. For a related provision, see Section 104.3.11 - Responsibility for Property of Others.

- 105.6.5 **Survey Control Markers** - If a survey control marker will be disturbed by Work on a Project, the Resident shall be informed a minimum of 2 weeks prior to performing any Work that may disturb the marker. If a survey control marker is accidentally disturbed by Work on a Project, the Resident shall be informed immediately. A disturbed marker will remain the property of the Department.

105.7 **Working Drawings**

- 105.7.1 **General** - The Contractor shall provide all necessary Working Drawings to the Department for review. The Contractor shall not allow final assembly or fabrication of structural units before the Department completes its review of the applicable Working Drawings and comments on them. The Contract price shall include the cost of furnishing and revising all Working Drawings.

The Department's review of and comment on Working Drawings may be limited to basic Contract requirements relating to design compliance and Material type(s). Such review shall not relieve the Contractor of responsibility under the Contract, including the overall correctness of Working Drawings, including Engineering and mathematical computations, shop fits, and field connections.

- 105.7.2 **Review Times** - The Contractor's Schedule of Work shall allow the Department the following review and comment times prior to the start of production. For a related provision, see Section 107.4 - Scheduling of Work.

- **First Submission** - 21 Days or 1 Day per drawing, whichever is greater.
- **Second Submission** - 10 Days or ½ Day per drawing, whichever is greater.
- **Each subsequent submission** - 10 Days or ½ Day per drawing, whichever is greater.

The above review times shall be doubled for submittals that include design computations.

The Department may combine separate submissions of analytically common elements of Work and require the per-drawing review times set forth above when it determines that the Contractor has divided Working Drawings into separate submissions for the purpose of avoiding said per-drawing review times.

Delay caused by exceeding the time periods listed above will be analyzed in accordance with Section 109.5 - Adjustments for Delay.

- 105.7.3 **Cost of Review** - The Department will review the first and second submission at no cost to the Contractor. For subsequent submissions, the Department will charge the Contractor a rate of \$75 per person-hour of review. Such costs will be deducted from amounts otherwise due the Contractor.

- 105.7.4 **Submittal Requirements** - The Contractor shall indicate the order of preference for review and return of Working Drawings and organize all Drawings in the order of their importance.

The Contractor shall submit three sets of Drawings or electronic copy to the Resident.

All submittals shall use the same system of units as that used in the Department's Plans.

- 105.7.5 **Review Standards and Procedures** - If the first submission does not meet accepted industry standards for Working Drawings or Engineering design Drawings and Specifications, as determined by the Department, the entire submission will be returned without review and will be recorded as the first submission. When resubmitted, the review time requirements shall be those applicable to a first submission.

One set of reviewed Working Drawings will be marked with comments and returned to the Contractor. The Contractor shall then revise its Working Drawings accordingly. Except as provided otherwise in the Contract, the Contractor shall furnish the Department with two reproducible copies of the final Working Drawings before construction of the element(s) depicted in the Working Drawing(s).

105.8 **Environmental Requirements**

- 105.8.1 **Temporary Soil Erosion and Water Pollution Control** - The Contractor shall provide continuous and effective soil erosion and water pollution control in compliance with Section 656 - Temporary Soil Erosion and Water Pollution Control.

105.8.2 **Permit Requirements**

- A. **Permits Granted to Department** - Permits are to be included in or incorporated by reference into the Bid Documents. If Permits are not so included and the Contractor is aware the Work will affect a regulated resource such as water bodies or wetland, the Contractor shall notify the Department before Bidding. For a related provision, see Section 102.5.2 - Bidder's Duty to Notify Department If Ambiguities Discovered.

The Contractor is responsible for complying with all Permit conditions. If the Contractor desires to modify or seek interpretation of any permit granted to the Department, it must coordinate any such requests through the Department.

- B. **All Other Permits** - Except as expressly provided otherwise in the Contract, the Contractor, at its expense, shall procure all other environmental or land use Permits, licenses, or other permissions that are necessary or appropriate to perform the Work. At the time of application, the Contractor shall provide the Department with notice of all applications for such Permits, licenses, or other permissions, and upon request, a copy of all such applications. For a related provision, see Section 104.3.2 - Furnishing of Other Property Rights, Licenses, and Permits.

105.8.3 **Wetland and Waterbody Impacts**

- A. **General Prohibition** - Except as specifically allowed by the Contract, there shall be no permanent or temporary impacts to water bodies or wetlands identified on the Plans or otherwise known to the Contractor. For a related provision, see Section 656.3.4 – Water Pollution Control Requirements.
- B. **Wetlands Outside Project Limits** - If the Contractor desires to conduct an activity that can disturb the soil in an area that is outside the Project Limits, but is contiguous or in close proximity to such Limits, the area first must be examined and analyzed by a qualified wetlands specialist in order to determine whether wetlands exist, and if so, to delineate them. The Contractor must notify the Department of all such examinations and analyses and the results thereof. Wetlands so delineated must not be impacted unless properly permitted.

Any fill Material generated from this Project shall not be placed, stored, or disposed of in a wetland at an off-site location unless the Contractor provides the Department with written evidence that all Permits necessary for such use have been obtained. Such evidence must be signed by the Owner of such site and otherwise acceptable to the Department.

- C. **Temporary Structures** - Temporary or permanent impacts to wetlands are prohibited without proper permitting or modification to existing Permits. Temporary Structures in a waterbody must comply with any Contract provisions regarding Instream Work.

- 105.8.4 **Hazardous Materials** - If the Contractor encounters any condition that indicates the presence of uncontrolled petroleum or hazardous Materials, the Contractor shall immediately stop Work, notify the Department, treat any such conditions with extreme caution, and secure the area of potential hazard to minimize health risks to workers and the public, and to prevent additional releases of contaminants into the environment. Such conditions include the presence of barrels, tanks, unexpected odors, discoloration of soil or water, an oily sheen on soil or water, excessively hot earth, smoke, or any other condition indicating uncontrolled petroleum or hazardous Materials. The Contractor shall continue Work in other areas of the Project unless otherwise directed by the Department. The Contractor shall utilize approved vendors and comply with all federal, State, and local laws concerning the handling, storage, treatment, and disposal of uncontrolled petroleum or hazardous Material. If the condition meets the definition of a Differing Site Condition under Section 109.4.1, the Contractor may be eligible for an Equitable Adjustment.
- 105.8.5 **Dredge Spoils (Dredge Materials)** - Unless otherwise provided in the Contract, dredge spoils may not be used as fill within the Project Limits. Any use or disposal of dredge spoils must be in accordance with all applicable federal and State laws.
- 105.8.6 **Pit or Quarry Requirements**
- General** - Pits or quarries that are sources of Material for the Project, including loam fields, shall meet the requirements of this Section 105.8.6. The Contractor must procure an Agreement from the Owners of such sources stating that the Owners will comply with these requirements. If requested by the Department, the Contractor will provide the Department with a copy of such Agreement. The Contractor shall provide the Resident with the center of the source GPS coordinate pairs (latitude and longitude) in decimal degrees (DD.DDDDDD), name, and town in which the source is located.
- Excavation Requirements** - Surface Material stripped from the pit shall be stored to allow for restoration of the pit. The Contractor shall not excavate from pit faces that are vertical or have an overhang. The Contractor must stop excavating within a 2 horizontal to 1 vertical slope 10 ft inside of a property line of a deposit, even though the Material within the pit may have a steeper angle of repose, except when an additional Agreement is reached with an adjacent property Owner to allow the extension of a pit onto the adjacent property Owner's land. The Contractor must insure that hazards such as steep pit faces and ponds are protected by flattening slopes or by erecting suitable fencing. Rehabilitation If the pit is licensed by MDEP or LURC, the Contractor shall follow the rehabilitation provisions of said

license. In the absence of such license requirements, the Contractor shall follow local Municipal Land Use Ordinances pursuant to Gravel Pit Operations. In the absence of such Ordinances, or if the Ordinances do not address rehabilitation of pits, the Contractor and Landowner shall agree, in writing, to the scope of rehabilitation of the pit. This agreement shall be signed by both parties. A copy of the agreement shall be submitted to the Resident.

- 105.8.7 ***Environmental Non-compliance - Remedies and Costs*** - The Contractor shall be in non-compliance if it, or Subcontractors at any tier, fail to comply with the terms of this Contract or, pursuant to Section 104.3.7 - Laws To Be Observed, any applicable environmental or land use law or regulation, including Project specific permit conditions.

If the Contractor is in non-compliance, the Department may, at its discretion:

- A. Withhold all Progress Payments, or any portion thereof, during the period the Contractor is in non-compliance;
- B. Remedy such non-compliance using State forces or another Contractor and deduct all costs incurred by the Department from Progress Payments. Such costs include direct costs, Project Engineering costs, and Contractor costs from amounts otherwise due the Contractor, and/or
- C. Suspend the Work for cause and without cost or liability to the Department. Said suspension shall continue until the Contractor has addressed all non-compliance issues as directed by the Department.

The Contractor shall be responsible for any fines and penalties assessed by environmental or land use regulatory agencies due to such non-compliance. Such penalties may be withheld from amounts otherwise due the Contractor. For related provisions, see Sections 108.5 - Right to Withhold Payments and 108.9.3 - Amounts Due the Department.

- 105.8.8 ***Protected Species*** - If the Contractor witnesses a bat (dead or alive), any activities that may injure any live bats must cease immediately and the Contractor shall contact the Resident. Dead and/or injured bats will be collected by the Department. Work in the vicinity of the live/dead bat sighting will not resume until the Department confirms it is acceptable to do so.

If the Contractor observes an active bird nest within the Project limits, any activities that may disturb the nest or injure birds (i.e., nesting

adults, chicks, eggs) must cease immediately, and the Contractor shall contact the Resident.

- 105.9 ***Historic and Archaeological Considerations*** - Unless otherwise provided in the Contract, the Contractor is approved to construct the Project in accordance with the Contract plans. This in accordance with Section 106 of the National Historic Preservation Act (16 U.S.C. § 470 f), the Regulation (36 CFR Part 800), and the 2004 Section 106 Maine Programmatic Agreement.

Changes during construction that vary from the Project Contract plans must be approved by the Department. These changes could have adverse effects to Historic Resources, as well as jeopardize federal funding.

If the Contractor or any Subcontractor discovers any object of potential historic archaeological or other historic interest, all Work that could disturb the object will immediately cease and will not resume until investigation of the object and related deposits have been completed, and if necessary recovered. The Contractor will notify the Department immediately if any such object is discovered. (The first indications of such an object may be burial grounds or campsites of Native Americans that reveal the bones of the dead and implements. Also the exposure of marine fossils or shells found mainly in clay deposits, as well as, exposure of dumps in landfill areas, abandoned campfire sites, and building foundations.)

Any Delay of the Contractor's operations resulting from the above discoveries will be analyzed in accordance with the Department Standard Specification Section 109.5 – Adjustment for Delay, except that in no event will such Delay be a Compensable Delay.

The Contractor is notified of 27 MRSA § 371, which provides that the State owns all artifacts, specimens, and material that are found on, in, or beneath State-controlled lands.

- 105.10 ***Equal Opportunity and Civil Rights***

105.10.1 ***Removed*** - Replaced with following:

105.10.1.1 ***Disadvantaged Business Enterprises Program*** - The Department has established a Disadvantaged Business Enterprise (DBE) program in accordance with regulations of the United States Department of Transportation (USDOT), 49 CFR Part 26. The Department receives federal financial assistance from USDOT, and as a condition of receiving this assistance, the Department has signed an assurance that it will comply with 49 CFR Part 26. The Department is responsible for determining the eligibility of and certifying DBE firms in Maine.

A DBE is defined as a for-profit business that is owned and controlled by one or more socially and economically

disadvantaged person(s). For the purpose of this definition:

“Socially and economically disadvantaged person” means an individual who is a citizen or lawful permanent resident of the United States and who is Black, Hispanic, Native American, Asian, Female; or a member of another group or an individual found to be disadvantaged by the Small Business Administration pursuant to Section 3 of the Small Business Act.

“Owned and controlled” means a business that is:

- A sole proprietorship legitimately owned and controlled by an individual who is a disadvantaged person.
- A partnership or limited liability company in which at least 51% of the beneficial ownership interests legitimately are held by a disadvantaged person(s).
- A corporation or other entity in which at least 51% of the voting interest and 51% of the beneficial ownership interests legitimately are held by a disadvantaged person(s).
- The disadvantaged group owner(s) or stockholder(s) must possess control over management, interest in capital, and interest in earnings commensurate with the percentage of ownership. If the disadvantaged group ownership interests are real, substantial, and continuing and not created solely to meet the requirements of this program, a firm is considered a bona fide DBE.

105.10.1.2 **Commercially Useful Function** - The Department will count expenditures of a DBE Contractor toward the DBE Goal only if the DBE is performing a commercially useful function (“CUF”) on that Contract. A DBE performs a CUF when it is responsible for execution of the Work of the Contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. Credit will be given only when the DBE meets all conditions for a CUF. Credit for labor will be given in accordance with the responsibilities outlined in the Contract. To perform a commercially useful function, the DBE must also be responsible, with respect to materials and supplies used on the Contract, for negotiating price,

determining quality and quantity, ordering the materials, and installing (where applicable) and paying for the material itself. To determine whether a DBE is performing a commercially useful function, the Department will evaluate the amount of work Subcontracted, industry practices, whether the amount the DBE firm is to be paid under the Contract is commensurate with the work it is actually performing and DBE credit claimed for its performance of the work, and other relevant factors.

If, while the DBE is performing under the Contract, the DBE purchases supplies or rents equipment from the Contractor, the costs of such supplies or rentals do not count toward the DBE goal as defined in Section 105.10.1.3.

A current listing of certified DBEs that may wish to participate in the highway construction program and the scope of work for which they are certified can be found at <http://www.maine.gov/mainedot/civilrights/dbe.htm>. Credit will be given for the value described by a DBE performing as:

- **A Contractor** - 100% of actual value of work performed by own workforces.
- **An approved Subcontractor** - 100% of work performed by own workforces.
- **An owner-operator of construction equipment** - 100% of expenditures committed.
- **A manufacturer** - 100% of expenditures committed. The manufacturer must be a firm that operates or maintains a factory or establishment that produces on the premises the materials or supplies obtained by the Contractor. Brokers and packagers shall not be regarded as manufacturers.
- **A regular dealer** - 60% of expenditures committed. A regular dealer is defined as a firm that owns, operates, or maintains a store, warehouse or other establishment in which the materials or supplies required for the performance of the Contract are bought, kept in stock, and regularly sold to the public. For purposes of this provision a “Broker” is a DBE that has entered into a legally binding relationship to provide goods or services delivered or performed by a

third party. Brokers and packagers shall not be regarded as regular dealers.

- ***A bona fide service provider*** - 100% of reasonable fees or commissions. Eligible services include professional, technical, consultant, or managerial, services and assistance in the procurement of essential personnel, facilities, equipment, materials, or supplies required for the performance of the Contract. Eligible services also include services provided by agencies providing bonding and insurance specifically required for the performance of the Contract.
- ***A trucking, hauling, or delivery operation*** - 100% of expenditures committed when trucks are owned, operated, licensed, and insured by the DBE and used on the Contract and, if applicable, includes the cost of the self-supplied materials and supplies. 100% of expenditures committed when the DBE leases trucks from another DBE firm, including an owner-operator. 100% of reasonable fees or commissions the DBE receives as a result of a lease arrangement for trucks from a non-DBE, including an owner-operator.
- Any combination of A through G.

105.10.1.3 ***Race-neutral Goals*** - The Department is required to set an annual goal (approved on a 3 year basis) for DBE participation in Federal-aid Projects (the “DBE Goal”) pursuant to 49 CFR 26.53. In order to fulfill that goal, Bidders are encouraged to utilize DBE businesses certified by the Department. The Department seeks to meet the established DBE goal solely through race-neutral means. Race-neutral DBE participation occurs when a DBE is awarded a prime Contract through customary competitive procurement procedures, is awarded a Subcontract on a Contract that does not carry a DBE Contract goal, or wins a Subcontract from a Contractor that did not consider its DBE status in making the award. A DBE/Subcontractor Utilization Proposed Form is required to be included in bid documents.

The Department will analyze each Project and create a Project Availability Target (PAT), based on a number of factors, including Project scope, available DBE firms, and firms certified in particular Project work. Each bid will

request that the Contractor attempt to meet the PAT. This PAT is developed to assist Contractors to better understand what the Department expectations are for a specific Project. The PAT is not a mandate but an assessment of what each Project can bear for DBE participation. The Department anticipates that each Contractor will make the best effort to reach or exceed this PAT for the Project.

- 105.10.1.4 ***Race-conscious Project Goals*** - If it is determined by the Department that the annual DBE goal will not be met through race-neutral means, the Department may implement race-conscious contract goals on some Projects. Race-conscious contract goals are goals that are enforceable by the Department and require that the Contractor use good faith effort as defined in 49 CFR 26.53 (“Good Faith Efforts”) to achieve the goal set by the Department for that particular Project. If race-conscious means are implemented on a Project, the Contractor must comply with the requirements of 49 CFR 26.51 and 26.53.

At the time of the bid opening, all Bidders shall submit with their bid a Disadvantaged Business Enterprise (DBE) Commitment Form provided by the Department. This form will list the DBE and non-DBE firms that are proposed to be used during the execution of the Work. This form must be filled out in its entirety. The dollar total of each commitment shall be totaled and a percentage determined.

If the Project goal is not met, acceptable documentation showing all Good Faith Efforts (“GFE”) made to obtain participation may be required in order to award the Project. Failure to provide the required listing with the dollar participation total or acceptable documentation of GFE to obtain DBE participation within 3 Days after the bid opening date will be considered a lack of responsiveness on the part of the low Bidder. Rejection of the low bid under these circumstances will require the low Bidder to surrender the Proposal Guaranty to the Department. The submission and approval of the above forms does not constitute a formal Subcontract.

If for any reason during the progress of the Work the Contractor finds that DBEs included on the list are unable to perform the proposed work, the Contractor, with written release by the committed DBE or approval of the

Department, may substitute other DBE firms for those named on the list. If the Contractor is able to clearly document its inability to find qualified substitute firms to meet the Project goal, the Contractor may request in writing approval to substitute the DBE with a non-DBE firm. If at any time during the life of the Contract the Department determines that the Contractor is not fulfilling the goal or commitment(s) and is not making a GFE to fulfill the DBE requirement, the Department may withhold progress payments. Fulfillment of the goal percentage shall be determined by dividing the dollars committed to the DBEs by the actual Contract dollars. These requirements are in addition to all other Equal Employment Opportunity requirements on Federal-aid Contracts.

105.10.1.5 **Certification of DBE attainment on Contracts** - The Department must certify that it has conducted post-award monitoring of all Contracts to ensure that DBEs have done the work for which credit was claimed. The Department will certify these Contracts through review of CUF forms, Elations Subcontract payment tracking as well as occasional on-site reviews of Projects and through the Project's final closeout documentation provided by our Contracts Section.

105.10.1.6 **Bidders' List** - Pursuant to 49 CFR § 26.11 the Department is required to "create and maintain" a Bidders list and gather Bidder information on our construction/consultant Projects. Contractors are required to maintain information on all Subcontract bids submitted by DBE and Non-DBE firms and provide that information to the Department. The following information is required:

- (i) Firm name;
- (ii) Firm address including ZIP code;
- (iii) Firm's status as a DBE or non-DBE;
- (iv) Race and gender information for the firm's majority owner;
- (v) NAICS code applicable to each scope of work the firm sought to perform in its bid;
- (vi) Age of the firm; and
- (vii) The annual gross receipts of the firm. You may obtain this information by asking each firm to

indicate into what gross receipts bracket they fit (e.g., less than \$1 million; \$1-3 million; \$3-6 million; \$6-10 million; etc.) rather than requesting an exact figure from the firm. Annual gross receipts amount as indicated by defined brackets on the survey form, i.e., \$500,000 to \$800,000

This data is required from all Bidders for federally assisted Contracts to be submitted with their bids as this information is critical in determining the availability of DBE Businesses relative to other businesses that do similar work.

105.10.2 **Requirements Applicable to All Contracts** - Unless expressly provided otherwise in the Bid Documents, the provisions contained in this Section 105.10.1 apply to this Contract.

A. **Maine Code of Fair Practices and Affirmative Action** - The Contractor must comply with the provisions of Maine's Code of Fair Practices and Affirmative Action, 5 MRSA § 781, et seq., and all regulations promulgated thereunder. This Code, found at 5 MRSA § 784(2), reads as follows.

"During the performance of this Contract, the Contractor agrees as follows:

- 1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religious creed, sex, national origin, ancestry, age, sexual orientation, physical and/or mental disability. Such action shall include, but not be limited to, the following: Employment, upgrading, demotions, transfers, recruitment or recruitment advertising; layoffs or terminations; rates of pay or other forms of compensation; and selection for training, including apprenticeship.
- 2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, State that all qualified applicants will receive consideration for employment without regard to race, color, sexual orientation, religious creed, sex, national origin, ancestry, age, physical disability, or mental disability.
- 3) The Contractor will send to each labor union or representative of the workers with which he has a collective or bargaining Agreement, or other Contract or understanding, whereby he is furnished with labor for the

performances of [sic] his Contract, a notice, to be provided by the Contracting Department or agency, advising the said labor union or workers' representative of the Contractor's commitment under this Section and shall post copies of the notice in conspicuous places available to employees and to applicants for employment.

- 4) The Contractor will cause the foregoing provisions to be inserted in all Contracts for any Work covered by this Agreement so that such provisions will be binding upon each Subcontractor.
- 5) Contractors and Subcontractors with Contracts in excess of \$50,000 will also pursue in good faith affirmative action programs."

B. **Maine Human Rights Act** - The Contractor must comply with the provisions of Maine's Human Rights Act, 5 MRSA § 4551, et seq., and all regulations promulgated thereunder. This Act provides, among other things, that it is unlawful discrimination for any employer to fail or refuse to hire or otherwise discriminate against any applicant for employment because of race or color, sex, physical or mental disability, religion, age, ancestry or national origin, or sexual orientation except when based on a bona fide occupational qualification.

C. **EEO Notice to Labor Sources** - Contractors and Subcontractors that are required by Maine's Code of Fair Practices and Affirmative Action or by Federal law to notify a labor union or a representative of workers with whom the Contractor or the Subcontractor has a collective bargaining agreement, Contract, or understanding through which labor is furnished must provide notice on the letter shown on this page below. The letter must be written on the Contractor's or Subcontractor's letterhead stationery. A list of Maine Department of Labor Career Center Job Service Centers follows the form below.

To: _____
(Union, employment agency or employee's representative)

(Address)

Subject: Equal Employment Opportunities on

State Project No.: _____

Federal Aid Project No.: _____

Location: _____

Description of Work: _____

For Work related to the construction of the above listed Project to be performed under State Contract No.: _____, I have pledged to provide equal employment opportunities without regard to race, color, religion, sex, national origin, sexual orientation, or disability. This pledge applies to all employees and applicants for employment in connection with:

- Hiring, Placement, Upgrading, Transfer or Demotion
- Recruitment, Advertising or Solicitation for Employment
- Treatment During Employment
- Rates of Pay or Other Forms of Compensation
- Selection for Training, Including Apprenticeship
- Layoff or Termination

Inquiries and complaints should be addressed to:

President's Committee on Equal Employment Opportunity
Washington, D.C. 20425

Signed: _____

(Title)

For: _____

(Contractor)

(Address)

(Dated)

**Maine Department of Labor
Career Centers & Job Service Centers**

AUGUSTA – KENNEBEC COUNTY

Address: 45 Commerce Drive, Augusta, ME 04333-0109
Phone: (207) 623-7981 augusta.careercenter@maine.gov
Fax: (207) 287-5933

BANGOR – PENOBSBOT COUNTY

Address: 45 Oak Street, Suite 3, Bangor, ME 04401-7902
Phone: (207) 623-7981 bangor.careercenter@maine.gov
Fax: (207) 561-4036

BRUNSWICK – CUMBERLAND COUNTY

Address: 29 Sewall Street, Brunswick, ME 04011
Phone: (207) 623-7981 brunswick.careercenter@maine.gov
Fax: (207) 373-4004

CALAIS – WASHINGTON COUNTY

Physical Address: 5 Lowell Street, Calais, ME 0461-0415
Mailing Address: 53 Prescott Drive, Ste 1, Machias, ME 04654
Phone: (207) 623-7981 Calais.careercenter@maine.gov
Fax: (207) 454-0349

HINCKLEY – KENNEBEC COUNTY

Address: 23 Stanley Road, PO Box 15, Hinckley, ME 04944
Phone: (207) 623-7981 nkv.careercenter@maine.gov
Fax: (207) 453-2501

LEWISTON – ANDROSCOGGIN COUNTY

Address: 5 Mollison Way, Lewiston, ME 04240
Phone: (207) 623-7981 Lewiston.careercenter@maine.gov
Fax: (207) 783-5301

MACHIAS – WASHINGTON COUNTY

Address: 53 Prescott Drive, Ste 1, Machias, ME 04654
Phone: (207) 623-7981 Machias.careercenter@maine.gov
Fax: (207) 664-1447

PORTLAND – CUMBERLAND COUNTY

Address: 151 Jetport Boulevard, Portland, ME 04102
Phone: (207) 623-7981 Portland.careercenter@maine.gov
Fax: (207) 822-0221

PRESQUE ISLE – AROOSTOOK COUNTY

Address: 66 Spruce Street, Ste 1, Presque Isle, ME 04769-0322
Phone: (207) 623-7981 Presqueisle.careercenter@maine.gov
Fax: (207) 768-6858

ROCKLAND – KNOX COUNTY

Address: 91 Camden Street, Ste 201, Rockland, ME 04841-3424
Phone: (207) 623-7981 Rockland.careercenter@maine.gov
Fax: (207) 594-1428

SPRINGVALE – YORK COUNTY

Address: 9 Bodwell Court, Springvale, ME 04083
Phone: (207) 623-7981 Springvale.careercenter@maine.gov
Fax: (207) 324-7069

WILTON – FRANKLIN COUNTY (Closed Tuesday & Friday)

Address: 865 US Route 2E, Wilton, ME 04294-6649
Phone: (207) 623-7981 Wilton.careercenter@maine.gov
Fax: (207) 645-2093

CAREERCENTER HOTLINE

Maine In-State Only: (888) 457-8883
Out of State Callers: (207) 623-7981

MAINE JOBLINK

Address: Bureau of Employment Services
55 State House Station
Augusta 04333 – 0055
Phone: (207) 623-7967 joblink@maine.gov

- D. ***Prevention of Sexual Harassment*** - It is the policy of the Department that all parties have a right to Work in an environment free from harassment, including sexual harassment. Maine State Law and the Department prohibit any and all forms of sexual harassment in the Workplace, on the job site, or that may have an effect on the Work environment.

THEREFORE:

The Contractor hereby agrees to the following requirements in order to provide and promote a non-discriminatory Workplace free of sexual harassment.

1. No Contractor, supervisor, or employee shall allow repeated, objectionable, or unwanted verbal or physical advances, sexually explicit derogatory statements, or sexually discriminatory remarks that cause discomfort, humiliation, or are in any way offensive to the recipient, or that interfere with the quality of any employee's Work environment in any way. Furthermore, no one on any job shall threaten or insinuate either explicitly or implicitly that any employee's submission to or rejection of sexual advances will have any effect on that person's employment, job assignment, training, evaluation, promotion, wages, or any other term or condition of employment or future job opportunity. Under Maine State Law, Contractors are responsible for ensuring and maintaining a Work environment that is free from sexual harassment.
2. Any Contractor whose employee sexually harasses another employee shall be subject to disciplinary action. Contractors that fail to adequately and expeditiously investigate sexual harassment claims will be subject to enforcement proceedings and such sanctions as are authorized by law. Contractors are required to provide detailed written reports to the Department when so requested that shall describe the investigation and corrective actions taken by Contractors in all instances of sexual harassment allegations.

Contractors shall also be responsible for ensuring that no retaliation, reprisal, or intimidation be directed against any complainant or other employee who provides information to any person or agency investigating an allegation or complaint of sexual harassment.

- E. **Certification of Continuing EEO** - Efforts the Contractor must certify, to the best of its knowledge and belief, that the Contractor has made and will continue to make a good-faith effort to comply with all applicable State requirements on equal employment opportunity, non-discrimination, and affirmative action, including employment of women, minorities, and disadvantaged as journeyed trade workers. Contractors not having achieved company-wide trade employment goals of 6.9% for females and 0.5% for minorities will, where indicated by Contract and to the maximum extent practical, comply with Section 660 - On-the-Job Training.

105.11 **Build America, Buy America Requirements** - Unless expressly otherwise provided in the Bid Documents, the following provisions are hereby incorporated into the Contract.

This project is subject to the Buy America (23 CFR 635.410) and Build America, Buy America Act (BABA) included in the Infrastructure Investment and Jobs Act (IIJA), Public Law No. 117-58. Further guidance can be found at the FHWA Buy America Construction Program Guide linked here:

<https://www.fhwa.dot.gov/construction/cqit/buyam.cfm>

The Contractor shall certify compliance with Buy America and BABA in the following categories. An article, material or supply should only be classified into one of the following categories and is classified based on its state when it arrives at the project site.

1. **Iron and Steel** - All iron and steel permanently incorporated into the project must be produced in the United States. The only exception to this requirement is the production of pig iron and the processing, pelletizing, and reduction of iron ore, which may occur in another country. This means all manufacturing processes, from the initial melting stage through the application of coatings, must occur in the United States. Any process that modifies the chemical content, the physical size and shape, or the final finish is considered a manufacturing process, including rolling, extruding, machining, bending, grinding, drilling, and coating. "Coating" includes epoxy coating, galvanizing, painting, or any other coating that protects or enhances the value of the material.

Existing De Minimis Use Exemption for Iron and Steel - The requirements of the law and regulations do not prevent a minimal use of foreign steel and iron materials if the total cost of such materials used does not exceed one-tenth of one percent (0.1%) of the total construction contract price or \$2,500.00, whichever is greater.

2. **Manufactured Products** - Articles, materials, or supplies that have been processed into a specific form and shape, or combined with other articles, materials, or supplies to create a product with different

properties than the individual green articles, materials, or supplies. If a domestic product is taken out of the United States for any process, it becomes a foreign source material.

All Manufactured Products used in the project must be manufactured in the United States (“final assembly requirement”). “Component” means an article, material, or supply, whether manufactured or unmanufactured, incorporated directly into a manufactured product or, where applicable, an iron or steel product. If a manufactured product is predominantly iron, steel, or a combination of both it must meet the above requirements for iron and steel products. Predominantly iron or steel or a combination of both means the total cost of the iron and steel content exceeds 50 percent of the total cost of all its components.

Precast concrete products classified as Manufactured Products must additionally have predominantly iron or steel components meet the above requirements for iron and steel. Cabinets or other enclosures of intelligent transportation systems (ITS) and other electronic hardware systems classified as Manufactured Products must also comply with the above requirements for iron and steel if the cabinet or enclosure is predominantly iron or steel.

3. **Construction Materials:** Items, articles, materials, or supplies that consist of only one of the items listed below:
 - i. Non-ferrous metals;
 - ii. Plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
 - iii. Glass (including optic glass);
 - iv. Fiber optic cable;
 - v. Optical fiber;
 - vi. Lumber;
 - vii. Engineered wood; and
 - viii. Drywall.

Minor additions of articles, materials, supplies, or binding agents to a Construction Material do not change the categorization of the Construction Material.

All Construction Materials permanently incorporated into the project must be produced in the United States. For the Construction Material to be considered “produced in the United States,” it must meet the following standards:

- i. **Non-ferrous metals** - All manufacturing processes, from initial smelting or melting through final shaping, coating, and assembly, occurred in the United States.

- ii. **Plastic and polymer-based products** - All manufacturing processes, from initial combination of constituent plastic or polymer-based inputs, or where applicable, constituent composite materials, until the item is in its final form, occurred in the United States.
- iii. **Glass** - All manufacturing processes, from initial batching and melting of raw materials through annealing, cooling, and cutting, occurred in the United States.
- iv. **Fiber optic cable (including drop cable)** - All manufacturing processes, from the initial ribboning (if applicable), through buffering, fiber stranding, and jacketing, occurred in the United States. All manufacturing processes also include the standards for glass and optical fiber, but not for non-ferrous metals, plastic, and polymer-based products, or any others.
- v. **Optical fiber** - All manufacturing processes, from the initial preform fabrication stage through the completion of the draw, occurred in the United States.
- vi. **Lumber** - All manufacturing processes, from the initial debarking through treatment and planning, occurred in the United States.
- vii. **Drywall** - All manufacturing processes, from initial blending of mined or synthetic gypsum plaster and additives through cutting and drying of sandwiched panels, occurred in the United States.
- viii. **Engineered wood** - All manufacturing processes, from the initial combination of constituent materials until the wood product is in its final form, occurred in the United States.

Construction Materials brought on site and combined with other materials are not considered Manufactured Products. Items that consist of two or more of the listed Construction Materials that have been combined off-site through a manufacturing process, and items that include at least one of the listed materials combined with a material that is not listed through a manufacturing process should be treated as Manufactured Products rather than as Construction Materials.

Specifically Excluded Materials

Section 70917(c) of the Build America Buy America Act specifically excludes certain materials from being classified as either construction materials or manufactured products. These exclusions include cement and cementitious materials, aggregates (such as stone, sand, or gravel), and aggregate binding agents or additives.

Additionally, when these materials are combined as an unsettled mixture without a final form upon arriving at the work site, such as wet concrete or hot mix asphalt, the mixture is not considered a manufactured product. However, if

these same materials are combined off-site to create a finished product, such as precast concrete, that finished product is considered a manufactured product.

Public Interest Waiver of BABA Requirements for De Minimis Costs

The US Department of Transportation issued a public interest Waiver of Buy America Requirements for De Minimis Costs. The Waiver for De Minimis Costs exempts Manufactured Products and Construction Materials produced outside the United States for which the total value of the non-compliant products is no more than the lesser of \$1,000,000 or 5% of total applicable costs for the project.

The obligation to track costs throughout the life of the contract is the Contractor's responsibility. The term "total applicable costs" is defined as the total actual final material cost of the compliant and non-compliant iron and steel, Manufactured Products, and Construction Materials.

Certification

For iron and steel materials and for Manufactured Products produced predominantly of iron or steel or a combination of both*, the Contractor shall submit a certification from the producer of steel or iron, or any product containing steel or iron as a component, stating that all steel or iron furnished or incorporated into the furnished product was manufactured in the United States in accordance with the requirements of the Buy America provisions of 23 CFR § 635.410, as amended. Such certification shall also include (1) a statement that the iron or steel product or component was produced entirely within the United States, or (2) a statement that the iron or steel product or component was produced within the United States, except for minimal quantities of foreign steel and iron valued at \$ (actual value). A "Buy America" Certification is required from each manufacturer, fabricator, supplier, subcontractor that engages in "manufacturing" as defined above.

- * Predominantly of iron or steel or a combination of both means that the cost of the iron and steel content exceeds 50% of the total cost of all its components. The cost of iron and steel is the cost of the iron or steel mill products, castings, or forgings utilized in the manufacture of the product and a good faith estimate of the cost of the iron or steel components.

In addition, upon completion of the project, the Contractor shall certify in writing as to the overall compliance with BABA and provide the total project delivered cost of all foreign Manufactured Products and Construction Materials. The Contractor shall also submit individual certifications from all subcontractors and suppliers that furnish applicable Construction Materials and Manufactured Products valued at \$10,000 or more. Such individual certifications shall be submitted upon delivery of the Construction Material or Manufactured Products to the site.

Example Certification

I hereby certify that this project is in compliance with the Build America, Buy America Act (Public Law 117- 58) requirements for this project. All Iron and Steel, Manufactured Products produced predominantly of steel or iron, Manufactured Products and Construction Materials that are permanently incorporated into the work for this project were produced in the United States of America, with the only exceptions as noted below.

As required, we will maintain all records and documents pertinent to the Build America, Buy America Act requirements, at the address given above, for not less than 3 years from the date of Final Acceptance. These files will be available for inspection and verification by the Maine Department of Transportation and/or the Federal Highway Administration.

We further certify that the total value of foreign steel and iron for this project is \$_____, said value being less than 0.1% of the total construction contract price or \$2,500.00, whichever is greater.

We further certify that the total material cost of foreign Manufactured Products and Construction Materials for this project is \$_____, said value being no more than the lesser of \$1,000,000 or 5% of total applicable costs. The term “total applicable costs” is defined as the total actual final material cost of the compliant and non-compliant iron and steel, Manufactured Products, and Construction Materials.

Signed (Contractor)

(President) (Contractor Firm)

SECTION 106 - QUALITY

Scope of Section This Section contains general provisions related to the Quality of Work, including roles, standards, Materials, Quality Control, Acceptance, Non-conforming Work, and warranties. When specified in the Contract, the Department will use the quality level analysis in this Section to determine quality-based pay adjustments.

106.1 Roles Regarding Quality

106.1.1 **Cooperation** - The Contractor and the Department shall work cooperatively within their respective Quality Assurance (QA) responsibilities to produce and document a high quality Project, meeting or exceeding the quality requirements of the Contract.

106.1.2 **Role of the Contractor** - The Contractor is responsible for all aspects of the quality of construction, including labor, equipment, materials, incidentals, processes, construction methods, and QC. When

required by the Contract, the Contractor shall develop, submit for approval, implement, and adjust if necessary a QCP for the Work specified.

- 106.1.3 **Role of the Department** - The Department is responsible for providing a quality design, approving the QCP, and assuring that the Contractor is following the QCP. The Department will perform acceptance sampling, testing, and inspection for any element of the Work to ensure compliance with the QCP and Contract requirements. The Department may also perform IA and Verification sampling and testing at any time.

106.2 **Quality Standards**

- 106.2.1 **Conformity with Contract** - The Contractor shall comply with all Contract requirements in performance of the Work. Any required plans such as QCP, the TCP, and the SEWPCP, as approved by the Department, are binding upon the Contractor as Contract requirements.

- 106.2.2 **Conformity with Other Standards** - Unless otherwise provided in the Contract, all Work shall conform to the following standards, as applicable.

- A. Department
- B. AASHTO
- C. ASTM
- D. AREMA
- E. Standard conditions and special conditions contained in any permit
- F. MUTCD
- G. American with Disabilities Act (ADA)

- 106.2.3 **Industry Standards** - If there is no applicable standard set forth in this Contract for a particular item of Work, then the Contractor shall perform that item of Work in accordance with industry standards prevailing at the time of the Bid.

106.3 **Material Quality**

- 106.3.1 **General** - Materials and manufactured products incorporated into the Work shall be new unless otherwise specified, free from defect, and in conformity with the Contract.

When Material is fabricated or treated with another Material or where any combination of Materials is assembled to form a finished product, any or all of which are covered by specifications, the Department may reject the finished product if any of the components do not comply with the specifications.

Title to all hot mix asphalt to be furnished by the Contractor shall pass to the Department immediately before installation. The preceding sentence shall not in any way affect any right or remedy the Department has relating to the quality of the material, installation, or workmanship.

- 106.3.2 **Quality Requirements** - Materials shall meet the requirements of the Contract at the time they are incorporated into the work. The Contractor shall sample and test proposed sources of materials, using accepted procedures and equipment no more than 60 Days prior to use. Materials shall not be used in the Work until passing results are obtained and provided to the Department. The Contractor shall provide the Resident with a copy of the passing test results, including the source of the Material as identified in Section 105.8.6.

The Contractor shall perform QC inspection, sampling, testing, and documentation in accordance with the Contract requirements. For work without specific QC requirements, the Contractor shall perform inspection, sampling, and testing as the Contractor deems necessary to ensure adequate process control and end product quality.

The Contractor shall provide all facilities, Equipment, and Material samples required by the Department to conduct Acceptance, Verification, and IA sampling and testing.

The Contractor shall supply Materials and perform work using methods and Equipment in a manner that will not degrade the quality of the Materials. Materials with prior approval that become unfit for use or fall outside the specification limits will result in the affected product being declared Non-conforming Work. For a related provision, see Section 106.8 - Non-conforming Work.

The cost of the Contractor's QC activities and its costs for furnishing facilities, testing Equipment, and samples for the Department's Acceptance and IA activities are incidental to the related Pay Items.

106.3.3 **Sources**

- A. **General** - The Contractor shall furnish all materials and products required to complete the work, except as otherwise provided in the Contract. Unless otherwise specified in the Contract, the Contractor shall use only those products contained on the Department's Qualified Products List (available on the Department internet site) if a list is established for that type of product or Material. For any material on the Department qualified products list that is being considered for incorporation into the Work, it shall be the Contractor's responsibility to verify that the Material is appropriate for the use being considered.

- B. **Department Furnished Materials** - The Contract may specify that the Department will furnish certain Materials. If the Contractor reasonably believes that the Department-furnished Material is deficient in any way, the Contractor shall immediately notify the Department before accepting delivery. After acceptance of delivery, the Contractor is responsible for all risk of loss of Department-furnished Material. The cost of inspecting, handling, and storing Department-furnished Materials after delivery is incidental to the Contract. The Department may deduct from amounts otherwise due the Contractor all costs necessary to make good any shortage, damage, or deficiencies discovered after the Contractor accepts delivery, including any demurrage or car hire charges.
- 106.3.4 **Storage** - The Contractor shall store Materials to preserve their quality and fitness for the work. Materials shall not be stored under or in close proximity to Highway Structures unless the Contractor receives written permission from the Resident. If Materials fail to meet the requirements of the Contract, the Materials will be rejected. The Department may inspect stored materials at any time. The Contractor shall locate stored Materials to facilitate their prompt inspection. The Department may approve portions of land within the Right-of-Way for storage purposes and for the placing of the Contractor's equipment, but the Contractor shall provide any additional land required without cost to the Department. The Contractor shall not use private property for storage purposes without written permission of the owner, with copies of the written permission furnished to the Department upon request. The Contractor shall restore all storage sites, whether within the Right-of-Way or on private property, to original condition at the completion of the Project, without cost to the Department.
- 106.3.5 **Handling** - The Contractor shall handle all Materials in a manner that preserves their quality and fitness for the work. The Contractor shall transport Aggregates in tight vehicles to avoid loss or segregation of Materials after loading and measuring.
- 106.3.6 **Unacceptable Materials** - The Department may reject Materials not conforming to the Specifications at any time, and the Contractor shall remove them immediately from the Project site unless otherwise instructed by the Department. The Contractor shall not store or use rejected materials on any Department Project.
- 106.3.7 **Sampling and Testing** - Qualified Departmental personnel may take samples of Materials for Acceptance Testing. Work in which Material is used without the Department's approval will be at the Contractor's sole risk and the work will be considered Non-conforming Work. Unless otherwise designated, the Department's testing costs will be at

the expense of the Department. Materials being used are subject to inspection, testing, or rejection at any time. The Department will furnish copies of test reports to the Contractor upon request.

The Contractor is responsible for the quality of construction and materials incorporated into the work. The Contractor shall perform all necessary QC inspection, sampling, and testing in accordance with the approved QCP. If a QCP is not required, the Contractor is still responsible for all QC necessary for a high quality Project. The Contractor shall not rely on the results of the Department's Acceptance Testing being available for process QC.

The Contractor may observe the Department's sampling and testing activities. If the Contractor observes a deviation from the specified sampling or testing procedures, then the Contractor shall describe the deviation to the Department immediately and document the deviation in writing within 24 hours to preserve its ability to dispute the sample.

The Department will randomly sample and test items designated for Acceptance in accordance with the procedure specified for that item. The Department may also sample and test at any time if the Material appears defective or when the Department determines that a change in the process or product has occurred. Acceptance Tests will govern in all cases for determination of pay factors without regard to QC tests, unless otherwise specified in the Contract.

When directed by the Department, the Contractor shall sample and test any Material that appears inconsistent with similar Material being sampled, unless such Material is voluntarily removed and replaced or corrected by the Contractor. All sampling shall be in accordance with Department, AASHTO, or ASTM procedures as specified for the material being sampled.

106.4 **Quality Control**

106.4.1 **General** - When required elsewhere in the Contract, the Contractor shall develop, submit, and implement a Quality Control Plan (QCP), approved by the Department, for those items of work specified that will result in work that meets or exceeds the quality requirements of this Contract. Regardless of whether a QCP is required, Quality Control for all work is the Contractor's responsibility.

- A. **Submittal** - Within 21 Days of Contract Execution or at least 30 Days before any related work is to be performed, the Contractor shall submit three copies of its QCP to the Department.
- B. **Approval** - Within 14 Days of Receipt, the Department will determine if the QCP is in accordance with the requirements

of this Section 106.4 and (1) notify the Contractor that its QCP is approved or (2) return it for any needed revisions. If returned for revision, the Contractor shall resubmit three copies of its revised QCP as provided above within 7 Days and the Department will have 7 Days from receipt of the revised plan to notify the Contractor whether its QCP is approved or again requires revision. Additional iterations will occur in a like manner until the Department approves the Contractor's QCP. Failure to submit an approvable QCP shall not be cause for any adjustment to compensation or time.

- C. **Standard QC Plans** - For items included in Section 400 – Pavements, the Contractor may choose to submit a standard QCP that includes any items common to all of its plants and paving operations. Standard plans shall be submitted to the Quality Assurance Engineer by March 1 of every year. The standard plan will apply to all Projects constructed by the Contractor until a new standard plan is approved the following year. In addition to the standard plan, the Contractor must submit a supplemental QCP for each Project that includes any required items and Project specific details not covered by the standard plan. Approval of both standard and Project specific QCPs shall be as done outlined in paragraph B above, with the exception that the initial 14 Day review period for standard plans will begin on March 1, and that the supplemental Project-specific QCP shall be submitted a minimum of 14 Days prior to any related work being performed with an initial review period of 7 Days.

Upon final approval of the QCP, the Contractor shall provide 5 bound copies or an electronic version to the Department. All Contractor QC personnel shall also be issued their own copy of the approved QCP. The Contractor shall communicate the applicable contents of the approved QCP to all Contractor and Subcontractor personnel involved in completing the work items covered by the QCP.

The Contractor's QCP shall consist of plans, procedures, responsibilities, authority, and an organizational structure that demonstrates that an effective level of QC will exist and that the finished products will comply with all Contract requirements. The Contractor shall provide all necessary QC inspection, sampling, and testing to implement the QCP. The QCP shall include an organizational structure and reporting requirements that demonstrate that QC personnel have sufficient independence to allow them to be primarily concerned with quality, as opposed to schedule and budget.

The individual administering the QCP shall be a full-time employee of or a consultant engaged by the Contractor. The individual shall have full authority to institute any and all actions necessary for the successful implementation of the QCP.

The Department will not sample or test for process control or assist in controlling the Contractor's production operations. The Contractor shall provide QC personnel and testing Equipment capable of providing a quality product that meets or exceeds the Contract requirements. Continued production of Non-conforming Work for a reduced price, instead of making adjustments to the production operations to bring work into conformance, is not allowed.

106.4.2 **Quality Control Plan Requirements** - The QCP shall include, at a minimum, the following:

- Construction items covered by the QCP, as specified in the Contract
- Sampling location and techniques
- Tests and test methods
- Testing frequencies
- Inspection frequencies
- Detailed description of production and placement Equipment and methods
- Documentation procedures, including:
 - Inspection and test records
 - Temperature measurements
- Accuracy, calibration, or recalibration checks performed on production or testing Equipment

The QCP shall identify the Contractor's QC personnel, including the company official ultimately responsible for the quality of the Work. The Department's QCP approval process may include inspection of testing Equipment and a sampling and testing demonstration by the Contractor's QC inspector(s) to assure an acceptable level of performance.

106.4.3 **Testing** - Qualified technicians in laboratories approved by the Department shall perform all QC testing covered by the QCP. Technician qualifications shall be as described in the Contract for the corresponding item of Work.

Laboratory facilities shall be clean, and all equipment shall be maintained in proper working condition. The Department shall be permitted unrestricted access to inspect the Contractor's laboratory facility. The Department will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment,

supplies, or testing personnel and procedures. Deficiencies shall be grounds for the Department to order an immediate stop to incorporating materials into the work until deficiencies are corrected. Work already in place affected by QC deficiencies is Non-conforming Work.

The Contractor shall maintain original documentation of all inspections, tests (including all associated data such as measurements, weights, dial readings, etc. used in the completion of the test), and calculations used to generate reports. The records shall indicate the nature, number, and type of deficiencies found, the quantities approved and rejected, and the nature of corrective actions taken. The Contractor shall maintain standard testing Equipment and qualified personnel as required by the Contract.

The QCP shall include the testing and record keeping requirements for each item as contained in the Contract. The number preceding each item refers to the item and specification number in the Standard Specifications. When testing requirements are not specified, the Contractor shall perform all testing and record keeping as recommended by the manufacturer, vendor, or supplier.

If an item is required to be in the QCP but the Contract does not specify testing requirements, the Contractor shall propose testing requirements in the QCP.

The Contractor shall maintain Control Charts in a manner and location acceptable to the Department. At a minimum, the Control Charts shall identify the Project number, the Pay Item number, each test parameter, the upper and lower control limits applicable to each test parameter, and the running average of the last three Contractor test results. The Contractor shall use the Control Charts as part of a process control system for identifying production and Equipment problems and for identifying potential quality reductions before they occur. Acceptable Control Charts are part of the approved QCP.

After final records review, the Contractor will certify in writing to the Department that the Project has been constructed and inspected, and all materials have been tested in accordance with the Contract. All Paving certs shall be submitted on the Paving Company's Letterhead.

- 106.4.4 **QC Inspector Qualifications** - When a QCP is required, the Contractor's QC Inspectors shall hold all certifications from MCTCB or NETTCP that apply to the items included in the QCP. The Department may require the Contractor to remove Inspectors from the Project who are not certified as required or who are otherwise unqualified or unable to fulfill their duties in a good and workmanlike manner.

- 106.4.5 **Inspection Requirements** - The QCP shall cover all construction operations on the site and at off-site production facilities, keyed to the proposed construction materials, sequence and schedule. The QCP shall also identify QC personnel (including qualifications), procedures, controls, tests, records, and forms to be used.

The Contractor shall provide a copy of each completed QC report to the Department by 1:00 P.M. on the Day following each construction activity, unless other arrangements are made with the Resident. Failure to provide this report will constitute non-compliance with the QCP and the Contract.

If an item is required to be in the QCP but QC Inspection requirements are not specified in the Contract, the Contractor shall propose inspection and record keeping requirements for such items in the QCP.

- 106.4.6 **QCP Non-Compliance** - The Contractor shall comply with the approved QCP and shall take all other steps necessary to assure a high quality Project.

Failure by the Contractor to comply with the approved Quality Control Plan will result in a letter describing the violation, a mandatory work suspension, and a reduction in payment as shown in Table 106.4A below. The Contractor shall submit a letter to the Department that details the corrective action made to address the violation(s) in its Quality Control Plan. Work may resume when the Department is satisfied the corrective action will result in adherence to the Quality Control Plan.

TABLE 106.4A - QUALITY CONTROL PAY REDUCTION

Quality Control Plan Value*		Pay Reduction		
From More Than	To and Including	1 st	2 nd	3 rd & Subsequent
\$0	\$500,000	\$1,000	\$2,000	\$4,000
\$500,000	\$1,000,000	\$2,000	\$4,000	\$8,000
\$1,000,000	\$3,000,000	\$5,000	\$10,000	\$20,000
\$3,000,000	and more	\$10,000	\$20,000	\$40,000
* The Quality Control Plan Value is the total Bid value of all items covered by a Quality Control Plan, as detailed in the applicable specification or Special Provision.				

During all periods of the Contractor's failure to follow the approved QCP, no positive pay incentives will be calculated or paid if the Department accepts the Material.

Pay reductions for failure to comply with the approved QCP are cumulative, and the Department will deduct any pay reductions due

from amounts otherwise due the Contractor. These pay reductions are intended to encourage the Contractor to comply with its approved QCP, and are not necessarily related to the quality of the material provided.

106.5 **Quality Assurance** - The Department will conduct Quality Assurance by:

- Review of QC Reports provided by the Contractor.
- Monitoring Contractor compliance with the QCP.
- Random inspection of production, placement, and workmanship
- Randomly accompanying the Contractor's inspector during QC Inspections/Testing.
- Acceptance Verification and IA sampling and testing of Materials or completed Work.

The Department's objective is a high quality Project through a cooperative effort with the Contractor. Items that are to be buried, covered, are of high cost, or affect the long-term durability of the Work will receive extra attention in the QA effort.

Unacceptable Work found by the Department's Inspector will be brought to the attention of the Resident, who will determine what corrective action the Contractor will need to take. The Contractor shall schedule the corrective work with the Resident, and both the QC and Department's Inspectors will witness the corrective action. Failure of the Contractor to correct unacceptable Work in a timely manner, as determined by the Department, may result in the withholding of progress payment(s) or suspension of the Work, or both. The Contractor will not be eligible for either additional monetary compensation or a time extension should they fail to correct. If necessary for protection of the Work or for public convenience, the Department may accomplish corrective Work by other means and deduct the cost from any monies due the Contractor.

The Department may review and obtain copies of all QC test reports (including original test data), inspections reports, and control charts at all reasonable times without cost to the Department.

If the Department decides to inspect the Materials or operations at the plant, then the following conditions shall be met:

- A. The Department shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has arranged for the Materials.
- B. The Department shall have full access at all times to the parts of the plant(s) that are involved with the manufacture and production of the Materials being furnished.
- C. If required, the Contractor shall arrange for an approved testing laboratory building for the sole use of the Department. The building shall be located

near the plant and conform to the requirements of Section 639 - Engineering Facilities.

- D. The Contractor shall provide any needed equipment for safe access to plant stockpiles, equipment, and operations.

106.6 **Acceptance** - The Department is responsible for determining the acceptability of the Work. Acceptance of the Material is based on the visual inspection of the construction, monitoring of the Contractor's QCP, and Acceptance Test results. Acceptance sampling and testing is the responsibility of the Department (unless alternate procedures are specified) except for furnishing facilities, testing equipment, transportation, and Material samples as required.

Acceptance of Hot Mix Asphalt Pavement will be based on Method A or C Statistical Acceptance, or Method B or D Acceptance as specified. The method of acceptance for each item is defined in Special Provision, Section 403 - Hot Mix Asphalt Pavement. When items of Hot Mix Asphalt Pavement are not so designated, Method A will be utilized whenever there are more than 1,000 tons per Hot Mix Asphalt Pavement item, and Method B will be utilized when there are less than or equal to 1,000 tons per Hot Mix Asphalt Pavement item.

Acceptance of structural concrete will be based on Method A or B Statistical Acceptance, or Method C Verification. Items to be accepted under Method A, Method B, or Method C are defined in Special Provision, Section 502 - Structural Concrete Acceptance Methods. When items of cast-in-place concrete are not so designated, Method B will be used when there are more than 10 cy and Method C will be used when there are 10 cy or less.

The Department may reject Material that appears to be defective based on visual inspection. No payment will be made for the Materials rejected by the Department.

Prior to Contractor's knowledge of the sample location, the Contractor may remove and replace defective Material at no cost to the Department. The Department will sample, test, and evaluate new Material for acceptance.

- A. Statistical Acceptance methods utilize the Quality Level Analysis and Pay Factor Specifications described in Section 106.7 - Quality Level Analysis and in Tables 106.7 A, along with specific information contained in the Divisions 400 and 500 Specifications, including Section 401 - Hot Mix Asphalt, Section 402 - Pavement Smoothness, and Section 502 - Structural Concrete.

Pay Items specified to be sampled and tested under Statistical Acceptance methods will be evaluated for acceptance in accordance with the guidelines specified for that Pay Item. All Acceptance Test results for a lot as defined in the Specification will be analyzed collectively and statistically by the Quality Level Analysis - Standard Deviation (Specification Conformance Analysis) Method using the procedures listed

to determine the total estimated percent of the lot that is within specification limits. Quality Level Analysis (Specification Conformance Analysis) is a statistical procedure for estimating the percent compliance with a specification and is affected by shifts in the arithmetic mean (x) and by the sample standard deviation (s). Analysis of test results will be based on an Acceptance Quality Level (AQL) of 90.0, unless otherwise specified. AQL may be viewed as the lowest percent within the specification limits of a material that is acceptable as a process average and receive 100% pay. The Department will exclude test results on Material not incorporated in the Work from the Quality Level Analysis.

For items evaluated using Quality Level, and in the Department's sole discretion, a lot with a Quality Level of less than 50% within limits will be either (1) removed and replaced with acceptable Material at the Contractor's expense, or (2) accepted and paid for at a Pay Factor determined by the Department. The Department may also reject Material with a Quality Level at or above this level, but such Material will be removed and replaced by the Contractor at the Department's expense.

- B. Items not designated for Statistical Acceptance will utilize Method B or D Acceptance testing to validate the quality of the material incorporated into the Project. For material paid under Item 403.209 – Method D, or designated to be visually accepted, the Contractor shall provide the Department with a Certification Letter that indicates that the material supplied complies with the Specifications. Test results representative of the certified material shall be attached to the letter.

The Department will randomly sample and test the certified Material for properties noted in Table 1 of Section 502 - Structural Concrete or Table 14 of Section 401.21 - Acceptance Method B & D. Material will be subject to rejection as noted in Structural Concrete Section 502.195 - Quality Assurance Method C Concrete or Hot Mix Asphalt, Section 401.2022 - Pay Adjustment – Method B & D.

106.7 **Quality Level Analysis**

- 106.7.1 **Standard Deviation Method** - Standard Deviation Method procedures are as follows:

- A. Determine the arithmetic mean ($\bar{x}$) of the test results:

$$\bar{x} = \frac{\sum x_i}{n}$$

Where $\sum$ = summation of

x_i = individual test value

n = total number of test values

- B. Compute the sample standard deviation(s):

$$s = \text{Square root of } \frac{\sum(x_i - \bar{x})^2}{n-1}$$

Where $\sum$ = summation of

x_i = individual test value

$\bar{x}$ = mean test value

n = total number of test values

- C. Compute the upper quality index (Q_U):

$$Q_U = \frac{USL - \bar{x}}{s}$$

Where USL = upper specification limit.

- D. Compute the lower quality index (Q_L):

$$Q_L = \frac{\bar{x} - LSL}{s}$$

Where LSL = lower specification limit.

- E. Determine P_U (percent within the upper Specification limit which corresponds to a given Q_U) from Table 106.7A.

Note - If a USL is not specified, P_U will be 100. If the mean test value is equal to the USL, then P_U will be 50 regardless of the computed value of s .

- F. Determine P_L (percent within the lower Specification limit which corresponds to a given Q_L) from Table 106.7A.

If the mean test value is equal to the USL, then P_U will be 50 regardless of the computed value of s .

Note - If a LSL is not specified, P_L will be 100.

- G. Determine the Quality Level (total percent within Specification limits).

$$\text{Quality Level} = (P_U + P_L) - 100$$

- H. Determine the Pay Factor (PF) for the lot using the Quality Level from Step G. For items included in Section 401 – Hot Mix Asphalt:

$$\text{Method A: PF} = [55 + (\text{Quality Level} * 0.5)] * 0.01$$

$$\text{Method C: PF} = [55 + (\text{Quality Level} * 0.5)] * 0.01$$

For items included in Section 402 – Pavement Smoothness:

$$\text{PF} = [55 + (\text{Quality Level} * 0.5)] * 0.01$$

For items included in Section 502 – Structural Concrete:

Method A: $PF = [55 + (\text{Quality Level} * 0.5)] * 0.01$

Method B: $PF = [70 + (\text{Quality Level} * 0.33)] * 0.01$

- I. Determine the Composite Pay Factor (CPF) for each lot.

$$CPF = \frac{[f_1(PF_1) + f_2(PF_2) + \dots + f_J(PF_J)]}{\sum f}$$

Where f_j = price adjustment factor listed in the specifications for the applicable property.

PF_j = Pay Factor for the applicable property.

$\sum f$ = Sum of the “f” (price adjustment) factors.

Note - Numbers used in the above calculations shall be carried to significant figures and rounded according to AASHTO Standard Recommended Practice R-11.

- 106.7.2 **Statistical Outliers** - This procedure specifies how outlying observations in sample test results will be evaluated for their statistical significance. The Department will use this procedure for only those items that are specified to be checked for outlying observations.

An outlying observation or “outlier” is one that appears to deviate markedly from other sample test values in the lot.

When specified, the procedure will determine whether any value is a statistical outlier. If a test result is found to be an outlier, the QA Engineer will investigate the outlying value to determine if it should be retained or discarded. The investigation will include but not be limited to an examination of all available test data and inspection reports relating to the questionable test result, possible additional testing, and discussions with appropriate Contractor and Department personnel. If the investigation concludes that an assignable cause cannot be determined for the outlying value, it will be discarded; otherwise, it will be retained for pay factor determination.

Procedure

- A. Calculate the sample average ($\bar{x}$) and standard deviation(s) of all the values in the lot.
- B. Find the value “t” from Table 106.7B corresponding to the sample size for the lot.
- C. Determine D (the total allowable deviation from the average) by multiplying t by s.

- D. Establish values for MAX and MIN by the following:

$$\text{MAX} = \bar{x} + D \quad \text{MIN} = \bar{x} - D$$

- E. Any value greater than MAX or less than MIN is an outlier. The Department will investigate any outlying values before determining the Pay Factor for that lot.

TABLE 106.7A – QUALITY LEVEL ANALYSIS BY THE STANDARD DEVIATION METHOD

Upper Quality Index Q_U or Lower Quality Index Q_L (See Notes on next page)															
P _U or P _L %*	n = 10 to n = 11 n = 12 to n = 14 n = 15 to n = 18 n = 19 to n = 25 n = 26 to n = 37 n = 38 to n = 69 n = 70 to n = 200 n = 201 to n = x														
	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 9	n = 10	n = 11	n = 12	n = 13	n = 14	n = 15	n = 16	n = 17
100	1.16	1.5	1.79	2.03	2.23	2.39	2.53	2.65	2.83	3.03	3.20	3.38	3.54	3.70	3.83
99		1.47	1.67	1.80	1.89	1.95	2.00	2.04	2.09	2.14	2.18	2.22	2.26	2.29	2.31
98	1.15	1.44	1.60	1.70	1.76	1.81	1.84	1.86	1.91	1.93	1.96	1.99	2.01	2.03	2.05
97		1.41	1.54	1.62	1.67	1.70	1.72	1.74	1.77	1.79	1.81	1.83	1.85	1.86	1.87
96	1.14	1.38	1.49	1.55	1.59	1.61	1.63	1.65	1.67	1.68	1.70	1.71	1.73	1.74	1.75
95		1.35	1.44	1.49	1.52	1.54	1.55	1.56	1.58	1.59	1.61	1.62	1.63	1.63	1.64
94	1.13	1.32	1.39	1.43	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.55
93		1.29	1.35	1.38	1.4	1.41	1.42	1.43	1.44	1.44	1.45	1.46	1.46	1.47	1.47
92	1.12	1.26	1.31	1.33	1.35	1.36	1.36	1.37	1.37	1.38	1.39	1.39	1.40	1.40	1.40
91	1.11	1.23	1.27	1.29	1.30	1.30	1.31	1.31	1.32	1.32	1.33	1.33	1.33	1.34	1.34
90	1.10	1.2	1.23	1.24	1.25	1.25	1.26	1.26	1.26	1.27	1.27	1.27	1.28	1.28	1.28
89	1.09	1.17	1.19	1.20	1.20	1.21	1.21	1.21	1.21	1.22	1.22	1.22	1.22	1.22	1.23
88	1.07	1.14	1.15	1.16	1.16	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.13	1.13
86	1.04	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
84	1.01	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.95
82	0.97	0.96	0.95	0.94	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
81	0.96	0.93	0.91	0.90	0.90	0.89	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88
80	0.93	0.90	0.88	0.87	0.86	0.86	0.86	0.85	0.85	0.85	0.85	0.84	0.84	0.84	0.84
79	0.91	0.87	0.85	0.84	0.83	0.82	0.82	0.82	0.82	0.81	0.81	0.81	0.81	0.81	0.81
78	0.89	0.84	0.82	0.80	0.80	0.79	0.79	0.79	0.78	0.78	0.78	0.78	0.77	0.77	0.77
77	0.87	0.81	0.78	0.77	0.76	0.76	0.76	0.75	0.75	0.75	0.75	0.74	0.74	0.74	0.74
76	0.84	0.78	0.75	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.71	0.71	0.71	0.71	0.71
75	0.82	0.75	0.72	0.71	0.70	0.70	0.69	0.69	0.69	0.68	0.68	0.68	0.68	0.68	0.67
74	0.79	0.72	0.69	0.68	0.67	0.66	0.66	0.66	0.66	0.65	0.65	0.65	0.65	0.64	0.64
73	0.76	0.69	0.66	0.65	0.64	0.63	0.63	0.63	0.62	0.62	0.62	0.62	0.62	0.61	0.61
72	0.74	0.66	0.63	0.62	0.61	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.59	0.58	0.58
71	0.71	0.63	0.60	0.59	0.58	0.57	0.57	0.57	0.57	0.56	0.56	0.56	0.56	0.55	0.55
70	0.68	0.60	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.52
69	0.65	0.57	0.54	0.53	0.52	0.52	0.51	0.51	0.51	0.50	0.50	0.50	0.50	0.50	0.50
68	0.62	0.54	0.51	0.50	0.49	0.49	0.48	0.48	0.48	0.48	0.47	0.47	0.47	0.47	0.47
67	0.59	0.51	0.47	0.47	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.44
66	0.56	0.48	0.45	0.44	0.44	0.43	0.43	0.43	0.42	0.42	0.42	0.42	0.42	0.41	0.41
65	0.52	0.45	0.43	0.41	0.41	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.36	0.36
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.33
62	0.43	0.36	0.34	0.33	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.28	0.28	0.28
60	0.36	0.30	0.28	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25
59	0.32	0.27	0.25	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23
58	0.29	0.24	0.23	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20
57	0.25	0.21	0.2	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
56	0.22	0.18	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15
55	0.18	0.15	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
54	0.14	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
53	0.11	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
52	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
51	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Note: For negative values of Q _U or Q _L , P _U or P _L is equal to 100 minus the table value for P _U or P _L . If the value of Q _U or Q _L does not correspond exactly to a figure in the table, use the next higher figure.															

TABLE 106.7B - VALUES OF t

n	t
3	1.155
4	1.481
5	1.715
6	1.887
7	2.020
8	2.126
9	2.215
10	2.290
11	2.355
12	2.412
13	2.462
14	2.507
15	2.549
16	2.585
17	2.620
18	2.651
19	2.681
20	2.709
21	2.733
22	2.758
23	2.781
24	2.802
25	2.822
26	2.841
27	2.859
28	2.876
29	2.893
30	2.908

106.7.3 **Early Termination of Lots** - In the event a lot in progress is terminated prematurely before the Department is able to take the number of acceptance samples required by the test method specified in the Contract, the following will apply as applicable unless otherwise detailed in the specifications for the item:

- A. If three or more samples have been taken, then pay factors will be generated using the available samples results for the lot.
- B. If the termination was requested by the Contractor and approved by the Department prior to three samples being taken, then each property's pay factor will be set to 0.80.

- C. If the termination was initiated by the Department prior to three samples being taken, then each property's pay factor will be set to 1.00 for each property.

106.8 ***Non-conforming Work***

- 106.8.1 ***Substantially Conforming Work*** - If the Department determines the Work substantially conforms to the Contract, the Department may accept the Non-conforming Work and may require a credit to the Department to be deducted from amounts otherwise due the Contractor. If the Department and Contractor cannot agree to the amount of the credit, the work shall be Unacceptable Work.
- 106.8.2 ***Unacceptable Work*** - The Contractor shall remove, replace, or otherwise correct all Unacceptable Work as directed by the Department at the expense of the Contractor, without cost or liability to the Department.
- 106.8.3 ***Unauthorized Work*** - Prior to Final Acceptance and upon written order by the Department, the Contractor shall remove or uncover Unauthorized Work. After examination, the Contractor shall rebuild the Unauthorized Work to a condition conforming to the Contract at the expense of the Contractor and without cost or liability to the Department. Any Delay arising from Unauthorized Work shall be an Inexcusable Delay.
- 106.8.4 ***Uninspected Work*** - Prior to Final Acceptance and upon written order by the Department, the Contractor shall uncover Uninspected Work. After examination, the Contractor shall rebuild the Uninspected Work to a condition conforming to the Contract. If the Department determines that the Uninspected Work is acceptable, the uncovering, removing, and rebuilding will be paid as Extra Work, and any resulting Delay shall be an Excusable Delay. If the Department reasonably determines that the Uninspected Work is unacceptable, the uncovering, removing, and rebuilding shall be at the Contractor's expense and any resulting Delay shall be an Inexcusable Delay.

106.9 ***Warranty Provisions***

- 106.9.1 ***Warranty by Contractor*** - The Contractor unconditionally warrants and guarantees that the Project will be free from Warranty Defects for 1 year from the date of Physical Work Complete. For a related provision, see Section 107.9.3 – Notices / Final Inspection / Physical Work Completion.

If the Department discovers any Warranty Defects during the warranty period, the Contractor agrees to promptly perform all remedial Work at no additional cost or liability to the Department.

For a related provision regarding obligations regarding plantings, see Section 621.36 – Maintenance Period.

- 106.9.2 **Warranty Definitions** - Notwithstanding any other provision of the Contract, the following words or phrases have the following definitions for the purposes of the Contractor's warranty obligation under this Contract.

Warranty Defects - Warranty Defects are conditions that result from Material, manufacture, or workmanship and that are not in conformity with the Contract or with industry standards applicable to the Work prevailing at the time of submission of the Bid. Warranty Defects do not include:

- (A) normal wear and tear,
- (B) conditions caused by occurrences clearly beyond the Contractor's control and not attributable to material, manufacture, or workmanship, and
- (C) Defects in landscape items that are the subject of Landscape Establishment Period Obligations. Examples of such excepted occurrences might be fires, floods, abnormally poor weather for the site of work, accidents, improper use, improper maintenance, vandalism, or Acts of God.

Emergency - "Emergency" means necessary for public safety or convenience, as determined by the Department.

Promptly - Unless there is an Emergency, "Promptly" means in the first construction season after the Contractor has been notified of the defect(s), but always within 1 year of Receipt of such notice. In case of an Emergency, Promptly means within 48 hours.

Remedial Work - "Remedial Work" means all Work necessary to make the item in like new condition as reasonably determined by the Department and performed in accordance with the Contract and in a good and skillful manner. Remedial Work includes all design, permitting, Project management, supervision, materials, and labor, including erosion control and traffic control.

- 106.9.3 **Remedial Work - Procedure and Requirements** - Within 30 Days of being notified of any Warranty Defects, the Contractor shall submit to the Department for approval a Remedial Work Plan, including the scope of Work, conceptual Work methods, schedule, construction phasing, and other significant aspects of the corrective Work (the Work Plan). Unless otherwise provided by the Department in writing, any Work commenced prior to Department's approval of the Work Plan will be at the Contractor's sole risk. Before starting any on-site Work, the Contractor shall deliver to the Department certificates of

insurance complying with Section 110.3 - Insurance. If the estimated cost of Remedial Work exceeds \$100,000, the Contractor shall provide Performance and Payment Bonds complying with Section 110.2 - Performance and Payment Bonds. If:

- (A) the Contractor fails to submit a Remedial Work Plan,
- (B) the Contractor does not comply otherwise with written instructions from the Department, or
- (C) a State of emergency exists in which Delay would cause serious risk of loss or damage, then the Department may perform or Contract for such remedial work and the Contractor will be responsible for all claims, costs, damages, losses, and expenses arising out of such work, including fees and charges of engineers, consultants, attorneys, dispute resolution professionals, and court costs.

Upon a final inspection satisfactory to the Department, the Department will issue a written acceptance of the Remedial Work. The Contractor warrants and guarantees all Remedial Work to be free from Warranty Defects for 1 year after such acceptance.

- 106.9.4 ***Other Warranty Provisions*** - The Contractor hereby assigns to the Department the right to enforce all manufacturer's warranties or guarantees on all Materials, Equipment, or products purchased for the Work that exceed the nature or duration of the warranty obligations assumed by the Contractor under this Contract.

The Performance Bond and/or Warranty Bond required by Section 110.2.1 - Bonds shall cover all warranty obligations of the Contractor provided by this Contract. Final Acceptance by the Department does not relieve the Contractor of any warranty obligations provided by this Contract.

The Contractor agrees that the warranty obligations provided by this Contract shall be reported as an outstanding obligation in the event of bankruptcy, dissolution, or the sale, merger, or cessation of operations of the Contractor.

SECTION 107 - TIME

Scope of Section This Section contains general time-related provisions of the Contract, including the Contract Time, allowable Work times, schedule requirements, Liquidated Damages, and Project Closeout.

- 107.1 ***Contract Time and Contract Completion Date*** - All Work must be Complete by the Contract Completion Date and within the Contract Time. Unless expressly provided otherwise by the Department in writing, the Contract Time shall be all

time between the Contract Execution and the Completion date specified in the Contract, and any authorized extensions.

- 107.2 **Commencement of Contract Time and Work** - Unless provided elsewhere in this Contract or in writing from the Department, the Contract Time will commence on the date of Contract Execution. For related provisions, see Sections 101.2 - Definitions of Contract Execution and 103.8 - Execution of Contract by the Department.

Unless specified otherwise, Work may commence upon Contract Execution, unless the Contractor has not secured and provided the Performance and Payment Bonds and Insurance Certificates required by Sections 103.5 - Award Conditions, 110.2 - Bonding, and 110.3 - Insurance. Any Work performed before the requirements of these sections are met is Unauthorized Work and is at the sole risk of the Contractor. Pursuant to Section 110.1 - Indemnification, the Contractor and Surety shall indemnify and hold harmless the Department from any claims arising from Work.

107.3 **Allowable Work Times**

107.3.1 **General** - Work can be performed at any time except Sundays and Holidays, unless expressly specified otherwise in this Contract, including any applicable Permit conditions. If a Holiday occurs on a Sunday, the following Monday shall be considered a Holiday. Sunday or Holiday Work must be approved by the Department, except that the Contractor may work on Martin Luther King Day, President's Day, Patriot's Day, Juneteenth, the Friday after Thanksgiving, and Indigenous Peoples Day without the Department's approval.

107.3.2 **Night Work** - If the Contractor performs Work during periods of darkness, the Contractor shall comply with Contract requirements governing night Work. If the Contractor elects to perform Work during periods of darkness on its own initiative and without direction from the Department, then the Contractor shall also comply with all municipal ordinances affecting such Work, including noise ordinances. When pricing and scheduling the Work, the Contractor shall not assume that such non-directed night Work will be allowed. Accordingly, the Contractor shall not be entitled to any adjustment to either compensation or time due to its inability to secure any required municipal approvals.

107.3.3 **Sundays and Holidays** - The Contractor shall not carry on construction operations on Sundays or Holidays unless:

- (A) expressly specified otherwise in this Contract,
- (B) expressly authorized by the Department, or
- (C) necessary to avoid or eliminate a clear and immediate risk of significant bodily injury to any person.

- 107.3.4 **Seasonal Work Restrictions** - The Contractor shall meet all seasonal restrictions on time of Work contained in the Contract, including all Permits.

107.4 **Scheduling of Work**

- 107.4.1 **General Duty of Contractor** - The Contractor is solely responsible for the planning and execution of Work in order to complete the Work within the Contract Time.

- 107.4.2 **Schedule of Work Required** - At least 3 Days before the pre-construction meeting and before beginning any on-site activities, the Contractor shall provide the Department with its Schedule of Work in a Critical Path Method (CPM) in the form of an activity on node (AON) diagram. This CPM schedule will become the basis for claims involving Delay. The Department will waive this CPM requirement for appropriate Contracts through a special provision. The Contractor shall plan the Work, including the activity of Subcontractors, vendors, and suppliers, such that all Work will be performed in Substantial Conformity with its Schedule of Work. The Schedule must include sufficient time for the Department to perform its functions as indicated in this Contract, including QA inspection and testing, approval of the Contractor's TCP, SEWPCP, and QCP, and review of Working Drawings.

At a minimum, the Schedule of Work shall show the major Work activities, milestones, durations, submittals and approvals, and a timeline. Milestones to be included in the schedule include:

- (A) start of Work,
- (B) beginning and ending of planned Work suspensions,
- (C) Completion of Physical Work, and
- (D) **Completion** - If the Contractor plans to complete the Work before the specified Completion date, the Schedule of Work shall so indicate.

Any restrictions that affect the Schedule of Work such as paving restrictions or In-Stream Work windows must be charted with the related activities to demonstrate that the Schedule of Work complies with the Contract.

The Department will review the Schedule of Work and provide comments to the Contractor within 20 Days of receipt of the Schedule of Work. The Contractor will make the requested changes and issue the finalized version to the Department.

- 107.4.3 **Projected Payment Schedule** - The Contractor shall provide the Department with a Quarterly Projected Payment Schedule that estimates the value of the Work as scheduled, including requests for

payment of Delivered Materials. The Projected Payment Schedule must be in accordance with the Contractor's Schedule of Work and prices submitted by the Contractor's Bid. The Contractor shall submit the Projected Payment Schedule as a condition of Award.

- 107.4.4 **Schedule Revisions** - The progress of the Work shall be compared against the Schedule of Work at each Progress Meeting. If the Department determines that the Contractor's actual progress is not in Substantial Conformity with the Schedule of Work, then the Contractor shall either increase Project resources to get back on schedule or submit a revised Schedule of Work and Projected Payment Schedule to the Department for its review.
- 107.4.5 **No Separate Payment** - Unless expressly provided otherwise, the costs for providing a Schedule of Work, a Projected Payment Schedule, and all revisions and updates are Incidental to the Contract.

107.5 **Suspension of Work**

107.5.1 **Winter Suspensions**

- A. **Start of Winter Suspension** - The Contractor may request in writing that the Department approve a Winter Suspension. If the Department determines that winter weather conditions make it impossible to perform all or specified portions of the Work, the Department will approve the Contractor's request with respect to such portions and set the start date of the Winter Suspension.
- B. **Monitoring and Communications** - During the Winter Suspension, the Contractor is responsible for monitoring weather conditions and requesting approval from the Department to resume Work as soon as possible. In any case, the Contractor shall notify the Project Manager or Resident 14 Days before the end date of the Winter Suspension specified in Section 107.5.1(C), being April 15th or May 1st, as applicable.
- C. **End of Winter Suspension** - Upon request by the Contractor or upon its own initiative, the Department may determine the end date of the Winter Suspension and the Contractor is responsible for resuming Work immediately after said end date. If the end date is not determined by the Department in writing, Winter Suspensions shall end on May 1st for Zone 1 and April 15th for Zone 2. For the purposes of the preceding sentence, Zone 1 means all areas north of Route 2 from Gilead to Bangor and Route 9 from Bangor to Calais and Zone 2 means all areas south of Zone 1, including Routes 2 and 9.

D. ***Impact on Liquidated Damages*** - Liquidated Damages will not be assessed for any portion of a Winter Suspension that occurs after expiration of the Contract Time. Winter Suspensions will not otherwise affect the assessment of Liquidated Damages. For a related provision, see Section 107.7 - Liquidated Damages.

107.5.2 ***Suspensions Due to Uncontrollable Events*** - Upon request of the Contractor or upon its own initiative, the Department may suspend the Work due to Uncontrollable Events. Any Delay related to such a suspension will be analyzed in accordance with Section 109.5 - Adjustments for Delay. For a related provision, see Section 101.2 - Definition of Uncontrollable Event.

107.5.3 ***Suspensions for Cause*** - The Department may suspend the Work if the Contractor violates any provision of the Contract that may affect the quality, cost, timeliness or Conformity of the Work. Any Delay related to such a suspension will be an Inexcusable Delay. For a related provision, see Section 109.5 - Adjustments for Delay.

107.5.4 ***Suspensions for Convenience*** - The Department may suspend the Work for any other reason it determines is in the best interest of the Department. Any Delay related to such a suspension will be analyzed in accordance with Section 109.5 - Adjustments for Delay.

107.5.5 ***Pre-Suspension Work*** - If Work is to be suspended for an extended period of time, the Contractor shall store all Materials in a manner that does not obstruct the free and safe flow of vehicular, pedestrian, railroad, or marine traffic and that protects the Materials from damage. The Department may direct the Contractor to install guardrail or other traffic control devices necessary to protect the traveling public. The Contractor shall take all precautions to prevent damage or deterioration of the Work already performed, provide suitable Drainage of the Roadway by opening ditches and Shoulder drains, erecting temporary Structures, and providing temporary erosion control where necessary. The cost of such pre-suspension Work will be analyzed in accordance with Section 109.5 - Adjustments for Delay.

For related provisions, see Sections 104.2.6 - Right to Suspend Work, 105.4.4 - Maintenance During Suspension of Work, 107.7 - Liquidated Damages, and 109.5 - Adjustments for Delay.

107.6 ***Completion Incentives and Disincentives*** - When provided in the Contract, financial incentives for early Completion and disincentives for late Completion will be added to or deducted from amounts otherwise due the Contractor. Incentives/Disincentives are separate and distinct from Liquidated Damages and Supplemental Liquidated Damages.

107.7 **Liquidated Damages**

107.7.1 **General** - The Department and the Contractor acknowledge that time is an essential element of the Contract, and that Delay in completing the Work beyond the designated completion date will result in damages, including but not limited to damages to the State of Maine due to public inconvenience, obstruction to traffic, interference with business, as well as increased engineering, inspection, and administrative costs to the Department. The Department and the Contractor acknowledge the difficulty of making a precise determination of such damages and, as a result, they have agreed to a sum of money in the amount stipulated in the Contract that will be charged against the Contractor for each Calendar Day that the Work remains uncompleted after the expiration of the designated Completion date, not as a penalty but as Liquidated and Supplemental Liquidated Damages.

Except as expressly provided otherwise in this Contract, the Contractor or, in case of default, its Surety, shall owe the Department the per diem amount specified in Section 107.7.2 - Schedule of Liquidated Damages, as well as any per diem amount of Supplemental Liquidated Damages as specified in the Supplement Specifications, for each Calendar Day that any portion of the Work remains incomplete after the Contract Time has expired. Should the Contractor or its Surety fail to complete the Work by the Completion date, a deduction of the amount stipulated in the Contract as Liquidated and Supplemental Liquidated Damages will be made for each and every Calendar Day that such Work remains uncompleted. This amount will be deducted from any money due the Contractor or its Surety under the Contract, and the Contractor and its Surety will be liable for any Liquidated and Supplemental Liquidated Damages in excess of the amount due.

The Contractor acknowledges that the specified amounts per diem of Liquidated and Supplemental Liquidated Damages in the Standard Specifications and Supplemental Specifications, respectively (if applicable) are reasonable, and agrees to stipulate to their reasonableness in any suit for the collection of or involving the assessment of said damages. The damages referred to herein are intended to be and are cumulative, and will be in addition to every other remedy now or hereafter enforceable at law, in equity, by statute, or under the Contract.

Permitting the Contractor to continue and finish the work or any part thereof after the expiration of the completion date shall in no way operate as a waiver on the part of the Department of its rights to

assess and recover Liquidated and Supplemental Liquidated Damages, or any other rights, under the Contract.

For related provisions, see Sections 107.1 - Contract Time, 107.5.1(D) - Winter Suspensions - Impact on Liquidated Damages, and 109.5 - Adjustments for Delay.

- 107.7.2 ***Schedule of Liquidated Damages*** - The specific per diem rates for Liquidated Damages are set forth below. By executing the Contract, the Contractor acknowledges that such an amount is not a penalty and that the daily amount set forth in the Contract is a reasonable per diem forecast of damages incurred by the Department due to the Contractor's failure to Complete the Work within the Contract Time.

Original Contract Amount			Per Diem Amount of Liquidated Damages Calendar Day
From More Than	To and Including		
\$0	to	\$100,000.00	\$250.00
\$100,000.00	to	\$250,000.00	\$500.00
\$250,000.00	to	\$500,000.00	\$650.00
\$500,000.00	to	\$1,000,000.00	\$800.00
\$1,000,000.00	to	\$2,000,000.00	\$1,000.00
\$2,000,000.00	to	\$4,000,000.00	\$1,200.00
\$4,000,000.00	and	More	\$2,100.00

- 107.8 ***Supplemental Liquidated Damages*** - Supplemental Liquidated Damages, if any, will be specified by Special Provision and are separate and distinct from Liquidated Damages. Supplemental Liquidated Damages will be deducted from amounts otherwise due the Contractor.

107.9 ***Project Closeout***

- 107.9.1 ***Final Cleanup and Finishing*** - To prepare for Final Acceptance, the Contractor shall clean the Project and all ground, lawns, streams, Structures, and other areas adjacent to the Project of all rubbish, excess Material, temporary Structures, and Equipment. The ground shall be backfilled with Material that is generally the same as the surrounding Material, graded to drain properly, and finished such that the surface matches the surrounding surface (examples - loam and seed, compacted gravel, pavement). The Contractor must leave all areas impacted by the Work in a condition that is reasonably acceptable to the Department.

- 107.9.2 ***Notice / Inspection / Punch List*** - The Contractor shall notify the Department in writing that it considers the Project complete. As soon as practicable thereafter, the Department will inspect the Work. If

incomplete or unsatisfactory Work is noted, the Department will prepare a written list of all items that must be completed or corrected before the Physical Work is Complete (“Punch List”). The Contractor shall immediately take such measures as are necessary to complete all Punch List items.

- 107.9.3 **Notices / Final Inspections / Physical Work Completion** - The Contractor shall notify the Department in writing that all Punch List items have been completed and/or corrected and that the Contractor considers the Project Complete. As soon as practicable thereafter, the Department will make another inspection of the Work. The Department and the Contractor will attend this inspection jointly. If incomplete or unsatisfactory Work is noted, the Department will prepare a revised Punch List (which may include items not on previous Punch List(s)) and the Contractor shall immediately take such measures as are necessary to complete the revised Punch List items. Additional iterations will occur in a like manner until the Department finds that the Physical Work is Complete and in Conformity with the Contract. If the Contractor has not already done so, the Contractor will Promptly remove all temporary traffic control devices.
- 107.9.4 **Closeout Documentation** - The Department will notify the Contractor in writing that the Physical Work is Complete and in Conformity with the Contract and that the Project will be Finally Accepted when the 106 Memo, Buy America Certification, Materials Certification and DBE Signoff, and any other documentation as requested in the Physical Work Complete letter are received from the Contractor. The Contractor shall deliver the Closeout documentation as requested in the Physical Work Complete letter to the Department within 30 Days of the date of the notification that the Physical Work is Complete. Liquidated Damages will cease to accrue upon the Completion of Physical Work. For a related provision, see Section 101.2 - Definition of Closeout Documentation.
- 107.9.5 **Final Acceptance** - Within 75 Days of Final Acceptance by the Department, the Department will advise the Contractor in writing of the Final Quantities and any damages to be assessed for the Project. The Contractor shall resolve any Project issues that remain and provide the All Bills Paid and Request for Final Payment Letters to the Department within 30 Days. The Department will make Final Payment, including the release of all remaining retainage, and release any escrowed bid documents within 20 Days of receipt of the above letters, which complete the Closeout Documentation. For a related provision, see Section 108.8 - Final Quantity Voucher.

If the Contractor fails to resolve issues and deliver Closeout Documentation within the 30 Days provided in Section 107.9.5, the

Department may provide a final notice informing the Contractor in writing that unless the Contractor Delivers all Closeout Documentation within 30 Days of the date of Receipt of final notice, the Contractor shall be in Default under the Contract. The Contractor shall become ineligible to Bid on any Department Contracts. The Department may then pursue all remedies provided by the Contract or by law, including withholding Final Payment. For a related provision, see Section 102.1.1 - Eligibility to Bid - Basic Requirements.

- 107.9.6 **No Waiver of Legal Rights** - Final Acceptance does not preclude the Department from correcting any measure, estimate, or certificate made. The Department may recover from the Contractor or its Surety, or both, overpayments made due to failure to fulfill Contract obligations.

A waiver on the part of the Department of any breach of any part of the Contract is not a waiver of any other or subsequent breach.

The Contractor retains liability for latent Defects, fraud (or such gross mistakes as may amount to fraud), and warranty obligations.

SECTION 108 - PAYMENT

Scope of Section This Section contains general provisions related to payment, including measurement of quantities, progress payment, retainage, the right to withhold payment, and other payment-related terms.

108.1 **Measurement of Quantities for Payment**

- 108.1.1 **Use of Plan Quantities** - Payment for all items labeled in the Bid Documents as “Plan Quantity” will be based upon the estimated quantity for the Work described in the Bid Documents. The Contractor shall accept such payment as full and complete compensation for that item without physical measurement. Quantities included in the Plan Quantity amount but not accomplished will be calculated by the Department using standard estimating procedures and deducted from the plan quantity. Areas not included in the Plan Quantity amount but completed will be measured and added to the Plan Quantity. Upon mutual written Agreement by the Department and the Contractor through a Contract Modification, the estimated quantity of any item of Work may be used as the final quantity for that item without physical measurement.

- 108.1.2 **General Measurement Provisions** - The Department will use the U.S. Customary system for all measurements unless the Contract utilizes the International System of Units (SI). Measurement of Bid Items shall include all resources necessary to complete the Pay Item of Work under the Contract. The Department will measure items for payment

in accordance with the “Method of Measurement” provisions of the applicable Specification. For all items of Work, other than those paid for by lump sum, the Department shall determine the quantities accepted as the basis for Final Payment after the Physical Work is Completed.

- 108.1.3 ***Provisions Relating to Certain Measurements*** - Unless expressly provided otherwise, the Department and the Contractor shall use the following general measurement provisions.

Lump Sum or Each - “Lump Sum” payment is total reimbursement for all resources necessary to complete the item of Work. Quantities provided for items measured and paid by Lump Sum are estimated quantities and are provided for informational purposes only. There will be no additional payment made by the Department or reduction in payment to the Contractor if the actual, final quantities for items measured and paid by Lump Sum are different than the quantities estimated by the Department. The only exception to this rule is when an item is eliminated, in which case Standard Specification Section 109.2 - Elimination of Items would take precedence.

“Each” payment is payment per complete unit.

Length - “Length” is defined as linear measurement parallel to the item base or foundation. A station is 100 ft.

Area - “Area” refers to the length, as defined above, multiplied by the width, which is defined as the linear measurement perpendicular to the item base or foundation. When calculating area for payment, use horizontal, longitudinal, and plan (neat) transverse measurements for surface area computations. Make no deductions for individual fixtures having an area of 1 square yard or less. For purposes of the preceding sentence, “fixtures” means small subareas that do not receive Material(s) or on which no Work is performed.

Volume - Measure Structures using plan (neat) or approved Contract Modification dimensions. Use the average end area method to compute excavation volumes. Use hauling vehicles approved by the Department when transporting Materials measured by volume. Measure materials at the point of delivery. Ensure the body shape allows contents to be accurately measured. Load and level vehicles to the lesser of their water level or legal capacity. Obtain the

Department's approval to convert Materials specified for measure by mass to volume. Use specified conversion factors.

- Measure water to the nearest gallon with calibrated tanks, distributors, certified scale weights, or water meters.
- Measure bituminous materials by the gallon or ton.
- Use net certified scale weights or certified rail car volumes. Correct for bituminous Material lost, wasted, or otherwise not incorporated in the Work. Correct net certified bituminous Material weights or volumes for loss or foaming when shipped by truck or transport.
- Measure timber by the board foot. Base measurement on nominal widths and thicknesses and individual maximum lengths.

Mass - One ton is 2,000 lb. Use certified scales to determine mass (weight). Accept certified "car weights" for Material shipped by rail, except for Material to be subsequently processed in mixing plants. Obtain certified haul truck tares as specified. Each haul truck shall display a legible identification mark.

- Measure cement by the pound or ton.
- Accept nominal mass or dimensions for standard manufactured items unless otherwise specified.
- Accept industry-established manufacturing tolerances, unless otherwise specified.
- Measure Aggregate mass in the saturated surface dry condition.

The Contractor shall furnish and maintain weigh systems tested and certified by the State or use certified permanently installed commercial scales. The Contractor shall provide certifications after each set-up and before use or as requested by the Department. The weigh system shall be scaled after certification and display a certification stamp. Only mechanical or electronic scales shall be used.

The beams, dials, platforms, and other scale Equipment shall be arranged for safe and convenient viewing by the operator and inspector. Scales shall be tested for accuracy before use at a new site. Platform scales shall be level and with rigid bulkheads at each end. The Department will adjust quantities of Materials received on scales found to be outside of specified tolerances, using a correction based on the last documented test within specified tolerances.

All materials that are measured or proportioned by weight shall be weighed on approved weighing systems. When a delivery slip is required for payment of Materials measured by weight, weighing, except for automatic ticket printer systems, shall be performed on approved platform truck scales by a Licensed Public Weighmaster furnished by the Contractor, in accordance with the following requirements.

- (A) **Licensed Public Weighmaster** - A Licensed Public Weighmaster shall be any person satisfying the requirements of the State Sealer of Weights and Measures and granted a license as a Public Weighmaster. Each Licensed Public Weighmaster shall provide him/her with an impression seal as required by the State Sealer and shall impress this seal upon delivery slips issued by him/her. When completed by a Licensed Public Weighmaster, delivery slips shall be considered as the Weight Certificates required by the Maine Weights and Measures Law, MRSA Title 10. The Weighmaster shall perform all duties required of him/her by law and the specifications.
- (B) **Weighing Trucks** - Tare weights of trucks hauling stone, bituminous mixes, and similar items shall be determined twice daily, once during the forenoon and once during the afternoon. The tare weight thus found shall be used to determine the net load until the next tare weighing of the empty truck. Tare weights of trucks hauling liquid and bituminous cement materials or other items not generally hauled on a repeat basis shall be determined immediately before being loaded and the weight thus found shall be used for that load only. The tare weight of a truck shall be defined as the weight of the empty vehicle, including the driver, but with no passengers.
- (C) **Platform Truck Weighing Systems** - An approved platform truck scale meeting the following requirements shall be provided, installed and maintained, when required, by the Contractor or be available to the Contractor at an approved nearby location:
 - 1) The weighing system shall conform to the specifications, tolerances, and regulations for commercial weighing devices of the National Institute of Standards and Technology and shall be accurate within maximum tolerances of plus or minus 2 lb for every 1.000 lb of load.

- 2) No auxiliary indicators, in combination with the beams or dial of the weighing system shall be used to increase the maximum allowable load above 105% of the manufacturer's rated capacity, as stated in the National Institute of Standards and Technology Handbook 44 S.1.7.
 - 3) The platform of the weighing system shall be of sufficient size to accommodate the entire vehicle or combination of vehicles. If a combination of vehicles must be divided into separate units in order to be weighed, each unit shall be entirely disconnected before weighing and a separate weight certificate, delivery slip, or ticket shall be issued for each separate unit.
 - 4) The value of the minimum graduation on the indicator of the scale shall not be greater than 20 lb. All weighing shall be read and recorded to the nearest 20 lb or one-hundredth ton.
 - 5) The weighing system shall be set on concrete or other approved foundation. The recording mechanism of the scale shall be suitably housed or protected from weather.
 - 6) The Contractor shall have the weighing system inspected and approved by the State Sealer of Weights and Measures or by a Repairman registered and approved by the State Sealer within a period of 12 months preceding the date of any weighing and again after each change of location.
- (D) ***Check Weighing for Platform Truck Weighing System -***
Check weighing shall be made on the weights and on the weighing in scales during production in the following manner:
- 1) At least twice during 5 Days of production, in the presence of a State Inspector, a loaded truck that has been weighed and issued a weigh slip shall be turned and a new weighing made of the truck and load with the truck heading in reverse direction and at the opposite end of the weighing system platform from the first weighing. The new weight will be recorded. If the variation from the first weight is 0.2% or less, the fact will be so noted in the Project records. However, if the variation exceeds 0.2%, the scales may not be used until rechecked and resealed by the State Sealer of Weights and Measures.
 - 2) At least twice during 5 Days of production a loaded truck that has moved off the weighing system will be

intercepted, directed back to the scales, and reweighed under the supervision of a State Inspector.

- 3) At least twice during 5 Days of production, in the presence of a State Inspector, a truck that has been emptied will be directed to the weighing system before being loaded at a time other than the normal tare weighing and weighed again for a check on the tare weight.
- 4) Check weighing will be on a plant basis and, although a plant may produce material for more than one Project or Contract, check weighing will not be required for each Project or Contract.

At least twice during 5 Days of production, additional checks will be made occasionally at the discretion of the Engineer.

Claims by the Contractor for delays or inconvenience due to check weighing will not be considered.

(E) **Reciprocal Agreements** - Weighing of materials on weighing systems located outside the State of Maine will be permitted for materials produced or stored outside the State when requested by the Contractor and approved by the Department. In order to be approved, out-of-State weighing must be performed by a Licensed Public Weighmaster or a person of equal authority in that state, on scales accepted in that state and meeting the requirements of this Section.

(F) **Delivery Slips** - Serially pre-numbered delivery slips of acceptable size and format for stating the following minimum information shall be furnished by the Contractor, in as many copies as may be necessary. One copy shall be retained by the Resident or Inspector upon accepting delivery of the material.

- 1) Vehicle identification
- 2) Date loaded
- 3) Work identification number & location
- 4) Identification of Material:
 - a) Item number
 - b) Source location of supplier
 - c) Type and grade
 - d) Tank number from which loaded, if liquid

- 5) Quality information as necessary for bituminous liquids:
 - a) Specific gravity at 60°F
 - b) Serial number of the Certificate of Analysis as furnished according to Division 700 - General Statement
 - c) The Certificate Statement as required in Division 700 - General Statement
 - d) Removed.
- 6) Quantity information as necessary: gross, tare and net weights, volume of load if not material requiring weighing, net gallons at 60°F if bituminous liquids
- 7) Signatures (legible initials acceptable) of Weighmaster (if weight measured material), Contractor's representative (if volume measured material), and Resident (Cover Slips).

If Materials are shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for Materials to be passed through mixing plants. Trucks used to haul Material being paid for by weight shall be weighed empty daily, at such times as directed. Each truck shall bear a legible identification mark.

Rail shipments of bituminous liquid shall be measured directly by volume. Correction shall be made when liquid bituminous Material has been lost from the car, wasted, or otherwise not incorporated in the work. Other shipments of bituminous liquids will be measured by the gallon or ton. Volumes will be measured at 60°F or will be corrected to the volume at 60°F using the tables in ASTM D1250.

When bituminous liquids are shipped by truck or transport, net certified weights or volume subject to correction for loss or foaming may be used for computing quantities. Net certified weight shall be determined upon loading for all bituminous liquids when shipped by truck or transport. The net weight of each load shall be converted to net gallons at 60°F by a conversion factor expressed in pounds per gallon.

- (G) **Time** - Measure Equipment by hours in accordance with Section 631 - Equipment Rental.

108.2 **Progress Payments**

- 108.2.1 **Generation of Progress Payment Estimates** - The Department will estimate the amount of Work performed at least monthly and make

payment based upon such estimates. Estimates may be paid once every 2 weeks if, in the opinion of the Resident, the amount of Work performed is sufficient to warrant such payment. No such estimates or payment will be made if, in the judgment of the Resident, the Work is not proceeding in accordance with the provisions of the Contract, or when the total value of the Work performed since the last estimate amounts to less than \$5,000. The Contractor agrees to waive all claims related to the timing and amount of such estimates.

If the Contract requires, the Contractor will submit an application for progress payment with a detailed written explanation of the payments requested, on forms and media approved by the Department, to the Resident for approval. The Resident may request that the Contractor submit backup documentation, including copies of receipts, invoices, and itemized payments to Subcontractors.

- 108.2.2 **Payment** - The Department will make payment within 15 Days if the Contractor agrees to accept electronic transfer of payments in a manner approved by the Department, except as otherwise provided in the Contract. In other cases, the Department will make payment within 30 Days, except as otherwise provided in the Contract. These payment obligations shall not apply in the event of unforeseeable circumstances such as insufficient legislative appropriations, information systems failure, and other Uncontrollable Events. All payments made are subject to correction in subsequent Progress Payments and the Final Payment. For related provisions, see Sections 108.8 - Final Payment, and 108.9.2 - No Inflation Adjustments/Interest.

- 108.2.3 **Mobilization Payments** - "Mobilization" includes the mobilization and demobilization of all resources as many times as necessary during the Work.

Percent Mobilization Bid will be determined by taking the amount Bid for Mobilization and dividing by the Total Contract Amount less Mobilization. $\text{Mob}/(\text{Total Contract} - \text{Mob})$. (See Table on next page.)

Payment will be made at the following intervals:

Percent Mobilization Bid	Percent Mobilization Paid at Contract Award	Percent Mobilization Paid after the Department determines 50% of the work is Complete	Percent Mobilization Paid at Final Acceptance
10% or less	50%	50%	
More than 10% to 15%	33%	33%	34%
More than 15% to 20%	25%	25%	50%
More than 20% to 30%	15%	15%	70%
Greater than 30%	10%	10%	80%

- 108.3 **Retainage** - The Department will pay 100% of each approved Progress Payment until the Work is approximately 50% complete. Thereafter, the Department will deduct 5% of the amount of each Progress Payment as retainage. In the event that the Department believes that the retainage will be insufficient to cover the Contractor's obligations under this Contract, the Department may withhold a greater percentage of the money to cover Contractor obligations.

The Department may hold, temporarily or permanently, retainage as needed to assure timely Completion of the Work and payment of all Subcontractors and Suppliers in Conformity with the Contract. The Department may also disburse retainage to Subcontractors as set forth in Section 104.5.6 - Subcontractor Claims for Payment.

Upon Final Acceptance, and determination by the department that there are no claims either by or on the Contractor or Subcontractors; no over payments by the department; no LDs due; and no disincentives due, the Department will reduce Retent to 1% of the original Contract Award amount, or \$100,000, whichever is less, as it deems desirable and prudent.

- 108.4 **Payment for Materials Obtained and Stored** - Acting upon a request from the Contractor and accompanied by bills or Receipted Bills, the Department will pay for all or part of the value of acceptable, non-perishable Materials that are to be incorporated in the Work, including Materials that are to be incorporated into the Work, not delivered on the Work site, and stored at places acceptable to the Department. Examples of such Materials include steel piles, stone masonry, curbing, timber and lumber, metal Culverts, stone and sand, gravel, and other Materials. The Department will not make payment on living or perishable Materials until acceptably planted in their final locations.

If payment for Materials is made to the Contractor based on bills, only, then the Contractor must provide Receipted Bills to the Department for these Materials within 14 Days of the date the Contractor receives payment for the Materials. Failure of the Contractor to provide Receipted Bills for these Materials within 14 Days of the date the Contractor receives payment will result in the paid amount

being withheld from the subsequent progress payment, or payments, until such time the Receipted Bills are received by the Department.

Materials paid for by the Department are the property of the Department, but the risk of loss shall remain with the Contractor until the materials are installed and accepted. Payment for Materials does not constitute Acceptance of the Material. If Materials for which the Department has paid are later found to be unacceptable, then the Department may withhold amounts reflecting such unacceptable Materials from payments otherwise due the Contractor.

In the event of Default, the Department may use or cause to be used all paid-for Materials in any manner that is in the best interest of the Department.

108.4.1 **Price Adjustment for Hot Mix Asphalt** - For each Contract, a price adjustment for performance graded binder will be made for the following pay items, when the total quantity of Hot Mix Asphalt included in these items is in excess of 500 tons, based on the estimated quantities of these items at the time of bid.

Item 403.102	Hot Mix Asphalt – Special Areas
Item 403.207	Hot Mix Asphalt - 19 mm
Item 403.2071	Hot Mix Asphalt - 19 mm (Polymer Modified)
Item 403.2072	Hot Mix Asphalt - 19 mm (Asphalt Rich Base)
Item 403.208	Hot Mix Asphalt - 12.5 mm
Item 403.2081	Hot Mix Asphalt - 12.5 mm (Polymer Modified)
Item 403.2084	Hot Mix Asphalt - 12.5 mm (Highly Modified HiMAP)
Item 403.209	Hot Mix Asphalt - 9.5 mm (sidewalks, drives, & incidentals)
Item 403.210	Hot Mix Asphalt - 9.5 mm
Item 403.2101	Hot Mix Asphalt - 9.5 mm (Polymer Modified)
Item 403.2104	Hot Mix Asphalt - 9.5 mm (Thin Lift Surface Treatment)
Item 403.21041	Hot Mix Asphalt - 9.5 mm (Polymer Modified Thin Lift Surface Treatment)
Item 403.211	Hot Mix Asphalt – Shim
Item 403.2111	Hot Mix Asphalt – Shim (Polymer Modified)
Item 403.212	Hot Mix Asphalt - 4.75 mm (Shim)
Item 403.213	Hot Mix Asphalt - 12.5 mm (base and intermediate course)
Item 403.2131	Hot Mix Asphalt - 12.5 mm (base and intermediate course Polymer Modified)
Item 403.2132	Hot Mix Asphalt - 12.5 mm (Asphalt Rich Base and intermediate course)
Item 403.301	Hot Mix Asphalt (Asphalt Rubber Gap-Graded)
Item 461.13	Light Capital Pavement
Item 461.210	9.5 mm HMA - Paver Placed Surface

Item 461.2101	Hot Mix Asphalt - 9.5 mm (Polymer Modified)
Item 461.216	Hot Mix Asphalt (Shim)
Item 462.30	Ultra-Thin Bonded Wearing Course
Item 462.301	Polymer Modified Ultra-Thin Bonded Wearing Course

Price adjustments will be based on the variance in costs for the performance graded binder component of hot mix asphalt. They will be determined as follows:

The quantity of hot mix asphalt for each pay item will be multiplied by the performance graded binder percentages given in the table below times the difference in price between the base price and the period price of asphalt cement. Adjustments will be made upward or downward, as prices increase or decrease.

Item 403.102	6.2%
Item 403.207	5.2%
Item 403.2071	5.2%
Item 403.2072	5.8%
Item 403.208	5.6%
Item 403.2081	5.6%
Item 403.2084	6.2%
Item 403.209	6.2%
Item 403.210	6.2%
Item 403.2101	6.2%
Item 403.2104	6.2%
Item 403.21041	6.2%
Item 403.211	6.2%
Item 403.2111	6.2%
Item 403.212	6.8%
Item 403.213	5.6%
Item 403.2131	5.6%
Item 403.2132	6.2%
Item 403.301	6.2%
Item 461.13	6.7%
Item 461.210	6.4%
Item 461.2101	6.4%
Item 461.216	6.7%
Item 462.30	0.0021 tons/yd ²
Item 462.301	0.0021 tons/ yd ²

Hot Mix Asphalt - The quantity of hot mix asphalt will be determined from the quantity shown on the progress estimate for each pay period.

Base Price - The base price of performance graded binder to be used is the price per standard ton current with the bid opening date. This

price is determined by using the average New England Selling Price (Excluding the Connecticut market area), as listed in the Asphalt Weekly Monitor.

Period Price - The period price of performance graded binder will be determined by the Department by using the average New England Selling Price (Excluding the Connecticut market area), listed in the Asphalt Weekly Monitor current with the paving date. The maximum Period Price for paving after the adjusted Contract Completion Date will be the Period Price on the adjusted Contract Completion Date.

108.5 **Right to Withhold Payments** - The Department may withhold payments claimed by the Contractor on account of:

- A. Defective Work,
- B. Damages for Non-conforming Work,
- C. Failure to provide the Department the opportunity to inspect the Work,
- D. Damage to a third party,
- E. Claims filed or reasonable evidence indicating probable filing of claims,
- F. Failure of the Contractor to make payments to Subcontractors or for Materials or labor, or failure of Subcontractors to make payments to Sub-Subcontractors or for Materials or labor,
- G. Substantial evidence that the Project cannot be completed for the unpaid balance,
- H. Substantial evidence that the amount due the Department will exceed the unpaid balance,
- I. Regulatory non-compliance or enforcement,
- J. Failure to submit Closeout Documentation,
- K. All other causes that the Department reasonably determines negatively affect the State's interest.

108.6 **Taxes, Fees, Allowances, and Notices** - The Contractor shall pay all taxes, charges, fees, and allowances and give all notices necessary and incidental to the due and lawful prosecution of the Work. Except as expressly provided otherwise in this Contract, all such taxes, charges, fees, and allowances are Incidental to the Contract.

Certain items of tangible personal property purchased by the Contractor for use in the Contract may be exempt from Maine sales tax. See 36 MRSA §§ 1760(2) & (61).

108.7 **Damages for Non-Conforming Work** - If the Contractor performs Non-conforming Work that causes the Department to incur costs, including environmental costs or penalties, failure of FHWA to share in certain costs, Departmental staff time related to the non-Conformity, penalties, or other damages of any nature whatsoever ("Damages"), then the Contractor shall be liable to the Department for such Damages. The Department, at its option, and without liability, may deduct such Damages from amounts otherwise due the

Contractor and/or postpone disbursement of Progress Payments until the Non-conforming Work is corrected.

- 108.8 ***Final Quantity Voucher*** - The Department will prepare a final quantity voucher reflecting final quantities of the items of Work performed. The Department may require the Contractor to provide information necessary to substantiate Pay Items, including Statements itemizing Force Account Work.

108.9 ***General Payment Provisions***

- 108.9.1 ***Full Compensation*** - Payments to the Contractor shall be full compensation for furnishing all labor, Equipment, Materials, services, and Incidentals used to perform all Work under the Contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of any kind arising from the nature or prosecution of the Work.
- 108.9.2 ***No Inflation Adjustments / Interest*** - No payments due the Contractor will be adjusted for inflation. No interest shall be due and payable on any payment due the Contractor, except that the Department will pay statutory interest on uncontested Final Payments for any period of time that extends beyond 60 Days of the date of Receipt of all Conforming Closeout Documentation. The preceding exception expressly does not include payments regarding pending Issues, a Dispute, or a claim.
- 108.9.3 ***Amounts Due the Department*** - Unless expressly provided otherwise in this Contract, in cases where the Department may deduct sums from amounts otherwise due the Contractor and where the sums to be deducted are more than the funds otherwise due the Contractor, the Contractor shall remit all amounts due the Department within 30 Days of receiving an Invoice from the Department. After such 30 Days, the Contractor shall be in Default of this Contract and shall not be entitled to any additional cure period. Statutory interest shall accrue after 60 Days of Receipt of the Invoice.

SECTION 109 - CHANGES

Scope of Section This Section contains general provisions related to changes in quantities, scope, time, and payment.

109.1 ***Changes in Quantities***

- 109.1.1 ***Changes Permitted*** - The Department may increase or decrease Pay Item quantities from the estimated quantities shown in the Bid Documents, and such increase or decrease shall not be considered Extra Work. Except as expressly provided otherwise in this Contract, the Contractor shall be paid for actual quantities in place and accepted at the Unit Prices contained in the Contractor's Bid. The

Contractor accepts such payment as full and complete compensation. There will be no adjustment to Contract Time due to an increase or decrease in quantities compared to those estimated, except as addressed through Contract Modification(s).

- 109.1.2 **Substantial Changes to Major Items** - If quantities of Major Items vary from the estimated quantities contained in the Bid Documents by more than 25%, then the Department may increase or decrease the Unit Price of such item using the extra work process. For related provisions, see Section 109.3 - Extra Work and Section 109.8 - Contract Modification. If an adjustment to the Unit Price is made, it will apply only to that portion of the actual quantity that is less than 75% of the estimated quantity or more than 125% of the estimated quantity.

- 109.2 **Elimination of Items** - Upon written notification to the Contractor, the Department may entirely eliminate item(s) of Work for any reason. Upon notification, the Department is entitled to a credit. For Minor Items, the credit shall be the Contractor's Bid price for the eliminated item(s). For Major Items, the amount of the credit shall be the Contractor's Bid price for the eliminated item(s), less

- (A) direct costs actually incurred by the Contractor after Award, including mobilization, shipping, and restocking expenses that the Contractor cannot recoup on other Projects as reasonably determined by the Department, and
- (B) 10% for overhead and profit. The Department may withhold said credit from amounts otherwise due the Contractor.

- 109.3 **Extra Work** - The Department reserves the right to revise the Contract by adding Extra Work. Such revisions neither invalidate the Contract nor release the Surety. The Contractor and/or its Surety agree to perform all such Extra Work. The Department will compensate for Extra Work by written Contract Modification in accordance with Section 109.7.1 - General and Section 109.7.2 - Basis of Payment. Any Delay related to Extra Work will be analyzed in accordance with Section 109.5 - Adjustments for Delay. For a related provision, see Section 109.8 - Contract Modification.

- 109.4 **Differing Site Conditions**

- 109.4.1 **Definition** - "Differing Site Conditions" are subsurface or latent physical conditions that, at the time of Bid submittal, were:

- (A) Materially different from conditions indicated in the Bid Documents,
- (B) Not discoverable from a reasonable site investigation prior to Bid,

- (C) Materially different from conditions ordinarily encountered and generally recognized as inherent in Work like that specified by the Contract by Contractors experienced in such Work, and
- (D) Actually unknown to the party seeking relief due to such conditions, which in the case of the Contractor includes its Subcontractors.

109.4.2 **Risk of Other Conditions** - All costs, Work, Delays, or other damages related to or arising from site conditions that are not Differing Site Conditions are the sole risk and responsibility of the Contractor.

109.4.3 **Notice and Procedural Requirements** - If the Contractor discovers what it considers Differing Site Conditions that may cause adjustments to compensation, time, or other Contract requirements, the Contractor shall provide "Notice of Issue for Consideration" within 48 hours of discovery and before doing any Work relating to such conditions as provided in Section 104.4.5 - Early Negotiation. The Contractor shall then comply with all other requirements of Section 104.4.5 - Early Negotiation, and Section 111 - Resolution of Disputes. The Contractor will not be entitled to any change to compensation, time, or Work requirements without proper notice as specified in this Section 109.4. Failure to provide such notice or to otherwise comply with this Section 109.4 will constitute a waiver of all claims related to such conditions.

If the Department discovers what it considers Differing Site Conditions that may cause adjustments to compensation, time, or other Contract requirements, then the Department will provide the Contractor with written notice within 48 hours of discovery. If the Contractor disagrees with the Department's finding of Differing Site Conditions or the related adjustments, then the Contractor shall provide "Notice of Issue for Consideration" within 48 hours of receipt of the Department's written notice and comply with the requirements of Section 104.4.5 - Early Negotiation and Section 111 - Resolution of Disputes.

109.4.4 **Investigation / Adjustment** - Upon notification by the Contractor or upon the Department's own initiative, the Department will investigate the conditions. If the Department determines that Differing Site Conditions exist and that the Differing Site Conditions have caused an increase in the cost or time required for the performance of the Work, then the Contractor is entitled to an Equitable Adjustment for the additional costs in accordance with Section 109.7 - Equitable Adjustments to Compensation and Time - Basis of Payment that are caused directly by the Differing Site Conditions. If the Department

determines that Differing Site Conditions exist and that the Differing Site Conditions have caused a decrease in the cost or time required for the performance of the Work, then the Department is entitled to a credit in the amount of savings to compensable items in accordance with Section 109.7 - Equitable Adjustments to Compensation and Time, that are caused directly by the Differing Site Conditions. Delays caused by Differing Site Conditions will be considered in accordance with Section 109.5 - Adjustments for Delay.

109.5 **Adjustments for Delay**

109.5.1 **Definitions - Types of Delays** - Delays are defined as follows and may be divided into more than one type depending upon cause.

A. **Excusable Delay** - Except as expressly provided otherwise by this Contract, an “Excusable Delay” is a Delay to the Critical Path that is directly and solely caused by

(1) a weather-related Event of such an unusually severe nature that either a Federal Emergency Disaster Declaration (FEMA eligible) or FHWA eligible Disaster Declaration/Proclamation either from the President or the Governor. FHWA must concur on a Governor’s proclamation. The Contractor will be entitled to an adjustment of time under this Section only if the Project falls within the geographic boundaries prescribed under the disaster declaration or

(2) a flooding event at the affected location of the Project that results in a Q25 headwater elevation, or greater, but less than a Q50 headwater elevation. Theoretical headwater elevations will be determined by the Department; actual headwater elevations will be determined by the Contractor and verified by the Department or

(3) an Uncontrollable Event.

B. **Compensable Delay** - A “Compensable Delay” is a Delay to the Critical Path that is directly and solely caused by:

(1) a weather-related Uncontrollable Event of such an unusually severe nature that either a Federal Emergency Disaster Declaration (FEMA eligible) or FHWA eligible Disaster Declaration/Proclamation either from the President of the Governor. FHWA must concur on a Governor’s proclamation. The Contractor will be entitled to an Equitable Adjustment under this Section only if the Project falls within the geographic boundaries prescribed

under the disaster declaration and receives Project-specific emergency funds, and the Contractor can show proof that the Work was delayed by this weather event,

- (2) an Uncontrollable Event caused by a Utility Company for which the Utility Company reimburses the Department,
- (3) an Uncontrollable Event caused by other third party (not Subcontractors) Working on Project-related Work within the Project Limits if, and only if, the such other third party offers the Department reimbursement for such Delay, or
- (4) acts by the Department that are in violation of applicable laws or the Contract, or
- (5) a flooding event at the affected location of the Project that results in a Q50 headwater elevation, or greater. Theoretical Q50 headwater elevations will be determined by the Department; actual headwater elevations will be determined by the Contractor and verified by the Department.

- C. ***Inexcusable Delay*** - “Inexcusable Delays” are all Delays that are not Excusable Delays or Compensable Delays.

For a related provision, see Section 101.2 - Definition of Uncontrollable Event.

109.5.2 ***Entitlement to Adjustments***

- A. ***Types of Adjustments*** - Provided the Contractor meets the requirements of Section 109.5.2(B) below and complies with the notification, documentation, and procedural requirements set forth in the Contract, the Contractor is entitled to certain adjustments to the Contract depending upon the type of Delay.
1. For an Excusable Delay, the Contractor is entitled to an extension of time, but no additional compensation.
 2. For a Compensable Delay, the Contractor is entitled to an extension of time and an Equitable Adjustment as set forth in Section 109.7 - Equitable Adjustments to Compensation and Time.
 3. For an Inexcusable Delay, the Contractor is entitled to neither an extension of time nor additional compensation.

For related provisions, see Sections 104.2.7 - Damage to Project Caused By Uncontrollable Events and 104.3.10 - Responsibility for the Damage to Work.

- B. **Requirements for Entitlement** - To be entitled to any adjustments for an Excusable Delay or a Compensable Delay, the Contractor must demonstrate all of the following:
1. The Contractor consistently utilized its Schedule of Work to schedule, coordinate, and manage the Work, as evidenced by documentation created as the Work progressed, including Progress Meeting minutes;
 2. The Delay affected the Critical Path of the Schedule of Work; and
 3. There are no concurrent Inexcusable Delays.
- C. **Concurrent Delays** - The Contractor is not entitled to a time extension for the period of time when Excusable and Inexcusable Delays are concurrent. The Contractor also is not entitled to either a time extension or an Equitable Adjustment for the period of time when Compensable and Inexcusable Delays are concurrent. In the event Compensable and Excusable Delays are concurrent, the Contractor is entitled only to a time extension, not an Equitable Adjustment, for the period of time such Delays are concurrent.

109.5.3 **Early Completion Date Delay Claims** - For the purposes of this Section 109.5.3, a “Contractor’s Early Completion Date” means a Project Completion date shown on the Contractor’s initial Schedule of Work submitted in accordance with Section 107.4.2 - Schedule of Work Required that is earlier than the Contract’s specified Completion date. The Department will not be liable for any claims or expenses related to the period of time between the Contractor’s Early Completion Date and the Contract’s specified Completion date, unless the Contractor demonstrates, by clear and convincing evidence that:

- (A) all requirements of Section 109.5.2(B) - Requirements for Entitlement are met, and
- (B) that the Contractor’s Early Completion Date was reasonable at the time of Bid in light of the surrounding facts and circumstances, including the Contractor's available resources, and the requirements of the Work.

109.5.4 **Notice and Procedural Requirements** - If the Contractor becomes aware of facts or circumstances that may cause a Delay for which the Contractor may seek adjustments to compensation, time, or other Contract requirements, the Contractor must notify the Resident of such “Issue” within 48 hours and before doing any Work relating to such facts or circumstances as provided in Section 104.4.5 - Early

Negotiation. Except as otherwise provided in this Section 109.5, the Contractor shall then comply with all other requirements of Section 111 - Resolution of Disputes. The Contractor will not be entitled to any change to compensation, time, or Work requirements without proper and timely notice. Failure to provide such notice constitutes a waiver of all claims related to such conditions.

109.5.5 ***Documenting the Delay and Request for Adjustments***

- A. ***Weekly Reports During Delay*** - To be entitled to any adjustments for Delay, the Contractor must keep records as provided in Section 111.1.6 – Contractor’s Obligation to Keep Records. Further, the Contractor must submit weekly written reports containing the following information.
 - 1. Number of Days of impact to the Critical Path.
 - 2. A summary of all operations that have been Delayed, or will be Delayed on the impact of the Contractor's Critical Path.
 - 3. A narrative describing how the cause of the Delay meets the definition of “Excusable Delay” or “Compensable Delay” contained in Section 109.5.1(A) or (B).
 - 4. Itemization of all extra costs being incurred, including
 - (A) how the extra costs relate to the Delay,
 - (B) the identification of all non-salaried Project employees for whom costs are being compiled, and
 - (C) a summary of time charges for Equipment, identified by the manufacturer’s number for which costs are being compiled.
- B. ***Request and Report After Completion*** - Within 14 Days of Completion of the phase of Work that the Contractor claims has been Delayed, the Contractor shall submit a written report to the Department that contains the following information:
 - 1. A description of the operations that were Delayed and the documentation and narrative of how the cause for the Delay meets the definition of “Excusable Delay” or “Compensable Delay” contained in Sections 109.5.1(A) or (B), including all reports prepared for the Contractor by consultants, if used;
 - 2. An as-built chart showing when Work operations were actually performed;

3. A graphic depiction of how the operations were Delayed and the impact on the Critical Path; and
4. An item-by-item request for additional time and compensation for items allowed under Section 109.7.5 – Force Account Work, including measurement and explanation.

The Department may require that all costs shown in the report be certified by an accountant, and that the Contractor provide all other information described in Section 111.2.2 - Detailed Notice of Dispute.

109.5.6 **Decision by Program Manager** - Within 30 Days of receiving all information described in Section 109.5.5(B) - Request and Report After Completion, the Program Manager will Deliver a written decision on the request made to the Contractor. Failure to provide a decision within said 30 Day period shall be considered a denial of the Contractor's request, unless the parties mutually agree to an extension of time for such decision.

109.5.7 **Additional Consideration by Department** - If the Contractor wants additional consideration, the Contractor shall Deliver a "Notice of Unresolved Dispute" to the Department's appropriate Bureau Director within 14 Days of Receipt of the Program Manager's decision. Such Notice shall comply with Section 111.3.1 - Notice of Unresolved Dispute. The parties must then comply with all other Dispute resolution provisions of this Contract, beginning with Section 111.3 - Negotiation By Management.

109.6 **Value Engineering**

109.6.1 **Overview - General Requirements** - A Value Engineering Change Proposal (VECP) is a proposal made by the Contractor after Contract Execution that is intended to produce cost savings without impairing essential characteristics of the Project, including function, serviceability, safety, durability, maintainability, and aesthetics, all as determined by the Department.

A VECP shall contain proven features that have been used under similar conditions. A proposal is not a VECP if equivalent options are already provided in the Contract.

A VECP must be approved by the Department. Unless otherwise agreed in writing, the Contractor and the Department will equally share the Net Savings generated by the VECP as provided in Section 109.6.4(C) - Contract Modification - Amount of Payment.

Unless mutually agreed otherwise, the VECP approval process will occur in three steps:

- (A) Conceptual VECP submission and review,
- (B) Detailed VECP submission and evaluation, and if approved,
- (C) Contract Modification, including the amount of payment due to the Contractor and credit due to the Department. When the nature and scope of a VECP warrants, the parties may agree to truncate the VECP approval process.

109.6.2 **Conceptual VECP**

- A. **Submittal** - To propose a VECP, the Contractor must submit a written “Conceptual VECP” to the Resident. The Conceptual VECP is not a formal and complete submittal based upon detailed technical analysis, but instead relays a conceptual idea based upon the Contractor’s knowledge and experience. The Conceptual VECP should include the following information:
 - 1. **General Description** - A narrative that describes the proposed change in concept and includes the basic differences between the existing Contract and the proposed change.
 - 2. **Advantages and Disadvantages** - A listing and brief description of the comparative advantages and disadvantages of the VECP, including effects on function, serviceability, safety, durability, maintainability, aesthetics, and any other factors significantly altered by the VECP.
 - 3. **Estimate of Net Savings** - An estimate of the Net Savings as defined in Section 109.6.4(C) - Contract Modification - Amount of Payment.
 - 4. **Savings and Schedule Impacts** - An estimate of the time necessary for the Contractor to submit a Detailed VECP. Such estimate must specify the date by which the Department must approve the VECP to obtain the maximum cost reduction, and the latest date by which the Department must approve the VECP for the Contractor to avoid significant impacts on the estimated Net Savings or the Contractor's Schedule of Work. If the Department determines that the time for response is insufficient for review, the Contractor will be so notified.
- B. **Conceptual Review and Response** - The Department will use its best efforts to review a Conforming Conceptual VECP and

respond to the Contractor within 14 Days of Receipt. The Department may, at its sole discretion,

- (1) invite the Contractor to submit a Detailed VECP,
- (2) reject the Conceptual VECP for reasons that will be described briefly, or
- (3) request additional information. The Department may also, in its sole discretion, agree to partially reimburse the Contractor for the costs to develop and submit a Detailed VECP.

109.6.3 **Detailed VECP**

A. **Submittal** - If the Department invites the Contractor to submit a Detailed VECP, it shall contain the following information that is sufficient in detail to clearly define and explain the proposed change(s):

1. Updated and more complete information regarding items included in the Conceptual VECP, including the general description of the VECP, advantages and disadvantages, use, or testing performed, elsewhere, a detailed computation of the estimated Net Savings generated in accordance with Section 109.6.4(C) - Contract Modification - Amount of Payment, actual VECP development costs to date, and estimated savings and schedule impacts, including approval date(s) required. If the Department determines that the time for response is insufficient for review, the Contractor will be notified promptly.
2. A complete set of Plans and Specifications showing the proposed revisions relative to the original Contract features and requirements. All VECPs that require engineering design, computations, or analysis shall be prepared under the responsible charge of, and sealed by, a Professional Engineer licensed in the State of Maine.

B. **Evaluation**

1. **Additional Information** - The Department may request any additional information that it determines is necessary to properly evaluate the VECP. Where design changes are proposed, such additional information may include results of field investigations and surveys, design computations, specifications, and field change sheets. The Contractor will promptly provide any such requested information.

2. **Cost Verification** - The Department may require the Contractor to provide additional information to verify the Contractor's cost analyses.

C. **Response** - The Department will evaluate a Conforming Detailed VECP and provide the Contractor with a written response within 14 Days of Receipt of all of the information it has determined is necessary to properly evaluate the VECP. Such response will include a brief description of the Department's reason(s) for its decision. The Department, at its sole discretion, will either approve the Detailed VECP, approve it with conditions, or reject it. The Department may base its decision on any reason that is in the best interest of the Department, including:

- (1) unacceptable impact on the function, serviceability, safety, durability, maintainability, or aesthetics of the Project,
- (2) insufficient testing or use of the VECP concepts elsewhere,
- (3) insufficient justification of cost savings,
- (4) unacceptable schedule impacts,
- (5) insufficient review time, or
- (6) differing engineering judgment. The Contractor may request that the Department reconsider certain portions of the decision. If requested, the Department will reconsider its decision and then issue a final decision, which is not subject to review or appeal.

D. **Termination of VECP Process** - If the Department rejects the VECP or the Contractor does not desire to proceed with the VECP as approved by the Department, the VECP process will terminate and the Department will reimburse the Contractor for 100% of all VECP development costs incurred by the Contractor to date.

109.6.4 **Contract Modification - Amount of Payment** - If the VECP is approved, or if it is approved with conditions, and the Contractor wants to proceed, a Contract Modification will be executed by the parties. In addition to the requirements of Section 109.8 - Contract Modifications, the VECP will set forth the net savings generated by the

VECP, which shall be split equally between the Contractor and the Department, per the following formula:

$$NS = EGS - CDC - DVEC$$

Where:

NS =	Net Savings - generated by the VECP, as determined by the Department.
EGS =	Estimated Gross Savings - which is the difference between the cost of performing the Work as originally specified in the Contract and the cost of performing the Work as revised by the VECP, at agreed upon or lump sum prices.
CDC =	Contractor's Development - Costs related to the preparation of the Detailed VECP, including costs of the Contractor's design subconsultants and Subcontractors. The Department shall reimburse the Contractor for these costs.
DVEC =	Department's VE Costs - related to review, approval, and implementation of the VECP, including design costs, field inspection, and the value of any Department provided property.

Once the Contract Modification is executed, the Contractor may be paid for its actual Development Costs. The Contractor's share of the Net Savings shall not be disbursed until the Work is complete and the actual Net Savings is known.

The Contract Modification shall also set forth any adjustments to Contract Time related to the Work as revised by the VECP, if any.

109.6.5 **Subsequent Payment Adjustments** - Upon Completion of the portion of the Work revised by the VECP, the Department, on its own initiative or upon request by the Contractor, may review the actual net savings realized by the VECP. The Contractor will be afforded an opportunity to review and comment on such a review. If the actual net savings was greater than set forth in the Contract Modification, the increased savings will be shared equally by the parties. If the net savings was less than set forth in the Contract Modification, the reduction in savings will be borne equally by the parties.

109.6.6 **General Conditions Regarding VECPs**

- A. VECPs will remain the property of the Contractor, provided that the Department will have the unrestricted right to use any approved VECP, or any VECP in which the Department has reimbursed the Contractor for any portion of the development

costs, on other Department Projects without notice, cost, or liability to the Contractor.

- B. Only the Contractor may submit VECPs. The Contractor shall review, be responsible for, and submit all proposals initiated by the Contractor's Subcontractors.
- C. The Contractor shall not anticipate Departmental approval of a VECP when Bidding or otherwise before approval of a Detailed VECP. The Contractor is responsible for all Delays caused by the VECP that were not negotiated in the Contract Modification.
- D. If a VECP is rejected, the Contractor shall perform the Work in accordance with the Contract.
- E. Except as otherwise provided in this Section 109.6, the Contractor shall have no claim against the Department for additional compensation or time resulting from the Delayed review or rejection of a VECP, including, but not limited to, development costs, loss of anticipated profits, and increased Material or labor costs.
- F. Cost sharing applies only to the Contract for which the VECP was submitted.
- G. Because the Department has no obligation to change the terms of the original Contract, all VECP decisions by the Department are final and are not subject to the Dispute resolution provisions provided in this Contract or otherwise available at law.

109.7 ***Equitable Adjustments to Compensation and Time***

- 109.7.1 **General** - Equitable Adjustment means an adjustment to compensation due to a change in the nature or scope of Work as defined in this Section 109.

This Section 109.7 applies to all changes to the nature or scope of the Work excepting

- (A) changes in quantities, which are governed by Section 109.1,
- (B) elimination of items of Work which is governed by Section 109.2, and
- (C) payment for Value Engineering Change Proposals, which is governed by Section 109.6.

- 109.7.2 **Basis of Payment** - Adjustments will be established by mutual Agreement based upon Unit or Lump Sum Prices that include labor, materials, equipment, mark-up, overhead, profit, and time. These agreed upon Unit or Lump Sum prices will be full compensation and

no additional overhead, profit, mark-ups, or fees are allowed. If Agreement on Equitable Adjustments cannot be reached, the Contractor shall accept payment on a Force Account basis as provided in Section 109.7.5 - Force Account Work, as full and complete compensation for all Work relating to the Equitable Adjustment.

109.7.3 **Reserved**

109.7.4 **Non-Compensable Items** - The Contractor is not entitled to compensation or reimbursement for any of the following items:

- A. Lost profits or lost opportunity costs,
- B. Labor inefficiencies,
- C. Consequential damages, including but not limited to loss of bonding capacity, loss of Bidding opportunities, and insolvency,
- D. Indirect costs or expenses of any nature,
- E. Dispute resolution costs of any nature, including attorney's fees, claims consultant fees, expert witness fees, claims preparation expenses, and costs related to DRB proceedings, mediation, arbitration, or litigation, and
- F. Interest.

109.7.5 **Force Account Work** - Compensation for Force Account Work will be computed according to this Section.

- A. **Labor** - The Contractor will receive the actual hourly wages paid to workers actually engaged in the changed Work and the foreperson in direct charge of the changed Work as determined from certified payrolls, plus 90% of the sum thereof for all fringe benefits, payroll taxes, overhead, and profit.
- B. **Materials** - For Materials incorporated in the permanent Work, the Contractor will receive the Actual Cost of Materials, including freight and Delivery charges (but excluding any sale or use tax) plus a single 15% markup. For all Materials not incorporated in the permanent Work, the Contractor will receive the difference of actual value of such Material at the time of its use less the fair salvage value of Material when released, plus 15% of said difference. There shall be no markup on markups.
- C. **Equipment** - For all authorized usage of power-operated machinery, trucks, or other Equipment, the Contractor will receive the rental rates for the actual time to the nearest ¼

hour that such Equipment is in operation on the Work. Time spent moving Equipment within the Project Limits and any approved idle time may be measured for payment when authorized. Time spent servicing, maintaining, and changing attachments will not be paid for. The rental rates shall include the cost of all fuel oil, lubrication, supplies, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, small tools, and all other Incidentals.

The maximum Hourly Equipment rental rates (R) will be determined using the most current Blue Book rates and the following formula:

$$R = A \times B \times E + C + D$$

Where:

A = Blue Book monthly rate divided by 176

B = Blue Book regional adjustment factor for Maine

C = Blue Book estimated operating costs per hour

D = Operator's hourly payroll rate plus 90%

E = Factor from the Rate Adjustment Table for the year the machine was made

When the Contractor's Equipment is ordered to be available for Force Account Work, but is idle for reasons not the fault of the Contractor, standby time will be paid at 70% of the hourly Equipment rental rate excluding all operating costs.

For each piece of Equipment, the Contractor shall provide the following information: the manufacturer's name, Equipment type, year of manufacture, model number, type of fuel used, horsepower rating, attachments required, together with its size or capacity and any further information necessary to ascertain the proper rate. The Contractor shall also provide a photocopy of the appropriate pages from the Blue Book that were used to arrive at the rates and prepare a chart that fully shows all the details of the Equipment costs.

Unless otherwise specified, manufacturer's ratings and manufacturer-approved modifications will be used to classify Equipment for the determination of applicable rental rates. A unit of at least the minimum rating recommended by the manufacturer shall power equipment that has no direct power unit.

If the Department specifies Equipment not listed in the above publication, the Department will establish a reasonable rate for such Equipment. If requested by the Department, the Contractor will produce cost data to assist the Department in the establishment of such rental rate, including all records that are relevant to the Actual Costs including rental Receipts, acquisition costs, financing documents, lease Agreements, and maintenance and operational cost records.

Equipment leased/rented from companies that are not owned by the Contractor, its subsidiary or parent company, for Force Account Work and actually used on the Project will be paid for at the actual invoice amount plus 10% markup for administrative costs.

- D. **Superintendence** - No part of the salary or expense of anyone connected with the Contractor above the grade of foreman or having general supervision of the Work will be included in the labor items as specified above, except when the Contractor's entire on-site Workforce is occupied with Force Account Work, in which case, the salaries of the Superintendent may be included in the labor item specified above when the nature of the Work is such that their services are required, as determined by the Department.
- E. **Documentation Requirements** - All Statements shall be accompanied and supported by Receipted Invoices for all Materials used and transportation charges. If Materials used on the Force Account Work are not specifically purchased for such Work but are taken from the Contractor's stock, then instead of Invoices, the Statements shall contain or be accompanied by an affidavit of the Contractor certifying that such Materials were taken from stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the Actual Cost to the Contractor, excluding storage costs.

No payment will be made for Work performed on a Force Account basis until the Contractor has furnished duplicate

itemized Statements of the cost of such Force Account Work detailed to the following:

- 1) Name, classification, date, daily hours, total hours, rate, and amount for each foreman and laborer.
- 2) Designation, dates, daily hours, total hours, rental rate, and amount for each unit of Equipment.
- 3) Quantities of Materials, prices, and amounts.
- 4) Transportation charges on Materials.

F. **Subcontractor Quoted Work** - When accomplishing Force Account Work that utilizes Subcontractors, the Contractor will be allowed a maximum markup of 5% for profit and overhead on the Subcontractor's portion of the Force Account Work. If the Department does not accept the Subcontractor quote, then the Subcontractor work will be subject to the Force Account provisions with a 5% markup for profit & overhead.

109.8 **Contract Modification** - Excepting changes to quantities as provided in Section 109.1.1 - Changes Permitted, all changes to the Contract that affect compensation, time, or quality must be made by written Contract Modification. The Contract Modification will describe the underlying issue that resulted in the Contract Modification and will specify adjustments to compensation, time, or other Work requirements, as applicable. If adjustments to compensation or time are not shown on the face of the Contract Modification, then there are no such adjustments.

All Contract Modifications must be signed by the Project Manager or Resident. By signing a Contract Modification, the Contractor agrees to all the terms thereof and waives any and all claims for additional compensation, time, or other Work requirement adjustments relating to the issue that is the subject of the Contract Modification. All Contract Modifications are to be noted in Progress Meeting minutes.

SECTION 110 - INDEMNIFICATION, BONDING, AND INSURANCE

Scope of Section This Section contains general requirements for indemnification, bonding, and insurance by the Contractor.

110.1 **Indemnification** - The Contractor agrees to indemnify, defend, and hold harmless the Department and its officers, directors, employees, agents, and consultants from and against all claims, actions, torts, costs, losses, and damages for bodily injury (including sickness, disease, or death) and property damage arising out of or relating to this Contract or the performance of Work by the Contractor, its Subcontractors, subconsultants, engineers, suppliers, any individuals or entities directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, excepting only claims directly and

solely caused by the negligence of the Department. Damages covered include, but are not limited to, all Dispute resolution costs, including court costs, attorney's fees, and the fees of engineers and consultants, arbitrators, and other professionals related to Dispute defense and preparation.

This indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any Subcontractor, subconsultant, engineer, supplier, or other individual or entity under Workers' Compensation acts, disability benefit acts, or other employee benefit acts.

110.2 **Bonding**

110.2.1 **Bonds** - The Contractor shall provide signed, valid, and enforceable Performance and Payment Bonds complying with the Contract. The Department may also require Warranty and Maintenance Bonds for specific items using a Contract specific special provision. For a related provision, see Section 103.5 - Award Conditions.

The Contractor shall procure bonds from a company organized and operating in the United States, licensed or approved to do business in the State of Maine by the State of Maine Department of Professional and Financial Regulation, Bureau of Insurance, and listed on the latest Federal Department of the Treasury listing for "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies."

The bonds shall each be in the full Contract amount, payable to the "Treasurer - State of Maine," and on the Department's forms, on exact copies thereof, or on forms that do not contain any significant variations from the Department's forms as solely determined by the Department.

By issuing a bond, the Surety agrees to be bound by all terms of the Contract, including those related to payment, time of performance, quality, warranties, and the Department's self-help remedy provided in Section 112.1 - Default to the same extent as if all terms of the Contract are contained in the bond(s).

Regarding claims related to any obligations covered by these bonds, the Surety shall provide, within 60 Days of Receipt of written notice thereof, full payment of the entire claim or written notice of all bases upon which it is denying or contesting payment. Failure of the Surety to provide such notice within the 60 Day period constitutes the Surety's waiver of any right to deny or contest payment and the Surety's acknowledgment that the claim is valid and undisputed.

If the Surety becomes financially insolvent, ceases to be licensed or approved to do business in the State of Maine, or stops operating in

the United States, the Contractor shall file new bonds complying with this Section within 10 Days of the date the Contractor is notified or becomes aware of such change.

For a related provision, see Section 106.9.4 - Other Warranty Provisions.

110.2.2 ***Bond for Use of Municipal Roads*** - A bond for use of municipal Roads may be required as provided in Section 105.5 - Hauling of Materials and Equipment.

110.2.3 ***Bonding for Landscape Maintenance Period*** - The Contractor shall provide a signed, valid, and enforceable Landscape Warranty Bond when specified in Special Provision 621. The Landscape Warranty Bond shall be presented to the Resident at the time of Physical Work Complete. Payment for the Landscape Warranty Bond shall be incidental to the Landscape Items. The bond shall be in the full amount for all Pay Items for work pursuant to Section 621 - Landscape, payable to the "Treasurer - State of Maine," and on the Department's forms, on exact copies thereof, or on forms that do not contain any significant variations from the Department's forms as solely determined by the Department.

The Contractor shall pay all premiums and take all other actions necessary to keep said bond in effect for the duration of the Landscape Establishment Period described in Special Provision 621.0036 - Maintenance Period. If the Surety becomes financially insolvent, ceases to be licensed or approved to do business in the State of Maine, or stops operating in the United States, the Contractor shall file new bonds complying with this Section within 10 Days of the date the Contractor is notified or becomes aware of such change.

All Bonds shall be procured from a company organized and operating in the United States, licensed or approved to do business in the State of Maine by the State of Maine Department of Business Regulation, Bureau of Insurance, and listed on the latest Federal Department of the Treasury listing for "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies."

By issuing a bond, the Surety agrees to be bound by all terms of the Contract, including those related to payment, time for performance, quality, warranties, and the Department's self-help remedy provided in Section 112.1 - Default to the same extent as if all terms of the Contract are contained in the bond(s).

Regarding claims related to any obligations covered by the bond, the Surety shall provide, within 60 Days of Receipt of written notice thereof, full payment of the entire claim or written notice of all bases

upon which it is denying or contesting payment. Failure of the Surety to provide such notice within the 60 Day period constitutes the Surety's waiver of any right to deny or contest payment and the Surety's acknowledgment that the claim is valid and undisputed.

110.3 **Insurance** - The Contractor shall provide signed, valid, and enforceable certificate(s) of insurance complying with this Section. All insurance must be procured from insurance companies licensed or approved to do business in the State of Maine by the State of Maine, Department of Business Regulation, Bureau of Insurance. The Contractor shall pay all premiums and take all other actions necessary to keep required insurances in effect for the duration of the Contract obligations, excluding warranty obligations.

110.3.1 **Workers' Compensation** - For all operations performed by the Contractor and any Subcontractor, the Contractor and each Subcontractor shall carry Workers' Compensation Insurance or shall qualify as a self-insurer with the State of Maine Workers' Compensation Board in accordance with the requirements of the laws of the State of Maine. If maritime exposures exist, coverage shall include United States Long Shore and Harbor Workers coverage.

110.3.2 **Commercial General Liability** - With respect to all operations performed by the Contractor and any Subcontractors, the Contractor and any Subcontractors shall carry commercial general liability insurance in an amount not less than \$1,000,000.00 per occurrence and \$2,000,000.00 in the aggregate. The coverage must include products, completed operations, and Contractual liability coverages, and Insurance Services Office (ISO) form #CG25031185 or equivalent. The Contractual liability insurance shall cover the Contractor's obligations to indemnify the Department as provided in this Contract, including Section 110.1 - Indemnification. The coverage shall also include protection against damage claims due to explosives, collapse, and underground coverage. No endorsement excluding damage caused by subsidence, earth movement, and/or earth pressure shall be permitted.

When the work to be performed entails the use of barges, tug boats, work boats, supply boats, or other watercraft, Protection and Indemnity coverage for such work shall be provided at the limits called for under Commercial General Liability insurance.

110.3.3 **Automobile Liability** - The Contractor shall carry Automobile Liability Insurance covering the operation of all motor vehicles, including any that are rented, leased, borrowed, or otherwise used in connection with the Project. The minimum limit of liability under this Section shall be \$1,000,000.00 per occurrence.

- 110.3.4 **Professional Liability** - Contractors and Subcontractor(s) who engage in design Work, preliminary engineering Work, and environmental consulting Work for the Department shall maintain a Professional Liability policy for errors and omissions that provides a minimum liability of \$1,000,000 per claim and annual aggregate. "Design Work" includes the design of temporary Structures and all other Work that requires design computations. This policy shall cover "Wrongful Acts," meaning negligent acts, errors, or omissions by the Contractor, or any entity for whom the Contractor is legally liable, arising out of the performance of, or failure to perform, professional services. The Department reserves the right to adjust liability coverage on a Project-by Project basis as it deems appropriate.
- 110.3.5 **Owners and Contractors Protective Liability** - If required by Special Provision, the Contractor shall carry an Owners and Contractors Protective (OCP) Policy covering all operations performed by the Contractor and any Subcontractor in an amount not less than \$1,000,000.00 per occurrence and \$2,000,000.00 in the aggregate, naming the Department as the sole insured party under the policy.
- 110.3.6 **Builders Risk** - Unless required by Special Provision, the Department does not require the Contractor to carry Builders Risk Insurance. However, the Contractor is advised of its risks for damage to the Work as provided in Section 104.3.10 - Responsibility for Damage to the Work. The Contractor is responsible for managing and insuring these risks as it deems appropriate.
- 110.3.7 **Pollution Liability** - If required by Special Provision, the Contractor shall carry Pollution Liability insurance to cover the risk of sudden or accidental discharge of pollutants during the prosecution of the Work. The limits of liability for this coverage shall be in the amount of \$1,000,000.00 per occurrence and \$2,000,000.00 in the aggregate. Regardless of whether such insurance is carried by the Contractor, the Contractor is responsible for managing these risks as it deems appropriate.
- 110.3.8 **Railroad Protective Liability** - When working adjacent to a railroad, the Contractor and Subcontractors shall carry Railroad Protective Liability Insurance as required by the Railroad.
- 110.3.9 **Administrative & General Provisions**
- A. **Additional Insured** - Each insurance policy, with the exception of Workers' Compensation, Automobile Liability, and Professional Liability insurance, shall list the Department of Transportation as an additional insured.
 - B. **Defense of Claims** - Each insurance policy shall include a provision requiring the carrier to investigate, defend,

indemnify, and hold harmless all named insureds against any and all claims for death, bodily injury, or property damage, even if groundless. The Contractor's insurer shall name the Department as a released party ("Releasee") on any release or settlement agreement for settled claims.

- C. **Primary Insurance** - The insurance coverage provided by the Contractor shall be primary insurance with respect to the State, its officers, agents, and employees. Any insurance or self-insurance maintained by the State for its officers, agents, and employees is in excess of the Agent's insurance and shall not contribute with it.
- D. **Reporting** - Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the State, its officers, agents, and employees.
- E. **Separate Application** - The insurance provided by the Contractor shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

Nothing in this document constitutes a waiver of any defense, immunity or limitation of liability that may be available to the Department or its officers, agents, or employees under the Maine Tort Claims Act (14 M.R.S.A. § 8101, et seq.), and shall not constitute a waiver of other privileges or immunities that may be available to the Department.

110.3.10 Assurance Required by 49 CFR: 26.13(a)(b)

- a. MaineDOT shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of any DOT-assisted Contract or in the administration of its DBE Program or the requirements of 49 CFR part 26. MaineDOT shall take all necessary and reasonable steps under 49 CFR part 26 to ensure nondiscrimination in the award and administration of DOT-assisted Contracts. MaineDOT's DBE Program, as required by 49 CFR part 26 and as approved by DOT, is incorporated by reference in this agreement. The implementation of this program is a legal obligation and failure to carry out its terms shall be treated as a violation of this agreement. Upon notification to the MaineDOT of its failure to carry out its terms shall be treated as a violation of this agreement. Upon notification to the MaineDOT of its failure to carry out its approved program, the Department may impose sanctions as provided for under 49 CFR Part 26, and may, in appropriate cases, refer the matter for enforcement

under 18 U.S.C. 1001 and/or the Program Fraud Remedies Act of 1986 (31 U.S.C. 3801 et seq.). This language will appear in financial assistance agreements with sub-recipients.

- b. The Contractor, sub-recipient, or Subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this Contract. The Contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT assisted Contracts. Failure by the Contractor to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as the recipient deems appropriate, including, but not limited to:
 - 1. Withholding monthly progress payments;
 - 2. Assessing sanctions;
 - 3. Liquidated damages; and/or
 - 4. Disqualifying the Contractor from future bidding as non-responsible.

SECTION 111 - RESOLUTION OF DISPUTES

Scope of Section This Section contains provisions for resolving Disputes early, efficiently, fairly, and as close to the Project level as possible. For related provision, see Section 104.4 - Communication and Coordination.

111.1 General

111.1.1 **Definitions** - “Dispute” is defined in Section 101.2 - Definitions. “Issue” is defined in Section 104.4.5 – Early Negotiation. Additionally, an “Issue” as used in Sections 111.1 through 111.3 below, is a matter that may give rise to a Dispute.

111.1.2 **Escalation Process** - To resolve Issues or Disputes, the Contractor and the Department may mutually agree in writing at any time to any form of Dispute resolution, including mediation, facilitated negotiation, neutral case evaluation, arbitration, or litigation.

In the absence of such written Agreement, the parties must pursue resolution of Issues or Disputes that arise after Contract Execution as follows:

- (A) first through negotiation at the Project level as provided in Sections 104.4.5 - Early Negotiation and 111.2 - Project Level Negotiation,
- (B) next through negotiation by management as provided in Section 111.3 - Negotiation by Management, and

- (C) next through the Commissioner as set forth in Section 111.5 - Appeal to Commissioner. If the Dispute remains unresolved after final agency action by the Commissioner, then, and only then, may a party seek judicial review of a Dispute as provided in Section 111.6 - Judicial Review.

- 111.1.3 ***Relationship to Partnering*** - Partnering, including the establishment of a partnership charter, does not in any way waive, alter, or otherwise affect any provision of the Contract, including those requiring notice and all other provisions governing the resolution of Issues or Disputes. For a related provision, see Section 104.4.1 - Partnering.
- 111.1.4 ***Mandatory Notice*** - The Contractor shall comply with all notice provisions of this Contract relating to Issues or Disputes, including those contained in Sections 104.3.3 - Duty to Notify If Ambiguities Discovered; 104.4.5(A) - Early Negotiation, Notice Required; 109.4.3 - Differing Site Conditions, Notice and Procedural Requirements; 109.5.4 - Adjustments for Delay, Notice and Procedural Requirements; and 111 - Resolution of Disputes. In order to promote the purposes of this Section 111, all notice provisions are mandatory and are to be strictly construed. Failure to provide conforming notice constitutes waiver by the Contractor of any and all claims to additional compensation, time, or modification of Contract requirements related to the Issue or Dispute.
- 111.1.5 ***Work to Proceed Despite Issue or Dispute*** - Regardless of the status or disposition of any Issue or Dispute, the Contractor and the Department must perform their Contractual responsibilities Promptly and diligently. Unless expressly directed otherwise by the Department, the Contractor shall proceed without Delay to perform the Work or to conform to the decision or order of the Department.
- 111.1.6 ***Contractor's Obligation to Keep Records*** - Throughout the course of any Issue or Dispute, the Contractor shall keep daily records, including supporting documentation, of extra costs and time related to the Issue or Dispute. Such records shall include all non-salaried labor, Material costs, Equipment expenses, and location for all operations that are affected by the Issue or Dispute. The Contractor will not be entitled to any change to compensation, time, or Work requirements without such records. The Contractor shall permit the Department daily access to and shall provide copies of these and any other records needed for evaluating the Dispute. The Contractor shall retain those records for the duration of the Dispute and as provided in Section 104.3.6 - Project Records.

- 111.1.7 **Dispute Resolution Time Extensions** - All deadlines provided in this Section 111 may be extended only by mutual written consent signed by both parties.
- 111.1.8 **Commissioner Communications Before Appeal** - Because the Commissioner may hear an Appeal and render final agency action under Section 111.5 - Appeal to Commissioner, the following persons shall not communicate with the Commissioner regarding the substance of a Dispute, except upon notice and opportunity for all parties to participate:
- (A) the Contractor or any agent for the Contractor and
 - (B) Department staff, counsel, or consultants who are directly participating in Dispute resolution processes in an advocate capacity. The preceding sentence does not prohibit the Commissioner from communicating with, or having the aid or advice of all other Department staff, counsel, or consultants. This Section does not apply where the Commissioner has delegated hearing the Appeal to other Department personnel, in which case, this Section shall apply instead to the Commissioner's delegate.
- 111.1.9 **Contract Modification Required** - All changes to the Contract that regard Issues or Disputes and that affect - compensation, time, quality, or other Contract requirements must be made by written Contract Modification as provided by Section 109.8 - Contract Modification.
- 111.2 **Project Level Negotiation**
- 111.2.1 **Early Negotiation** - The parties must first comply with all requirements of Section 104.4.5 - Early Negotiation.
- 111.2.2 **Detailed Notice of Dispute** - If Early Negotiation fails to resolve the Issue within 45 Days of the date of Receipt of the written Notice of Issue for Consideration Conforming to Section 104.4.5(A) - Early Negotiation, and if the Contractor desires additional consideration by the Department, then the Contractor must Deliver a written Detailed Notice of Dispute to the Program Manager within 14 Days of the expiration of said 45 Day period. At a minimum, the Detailed Notice of Dispute shall include all of the following information in sufficient detail to allow reasoned analysis as determined by the Program Manager:
- A. A description of the background of Dispute, including the date(s) the Issue or Dispute first arose and the date the Contractor provided the Project Manager or Resident with the

“Notice of Issue for Consideration” Conforming to Section 104.4.5(A) - Early Negotiation;

- B. All Contract provisions that are relevant to the Dispute;
- C. All facts relevant to the Dispute, including all non-Contract Documents and all non-documentary facts, including identification of all persons with knowledge of relevant facts and a synopsis of their testimony;
- D. The Contractor’s position as to why the Contract and facts demonstrate that the Contractor is entitled to additional compensation and/or time;
- E. The estimated dollar cost, if any, of the Disputed Work and how the estimate was determined;
- F. If the Contractor is asserting an Excusable or Compensable Delay occurred, an analysis of the progress schedule showing the impact on the Critical Path; and
- G. A specific request for additional compensation or time, or other change to provisions of the Contract.

111.2.3 **Decision by Program Manager** - Within 30 Days of receiving a Detailed Notice of Dispute Conforming to Section 111.2.2 - Detailed Notice of Dispute, the Program Manager will Deliver a written decision to the Contractor on the specific request made.

111.3 **Negotiation by Management**

111.3.1 **Notice of Unresolved Dispute** - If the Contractor desires additional consideration, the Contractor shall Deliver a written “Notice of Unresolved Dispute” to the Department's appropriate Bureau Director (hereafter "Director" in this Section 111 - Resolution of Disputes within 14 Days of receiving the Program Manager’s decision provided for in Section 111.2.3 - Decision by Program Manager.

At a minimum, the Notice of Unresolved Dispute must include the following information in sufficient detail to allow reasoned analysis as determined by the Director or the director's designee(s):

- (A) all documentation submitted to the Resident for Project-level negotiation,
- (B) all decisions rendered by the Program Manager or equivalent Bureau level manager, and
- (C) all additional information the Contractor desires the Department to consider.

111.3.2 **Additional Documentation** - Within 14 Days of the receiving a Notice of Unresolved Dispute Conforming to Section 111.3.1, the Director or the Director’s designee(s) may require the Contractor to provide

Additional Documentation. If required, the Contractor shall completely and accurately supply all requested information in writing within 21 Days of receiving said request. Failure to provide all Additional Documentation constitutes a waiver of all claims for additional compensation or time.

Additional Documentation may include the following:

- A. The date(s) on which facts arose which gave rise to the Issue or Dispute.
- B. The dates the Department Received the “Notice of Issue for Consideration” Conforming to Section 104.4.5(A) - Early Negotiations - Notice Required and the “Detailed Notice of Dispute” Conforming to Section 111.2.2.
- C. A list of all Contract provisions that is relevant to the Dispute and a Statement of which specific Contract provisions the Contractor believes controls or is relevant to the outcome of the Dispute.
- D. A narrative setting forth the Contractor’s position regarding additional compensation and time, if any, including all supporting facts, including dates, locations, and items of Work affected by the Dispute, and how the Contract provisions set forth in subparagraph C support the Contractor’s position.
- E. A list of and copies of all documents that are relevant to the Dispute organized chronologically. With respect to each document, the list must include its date, the author(s) (including address and telephone numbers), and the recipient(s).
- F. A list of all persons who are involved in or knowledgeable of the Dispute, including addresses and telephone numbers of such persons. If such person has knowledge of oral statements upon which the Contractor is relying, the list must also include the substance of the oral statements, the date(s) they were made, and all people present at the time the statement was made.
- G. If an extension of time is sought:
 - 1. The specific Days or dates for which it is sought, including an explanation of impact on the Critical Path;
 - 2. The specific reasons the Contractor believes a time extension should be granted; and
 - 3. The specific provisions of the Contract under which it is sought.

- H. If additional compensation is sought, the exact amount sought and a breakdown of that amount into the categories provided by Section 109.7- Equitable Adjustments to Compensation and Time.
- I. An oath consisting of the following language:

“ON OATH, and under the penalty of law for perjury or falsification, the undersigned, (Name of person signing oath and title) hereby certifies that the amounts claimed by the Contractor for additional compensation and time (as applicable) set forth in the Notice of Unresolved Dispute and this additional documentation are a true and complete Statement of the Actual Costs incurred and time sought, and are fully documented and supported in accordance with the Contract.”
- J. Date of signature, sworn signature, and acknowledgment by notary.

The Director or the Director’s designee may also retrieve and review the Bid Escrow Documentation, if any, if the Contract required submission of Bid Escrow.

- 111.3.3 **Decision by Director** - Within 21 Days of receiving a Notice of Unresolved Dispute Conforming to Section 111.3.1 - Notice of Unresolved Dispute or, if requested, all Additional Documentation, whichever is later, the Director or the Director’s designee(s) will Deliver a written decision. The decision will affirm, reverse, revise, or amend the decision of the Program Manager.

111.5 **Appeal to Commissioner**

- 111.5.1 **Filing of Appeal** - If the Contractor elects, the Contractor may file an “Appeal of the Director’s Decision.” Such Appeal must be filed within 14 Days of the Contractor’s Receipt of the Director’s Decision. At a minimum, the Appeal must contain:

- A. All Materials submitted to the Director and all decisions by the Director;
- B. The specific findings of the Director that the appealing party claims are contrary to law and/or fact;
- C. Any other pertinent new documentary evidence;
- D. Any written arguments the appealing party wishes the Commissioner to consider; and
- E. The specific relief sought.

Unless directed otherwise by the Commissioner, review of the Appeal will be limited to the documentation submitted.

- 111.5.2 **Director's Response** - The Director may submit a written response within 14 Days of receiving notice that an Appeal was filed with the Commissioner.
- 111.5.3 **Time and Alternatives for Commissioner** - Action Within 30 Days of receiving an Appeal Conforming to Section 111.5.1 or, if applicable, the Director's response, allowed by Section 111.5.2, the Commissioner will:
- A. Affirm the decision of the Director, or
 - B. Revise, amend, or reverse the decision of the Director.
- 111.5.4 **Final Agency Action** - Any affirmation, revision, amendment, or reversal by the Commissioner is final agency action as of the date of Receipt of such action by the Contractor. If the Commissioner takes no action within such 30 Day period, the decision of the Director shall be final agency action upon the expiration of said 30 Day period.
- 111.6 **Judicial Review** - All Bidders and Contractors hereby agree and acknowledge that with respect to any and all Disputes and/or Issues arising from the Bid and/or the Contract, they must and will comply with all of the Notice and Dispute Resolution provisions of this Contract. For related provisions see Sections 111.1.2 – Escalation Process and 111.1.4 – Mandatory Notice. All Bidders and Contractors hereby agree and acknowledge that they must comply with, and exhaust, the Notice and Dispute Resolutions provisions of this Contract to the point of Final Agency Action prior to seeking judicial review. See Section 111.5.4 - Final Agency Action.
- All Bidders and Contractors hereby agree and acknowledge that the sole and exclusive means of judicial review of final agency actions under the Contract is through a petition for review pursuant to Maine Rule of Civil Procedure 80C and 5 MRSA § 11001, et seq., of the Maine Administrative Procedure Act, to be filed in Maine Superior Court, Kennebec County.

SECTION 112 - DEFAULT AND TERMINATION

Scope of Section This Section contains general provisions related to Default and termination of the Contract.

112.1 **Default**

- 112.1.1 **Grounds for Default** - The Contractor and the Surety are in Default of the Contract if the Contractor or the Surety violate any provision of Section 103.3.2 or the following:
- A. Fails to Promptly begin the Work under the Contract after being authorized to proceed,
 - B. Fails to perform the Work with sufficient labor, Equipment, or Materials to assure the timely Completion of the Work,

- C. Performs Defective Work, neglects or refuses to uncover, remove or rebuild Unacceptable Work, or neglects or refuses to uncover Unauthorized or Uninspected Work when directed by the Department,
- D. Discontinues the prosecution of the Work without Departmental approval,
- E. Continues to perform Work after the Department directs that Work be stopped,
- F. Fails to resume Work that has been suspended as required by the Contract,
- G. Becomes insolvent or is declared bankrupt or commits any act of bankruptcy or insolvency that could affect the Work in any way,
- H. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 Days,
- I. Makes an assignment for the benefit of creditors without authorization by the Department, or
- J. In any other manner, fails to perform the Work in Substantial Conformity with any material provision of the Contract.

112.1.2 **Notice of Default / Cure** - Except as otherwise provided in this Contract, if Default occurs, the Department may give written Notice of Default to the Contractor and its Surety. Failure to give Notice of Default is in no way a waiver by the Department of any provision of the Contract.

If the Contractor or Surety fails to completely cure such Default within a period of 14 Days after Notice of Default, then the Department may:

- (A) terminate the Contract for cause in accordance with Section 112.2.1 - For Cause, or
- (B) take prosecution of the Work away from the Contractor without violating the Contract.

112.2 **Termination** - The Department may, by written order to the Contractor, terminate the Contract as provided in this Section 112. Termination of the Contract or portion thereof shall not relieve the Contractor of its Contractual responsibilities for the Work completed (including warranty obligations), nor shall it relieve the Surety of its obligation for claims arising from the Work or the Contract.

112.2.1 **For Cause** - If the Contractor fails to completely cure all Defects identified in the Notice(s) of Default provided for in Section 112.1.2 within the 14 Day cure period provided, the Department may immediately terminate the Contract for cause by written Notice of

Termination For Cause. In this event, the Department may use any or all Materials and Equipment for the Work and may enter into an Agreement with another entity for the Completion of the Work, or use such other methods as in the opinion of the Department are required for the Completion of the intent of the Contract in an acceptable and timely manner.

The Department will pay for all Accepted items of Work as of the date of Termination at agreed upon prices. Items eliminated in their entirety by Termination will be paid for as provided in Section 109.2 -

Elimination of Items, except that there will be no reductions in the amount of the credit to the Department. The Contractor shall make all Work records available to the Department upon request regarding payment under this Section. All costs and charges incurred by the Department, together with the cost of completing the Work specified in the Contract, will be deducted from amounts otherwise due the Contractor. If such expenses exceed the sum that would have been payable under the Contract, then the Contractor and the Surety are liable and shall pay to the Department the amount of such excess within 30 Days of the Delivery of a Statement setting forth such expenses to the Contractor and the Surety, as applicable.

If the Contractor files for bankruptcy at any time before expiration of the warranty periods provided by this Contract, then the Contractor and its Surety agree, if requested by the Department and within 30 Days of such request, to take all actions necessary or convenient to reject or accept this Contract under the executory Contract provisions of the federal bankruptcy code.

- 112.2.2 ***For Convenience*** - The Department may terminate this Contract for convenience or for any reason that is in the best interest of the Department. Terminations caused without fault of or for reasons beyond the control of the Contractor are Terminations for Convenience. The Department will notify the Contractor of such terminations by sending a Notice of Termination for Convenience.

In case of a Termination for Convenience, the Department will pay for all Accepted items of Work as of the date of termination at agreed upon prices. Items eliminated in their entirety by Termination will be paid for as provided in Section 109.2 - Elimination of Items. The Contractor shall make all Work records available to the Department upon request regarding payment under this Section. Acceptable Materials, obtained by the Contractor for the Work but which have not been incorporated therein, may at the option of the Department be purchased from the Contractor at Actual Costs delivered to a prescribed location or otherwise disposed of as mutually agreed.

After Receipt of Notice of Termination for Convenience from the Department, the Contractor may also submit a claim for additional damages or costs not covered above or elsewhere in this Contract to the Project Manager within 60 Days of the effective Termination date. Such claim may include such cost items as idle Equipment time, Bidding and Project investigative costs, overhead expenses attributable to the Project terminated, legal and accounting charges involved in claim preparation, Subcontractor costs not otherwise paid for, idle labor cost if Work is stopped in advance of termination date, guaranteed payments for private land usage as part of the original Contract, and any other cost or damage item for which the Contractor reasonably believes reimbursement should be made. In no event, however, will loss of anticipated profits be considered as part of any settlement.

The Contractor agrees to make the Bid Escrow, Documentation, if any, and its cost records available to the extent necessary to determine the validity and amount of each item claimed.

The Department will respond in writing to such claim within 60 Days of Receipt. If the Contractor wants additional consideration, the Contractor must Deliver a written "Notice of Unresolved Dispute" to the Director as provided in Section 111.3.1 - Notice of Unresolved Dispute and comply with all other applicable Dispute resolution provisions of Section 111 - Resolution of Disputes.

APPENDIX A TO DIVISION 100

September 28, 2023

Supersedes August 05, 2022

SECTION 1 - BIDDING PROVISIONS

- A. **Federally Required Certifications** - By signing and delivering a Bid, the Bidder certifies as provided in all certifications set forth in this Appendix A - Federal Contract Provisions Supplement including:
- Certification Regarding No Kickbacks to Procure Contract as provided on this page 1 below.
 - Certification Regarding Non-collusion as provided on page 1 below.
 - Certification Regarding Non-segregated Facilities as provided by FHWA Form 1273, section III set forth on page 21 below.
 - "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion" as provided by FHWA Form 1273, section XI set forth on page 32 below.
 - "Certification Regarding Use of Contract Funds for Lobbying" as provided by FHWA Form 1273, section XII set forth on page 35 below.

Unless otherwise provided below, the term "Bidder", for the purposes of these certifications, includes the Bidder, its principals, and the person(s) signing the Bid. Upon execution of the Contract, the Bidder (then called the Contractor) will again make all the certifications indicated in this paragraph above.

Certification Regarding No Kickbacks to Procure Contract - Except expressly stated by the Bidder on sheets submitted with the Bid (if any), the Bidder hereby certifies, to the best of its knowledge and belief, that it has not:

- A. employed or retained for a commission, percentage, brokerage, contingent fee, or other consideration, any firm or person (other than a bona fide employee working solely for me) to solicit or secure this Contract;
- B. agreed, as an express or implied condition for obtaining this Contract, to employ or retain the services of any firm or person in connection with carrying out the Contract, or;
- C. paid, or agreed to pay, to any firm, organization, or person (other than a bona fide employee working solely for me) any fee, contribution, donation, or consideration of any kind for, or in connection with, procuring or carrying out the Contract;

By signing and submitting a Bid, the Bidder acknowledges that this certification is to be furnished to the Maine Department of Transportation and the Federal Highway Administration, U.S. Department of Transportation in connection with this Contract in anticipation of federal aid highway funds and is subject to applicable state and federal laws, both criminal and civil.

Certification Regarding Noncollusion - Under penalty of perjury as provided by federal law (28 U.S.C. §1746), the Bidder hereby certifies, to the best of its knowledge and belief, that:

- the Bidder has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of competitive bidding in connection with the Contract.

For a related provisions, see Section 102.7.2 (C) of the Standard Specifications - "Effects of Signing and Delivery of Bids" - "Certifications", Section 3 of this Appendix A entitled "Other Federal Requirements" including section XI - "Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion" and section XII. - "Certification Regarding Use of Contract Funds for Lobbying."

B. ***Bid Rigging Hotline*** - To report bid rigging activities call: 1-800-424-9071.

The U.S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m., eastern time. Anyone with knowledge of possible bid rigging, Bidder collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

SECTION 2 - FEDERAL EEO AND CIVIL RIGHTS REQUIREMENTS

Unless expressly otherwise provided in the Bid Documents, the provisions contained in this Section 2 of this "Federal Contract Provisions Supplement" are hereby incorporated into the Bid Documents and Contract.

A. ***Nondiscrimination & Civil Rights - Title VI*** - The Contractor and its Subcontractors shall not discriminate on the basis of race, color, national origin, or sex in the performance of this Contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the Department deems appropriate. The Contractor and Subcontractors shall comply with Title VI of the

Civil Rights Act of 1964, as amended, and with all State of Maine and other Federal Civil Rights laws.

For related provisions, see Subsection B - "Nondiscrimination and Affirmative Action - Executive Order 11246" of this Section 2 and Section 3 - Other Federal Requirements of this "Federal Contract Provisions Supplement" including section II - "Nondiscrimination" of the "Required Contract Provisions, Federal Aid Construction Contracts", FHWA-1273.

- B. ***Nondiscrimination and Affirmative Action - Executive Order 11246*** - Pursuant to Executive Order 11246, which was issued by President Johnson in 1965 and amended in 1967 and 1978, this Contract provides as follows.

The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its efforts to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

Ensure and maintain a working environment free of harassment, intimidations, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction Project. The Contractor shall specifically ensure that all forepersons, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its union have employment opportunities available, and to maintain a record of the organization's responses.

Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.

Provide immediate written notification to the Department's Civil Rights Office when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Design-Builder's efforts to meet its obligations.

Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under B above.

Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligation; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring assignment, layoff, termination, or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Forepersons, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractor's and Subcontractors with whom the Contractor does or anticipates doing business.

Direct its recruitment efforts, both orally and written to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above describing the openings, screenings, procedures, and test to be used in the selection process.

Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth, both on the site and in other areas of a Contractor's workforce.

Validate all tests and other selection requirements.

Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

Ensure that all facilities and company activities are non segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

Document and maintain a record of all solicitations of offers for Subcontracts from minority and female construction Contractor's and suppliers, including circulation of solicitations to minority and female Contractor associations and other business associations.

Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

- C. ***Goals for Employment of Women and Minorities*** - Per Executive Order 11246, craft tradesperson goals are 6.9% women and 0.5% minorities employed. However, goals may be adjusted upward at the mutual agreement of the Contractor and the Department. Calculation of these percentages shall not include On-the-Job Training Program trainees, and shall not include clerical or field clerk position employees.

For a more complete presentation of requirements for such Goals, see the federally required document "Goals for Employment of Females and Minorities" set forth in the next 6 pages below.

Start of GOALS FOR EMPLOYMENT OF FEMALES AND MINORITIES Federally Required Contract Document

§60-4.2 Solicitations

- (d) The following notice shall be included in, and shall be part of, all solicitations for offers and bids on all Federal and federally assisted construction contracts or Subcontracts in excess of \$10,000 to be performed in geographical areas designated by the Director pursuant to §60-4.6 of this part (see 41 CFR 60-4.2(a)):

***Notice of Requirement for Affirmative Action to Ensure Equal Opportunity
(Executive Order 11246)***

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Goals for female participation in each trade: 6.9%

Goals for minority participation for each trade

Maine

- 001 Bangor, ME: 0.8%
 - Non-SMSA Counties: Aroostook, Hancock, Penobscot, Piscataquis, Waldo, Washington
- 002 Portland-Lewiston, ME
 - SMSA Counties: 4243 Lewiston-Auburn, ME: 0.5%
 - Androscoggin
- 6403 Portland, ME: 0.6%
 - Cumberland, Sagadahoc
- Non-SMSA Counties: 0.5%
 - Franklin, Kennebec, Knox, Lincoln, Oxford, Somerset, York

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non federally involved construction.

The contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its Projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from Project to Project for the sole purpose of meeting the Contractor's goals shall be in violation of the contract, the Executive Order and the

regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 Working Days of award of any construction Subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the Subcontractor, employer identification number of the Subcontractor, estimated dollar amount of the Subcontract; estimated started and completion dates of the Subcontract; and the geographical area in which the Subcontract is to be performed.
4. As used in this Notice, and in the Contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)

1. As used in these specifications:
 - a. **Covered area** - means the geographical area described in the solicitation from which this contract resulted;
 - b. **Director** - means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
 - c. **Employer identification number** - means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department form 941;
 - d. **Minority** - includes:
 - (i) **Black** - (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (ii) **Hispanic** - (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - (iii) **Asian and Pacific Islander** - (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - (iv) **American Indian or Alaskan Native** - (all persons having origins in any of the original peoples of the North America and maintaining

identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, Subcontracts a portion of the work involving any construction trade, it shall physically include in each Subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.
3. If the contractor, is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors for Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.
4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a. through p. of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical areas where the work is being performed. Goals are published periodically in the Federal Register in notice form and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specific.
5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant, thereto.

6. In order for the non working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.
7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as expensive as the following:
 - a. Ensure and maintain a working environment free of harassment, intimidation, coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, when possible, will assign two or more women to each construction Project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
 - b. Establish and maintain a current list of minority and female recruitment sources provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organization's responses.
 - c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment sources or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.
 - d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

- e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources complied under 7b above.
- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
- i. Direct its recruitment, efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing prior to the date for the acceptance of applications for apprenticeship or the openings, screening procedures, and tests to be used in the selection process.

- j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on site and in other areas of a Contractor's work force.
 - k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
 - l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
 - m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
 - n. Ensure that all facilities and company activities are non segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
 - o. Document and maintain a record of all solicitations of offers for Subcontracts from minority and female construction contractors and suppliers, including circulation of solicitation to minority and female contractor associations and other business associations.
 - p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7 a through p.). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7 a through p. of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program and reflected in the Contractor's minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions take on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, specific minority group of women is underutilized.)
10. The Contractor shall not use the goals and timetables or affirmative action even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if standards to discriminate against any person because of race, color, religion, sex, or national origin.
11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.
12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing Subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementation regulations by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.6.
14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g. mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and location at which the work was performed. Records be maintained in an easily understandable and retrievable form; however, to the degree that

existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

End of GOALS FOR EMPLOYMENT OF FEMALES AND MINORITIES

Federally Required Contract Document

- D. **Section 'D Disadvantaged Business Enterprise (DBE) Requirements'** is removed in its entirety. The DBE material is in: Section 105.10 - Equal Opportunity and Civil Rights.

SECTION 3 - OTHER FEDERAL REQUIREMENTS

Unless expressly otherwise provided in the Bid Documents, the provisions contained in this Section 3 of this "Federal Contract Provisions Supplement" are hereby incorporated into the Bid Documents and Contract.

- A. **Buy America** – Updated see Section 105.11.

- B. **Materials**

- a. **Convict Produced Materials References** - 23 U.S.C. 114(b)(2), 23 CFR 635.417

Applicability - FHWA's prohibition against the use of convict material only applies to Federal-aid highways. Materials produced after July 1, 1991, by convict labor may only be incorporated in a Federal-aid highway construction Project if: 1) such materials have been produced by convicts who are on parole, supervised release, or probation from a prison; or 2) such material has been produced in a qualified prison facility, e.g., prison industry, with the amount produced during any 12-month period, for use in Federal-aid Projects, not exceeding the amount produced, for such use, during the 12-month period ending July 1, 1987.

Materials obtained from prison facilities (e.g., prison industries) are subject to the same requirements for Federal-aid participation that are imposed upon materials acquired from other sources. Materials manufactured or produced by convict labor will be given no preferential treatment.

The preferred method of obtaining materials for a Project is through normal contracting procedures which require the contractor to furnish all materials to be incorporated in the work. The contractor selects the source, public or private, from which the materials are to be obtained (23 CFR 635.407). Prison industries are prohibited from bidding on Projects directly (23 CFR 635.112e), but may act as material supplier to construction contractors.

Prison materials may also be approved as State-furnished material. However, since public agencies may not bid in competition with private firms, direct acquisition of materials from a prison industry for use as State-furnished material is subject to a public interest finding with the Division Administrator's concurrence (23 CFR 635.407d). Selection of materials produced by convict labor as State-furnished materials for mandatory use should be cleared prior to the submittal of the Plans Specifications & Estimates (PS&E).

b. ***Convict Patented/Proprietary Products References*** - 23 U.S.C. 112, 23 CFR 635.411

FHWA will not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a Project, unless:

- the item is purchased or obtained through competitive bidding with equally suitable unpatented items,
- the STA certifies either that the proprietary or patented item is essential for synchronization with the existing highway facilities or that no equally suitable alternative exists, or
- the item is used for research or for a special type of construction on relatively short sections of road for experimental purposes. States should follow FHWA's procedures for "Construction Projects Incorporating Experimental Features" ([expermnt.htm](#)) for the submittal of work plans and evaluations.

The primary purpose of the policy is to have competition in selection of materials and allow for development of new materials and products. The policy further permits materials and products that are judged equal may be bid under generic specifications. If only patented or proprietary products are acceptable, they shall be bid as alternatives with all, or at least a reasonable number of, acceptable materials or products listed; and the Division Administrator may approve a single source if it can be found that its utilization is in the public interest.

Trade names are generally the key to identifying patented or proprietary materials. Trade name examples include 3M, Corten, etc. Generally, products identified by their brand or trade name are not to be specified without an "or equal" phrase, and, if trade names are used, all, or at least a reasonable number of acceptable "equal" materials or products should be listed. The licensing of several suppliers to produce a product does not change the fact that it is a single product and should not be specified to the exclusion of other equally suitable products.

c. **State Preference References** - 23 U.S.C. 112, 23 CFR 635.409

Materials produced within Maine shall not be favored to the exclusion of comparable materials produced outside of Maine. State preference clauses give particular advantage to the designated source and thus restrict competition. Therefore, State preference provisions shall not be used on any Federal-aid construction Projects.

This policy also applies to State preference actions against materials of foreign origin, except as otherwise permitted by Federal law. Thus, States cannot give preference to in-State material sources over foreign material sources. Under the Buy America provisions, the States are permitted to expand the Buy America restrictions provided that the STA is legally authorized under State law to impose more stringent requirements.

d. **State Owned/Furnished/Designated Materials References** - 23 U.S.C. 112, 23 CFR 635.407

Current FHWA policy requires that the contractor must furnish all materials to be incorporated in the work, and the contractor shall be permitted to select the sources from which the materials are to be obtained. Exceptions to this requirement may be made when there is a definite finding, by MaineDOT and concurred in by Federal Highway Administration's (FHWA) Division Administrator, that it is in the public interest to require the contractor to use materials furnished by the MaineDOT or from sources designated by MaineDOT. The exception policy can best be understood by separating State-furnished materials into the categories of manufactured materials and local natural materials.

Manufactured Materials - When the use of State-furnished manufactured materials is approved based on a public interest finding, such use must be made mandatory. The optional use of State-furnished manufactured materials is in violation of our policy prohibiting public agencies from competing with private firms. Manufactured materials to be furnished by MaineDOT must be acquired through competitive bidding, unless there is a public

interest finding for another method, and concurred in by FHWA's Division Administrator.

Local Natural Materials - When MaineDOT owns or controls a local natural materials source such as a borrow pit or a stockpile of salvaged pavement material, etc., the materials may be designated for either optional or mandatory use; however, mandatory use will require a public interest finding (PIF) and FHWA's Division Administrator's concurrence.

In order to permit prospective Bidders to properly prepare their bids, the location, cost, and any conditions to be met for obtaining materials that are made available to the contractor shall be stated in the bidding documents.

Mandatory Disposal Sites - Normally, the disposal site for surplus excavated materials is to be of the contractor's choosing; although, an optional site(s) may be shown in the contract provisions. A mandatory site shall be specified when there is a finding by MaineDOT, with the concurrence of the Division Administrator, that such placement is the most economical or that the environment would be substantially enhanced without excessive cost. Discussion of the mandatory use of a disposal site in the environmental document may serve as the basis for the public interest finding.

Summarizing FHWA policy for the mandatory use of borrow or disposal sites:

- mandatory use of either requires a public interest finding and FHWA's Division Administrator's concurrence,
- mandatory use of either may be based on environmental consideration where the environment will be substantially enhanced without excessive additional cost, and
- where the use is based on environmental considerations, the discussion in the environmental document may be used as the basis for the public interest finding.

Factors to justify a public interest finding should include such items as cost effectiveness, system integrity, and local shortages of material.

- C. **Standard FHWA Contract Provisions - FHWA 1273** - Unless expressly otherwise provided in the Bid Documents, the following "Required Contract Provisions, Federal Aid Construction Contracts", FHWA-1273, are hereby incorporated into the Bid Documents and Contract.

CARGO PREFERENCE ACT

Contractor and Subcontractor Clauses - “Use of United States-flag vessels: The contractor agrees—“(1) To utilize privately owned United States-flag commercial vessels to ship at least 50% of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.”(2) To furnish within 20 Days following the date of loading for shipments originating within the United States or within 30 Working Days following the date of loading for shipments originating outside the United States, a legible copy of a rated, “on-board” commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (1) of this section to both the Contracting Officer (through the prime contractor in the case of Subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.”(3) To insert the substance of the provisions of this clause in all Subcontracts issued pursuant to this contract.”(Reorganization Plans No. 21 of 1950 (64 Stat. 1273) and No. 7 of 1961 (75 Stat. 840) as amended by Pub. L. 91-469 (84 Stat. 1036) and Department of Commerce Organization Order 10-8 (38 FR 19707, July 23, 1973)) [42 FR 57126, Nov. 1, 1977]

The Cargo Preference Act requirements apply to materials or equipment that are acquired for a specific Federal-aid highway Project. In general, the requirements are not applicable to goods or materials that come into inventories independent of an FHWA funded-contract. For example, the requirements would not apply to shipments of Portland Cement, asphalt cement, or aggregates, as industry suppliers and contractors use these materials to replenish existing inventories. In general, most of the materials used for highway construction originate from existing inventories and are not acquired solely for a specific Federal-aid Project. However, if materials or equipment are acquired solely for a Federal-aid Project, then the Cargo Preference Act requirements apply.”

Start of FHWA 1273 REQUIRED CONTRACT PROVISIONS

FEDERAL-AID CONSTRUCTION CONTRACTS (As revised through October 23, 2023)

FHWA-1273 – Revised October 23, 2023 REQUIRED CONTRACT PROVISIONS

FEDERAL-AID CONSTRUCTION CONTRACTS

I. General	Subcontractor) must insert this form in
II. Nondiscrimination	each Subcontract and further require its
III. Non-segregated Facilities	inclusion in all lower tier Subcontracts
IV. Davis-Bacon and Related Act Provisions	(excluding purchase orders, rental
V. Contract Work Hours and Safety Standards Act Provisions	agreements and other agreements for
VI. Subletting or Assigning the Contract	supplies or services). 23 CFR 633.102(e).
VII. Safety: Accident Prevention	The applicable requirements of Form
VIII. False Statements Concerning Highway Projects	FHWA-1273 are incorporated by reference
IX. Implementation of Clean Air Act and Federal Water Pollution Control Act	for work done under any purchase order,
X. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion	rental agreement or agreement for other
XI. Certification Regarding Use of Contract Funds for Lobbying	services. The prime contractor shall be
XII. Use of United States-Flag Vessels:	responsible for compliance by any
	Subcontractor, lower-tier Subcontractor or
	service provider. 23 CFR 633.102(e).
	Form FHWA-1273 must be included in all
	Federal-aid design build contracts, in all
	Subcontracts and in lower tier
	Subcontracts (excluding Subcontracts for
	design services, purchase orders, rental
	agreements and other agreements for
	supplies or services) in accordance with 23
	CFR 633.102. The design-builder shall be
	responsible for compliance by any
	Subcontractor, lower-tier Subcontractor or
	service provider.
	Contracting agencies may reference Form
	FHWA-1273 in solicitation-for-bids or
	request-for-proposals documents,
	however, the Form FHWA-1273 must be
	physically incorporated (not referenced) in
	all contracts, Subcontracts and lower-tier
	Subcontracts (excluding purchase orders,
	rental agreements and other agreements

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or

Subcontractor) must insert this form in each Subcontract and further require its inclusion in all lower tier Subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any Subcontractor, lower-tier Subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design build contracts, in all Subcontracts and in lower tier Subcontracts (excluding Subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any Subcontractor, lower-tier Subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, Subcontracts and lower-tier Subcontracts (excluding purchase orders, rental agreements and other agreements

for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by Subcontract. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction Project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction Subcontracts of \$10,000 or more. The

provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all Subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all Subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 601.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (see 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140, shall constitute the EEO and specific affirmative action standards for the contractor's Project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, sexual orientation, gender identity, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or

termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action or are substantially involved in such action, will be made fully cognizant of and will implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the Project will be

instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the Project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of Project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of Project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time.

If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs (i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of

such unions to increase opportunities for minorities and women. 23 CFR 230.409. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability.

b. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability; making full efforts to

obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities:

The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:

The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of Subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential Subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure Subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or Subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

Withholding monthly progress payments;

(1) Assessing sanctions;

(2) Liquidated damages; and/or

(3) Disqualifying the contractor from future bidding as nonresponsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized

representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and nonminority group members and women employed in each work classification on the Project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and Subcontractors will submit an annual report to the contracting agency each July for the duration of the Project indicating the number of minority, women, and nonminority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#). The staffing data should represent the Project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction Subcontracts of more than \$10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction Projects exceeding \$2,000 and to all related Subcontracts and lower-tier Subcontracts (regardless of Subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all Projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that Projects be treated as a Project on a Federal-aid highway, the provisions of this subpart will

apply regardless of the location of the Project. Examples include: Surface Transportation Block Grant Program Projects funded under 23 U.S.C. 133 [excluding recreational trails Projects], the Nationally Significant Freight and Highway Projects funded under 23 U.S.C. 117, and National Highway Freight Program Projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. **Wage rates and fringe benefits.** All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the Project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act ([29 CFR part 3](#))), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or

costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act ([40 U.S.C. 3141\(2\)\(B\)](#)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH-1321) must be posted at all times by the contractor and its Subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. Frequently recurring classifications.

(1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in [29 CFR part 1](#), a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly

submitted pursuant to paragraph 1.c. of this section, provided that:

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. **Conformance.** (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a

reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to

DBAconformance@dol.gov. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to DBAconformance@dol.gov, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. **Fringe benefits** not expressed as an hourly rate. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. **Unfunded plans.** If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

f. **Interest.** In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to

pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. **Withholding requirements.** The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any Subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and after written notice to the contractor, take such action as may be necessary to cause the suspension of any

further payment, advance, or guarantee of funds until such violations have ceased.

b. **Priority to withheld funds.** The Department has priority to funds withheld or to be withheld in accordance with paragraph 2.a. of this section or Section V, paragraph 3.a., or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its procurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, [31 U.S.C. 3901–3907](#).

3. Records and certified payrolls (29 CFR 5.5)

a. **Basic record requirements (1) Length of record retention.** All regular payrolls and other basic records must be maintained by the contractor and any Subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the Project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) **Information required.** Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such

worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in [40 U.S.C. 3141\(2\)\(B\)](#) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) **Additional records relating to fringe benefits.** Whenever the Secretary of Labor has found under paragraph 1.e. of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in [40 U.S.C. 3141\(2\)\(B\)](#) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) **Additional records relating to apprenticeship.** Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. **Certified payroll requirements (1) Frequency and method of submission.** The contractor or Subcontractor must submit weekly, for each week in which any DBA- or Related Acts covered work is performed, certified payrolls to the

contracting agency. The prime contractor is responsible for the submission of all certified payrolls by all Subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) **Information required.** The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (e.g., the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH-347 or in any other format desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division website at https://www.dol.gov/sites/dolgov/files/WH_D/legacy/files/wh347/.pdf or its successor website. It is not a violation of this section for a prime contractor to require a Subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email

addresses to the prime contractor for its own records, without weekly submission by the Subcontractor to the contracting agency.

(3) **Statement of Compliance.** Each certified payroll submitted must be accompanied by a “Statement of Compliance,” signed by the contractor or Subcontractor, or the contractor's or Subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in [29 CFR part 3](#); and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) **Use of Optional Form WH-347.** The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 will satisfy the

requirement for submission of the “Statement of Compliance” required by paragraph 3.b.(3) of this section.

(5) **Signature.** The signature by the contractor, Subcontractor, or the contractor's or Subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) **Falsification.** The falsification of any of the above certifications may subject the contractor or Subcontractor to civil or criminal prosecution under [18 U.S.C. 1001](#) and [31 U.S.C. 3729](#).

(7) **Length of certified payroll retention.** The contractor or Subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. **Contracts, Subcontracts, and related documents.** The contractor or Subcontractor must maintain this contract or Subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or Subcontractor must preserve these contracts, Subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. **Required disclosures and access (1) Required record disclosures and access to workers.** The contractor or Subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the

applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) **Sanctions for non-compliance with records and worker access requirements.** If the contractor or Subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under [29 CFR part 6](#) any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other

things, the location of the records and the volume of production.

(3) *Required information disclosures.*

Contractors and Subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices (1) Rate of pay.*

Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits.* Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio.* The allowable ratio of apprentices to journey workers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the Project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(3) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a Project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journey worker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no

applicable ratio or wage rate for the locality of the Project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. **Equal employment opportunity.** The use of apprentices and journey workers under this part must be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and [29 CFR part 30.](#)

c. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journey workers shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or Subcontractor must insert FHWA-1273 in any Subcontracts, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the Subcontractors to include these clauses and wage determination(s) in any lower tier Subcontracts. The prime

contractor is responsible for the compliance by any Subcontractor or lower tier Subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any Subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier Subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a Subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its Subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it nor any

person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of [40 U.S.C. 3144\(b\)](#) or § 5.12(a).

b. No part of this contract shall be Subcontracted to any person or firm ineligible for award of a Government contract by virtue of [40 U.S.C. 3144\(b\)](#) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, [18 U.S.C. 1001](#).

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or [29 CFR part 1 or 3](#);

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or [29 CFR part 1 or 3](#);

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or [29 CFR part 1 or 3](#); or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or [29 CFR part 1 or 3](#).

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or Subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any Subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and Subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages.

Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* \$31 as of January 15, 2023 (See 88 FR 88 FR 2210) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. **Withholding process.** The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any Subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime

contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. **Priority to withheld funds.** The Department has priority to funds withheld or to be withheld in accordance with Section IV paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its procurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, [31 U.S.C. 3901–3907](#).

4. **Subcontracts.** The contractor or Subcontractor must insert in any Subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the Subcontractors to include these clauses in any lower tier Subcontracts. The prime contractor is responsible for compliance by any Subcontractor or lower tier Subcontractor with the clauses set forth in paragraphs 1. through 5. In the event of any violations of these clauses, the prime contractor and any Subcontractor(s) responsible will be

liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower tier Subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. *Anti-retaliation.* It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30% (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by Subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” in paragraph 1 of Section VI refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a Subcontractor or lower tier Subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the Project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the

contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each Subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on longstanding interpretation of 23 CFR 635.116).

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related Subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each Subcontract, which the contractor enters into pursuant to this contract, that the contractor and any Subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or

under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related Subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal aid highway Projects, it is essential that all persons concerned with the Project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the Project is a violation of Federal law. To prevent any misunderstanding regarding the

seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway Project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the Project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related Project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related Project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of \$150,000 and to all related Subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or Subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, Subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every Subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, Subcontracts, lower-tier Subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts

180 and 1200. 2 CFR 180.220 and 1200.220.

1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when

submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. "First Tier Covered Transactions" refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as Subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as Subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered

Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (<https://www.sam.gov/>). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or

voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

* * * * *

3. Instructions for Certification - Lower Tier Participants:

(Applicable to all Subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which

reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as Subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as Subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (<https://www.sam.gov/>), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

* * * * *

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order

4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBY

This provision is applicable to all Federal-aid construction contracts and to all related Subcontracts which exceed \$100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension,

continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier Subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, Subcontracts, lower-tier Subcontracts, purchase orders, lease

agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway Project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction Project, the bidder, proposer, contractor, Subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50% of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of Subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive

information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B)

This provision is applicable to all Federal-aid Projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

- a. To the extent that qualified persons regularly residing in the area are not available.
- b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.
- c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20% of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within 1 week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent Project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every Subcontract for work which is, or reasonably may be, done as on-site work.

End of FHWA 1273

DIVISION 200 - EARTHWORK

SECTION 201 - CLEARING RIGHT-OF-WAY

201.01 **Description** - This work shall consist of clear cutting, selective clearing and thinning, tree trimming, removing single trees, including dead, blown down or uprooted trees, removing and disposing of all stumps and debris within the limits of the right-of-way and easement areas except such objects as are designated to remain or are to be removed in accordance with other sections of these specifications. This work shall also include the preservation from injury to or defacement of all vegetation and objects designated to remain and the treatment of stumps with herbicides.

- a. Clearing shall consist of cutting and disposing of all trees, down timber, brush, bushes, and debris within designated limits.
- b. Tree trimming shall consist of removing any designated branches and other tree portions for preservation purposes.
- c. Selective Clearing and Thinning shall consist of cutting and disposing of designated trees, down timber, stubs, brush, bushes, and debris within designated limits. This work also includes application of approved herbicides on hardwood stumps.
- d. Removing trees shall consist of cutting and disposing of single trees, stumps and roots, located outside the limits of clearing or selective clearing and thinning limits, as indicated on the plans or as authorized.
 1. A single tree is defined as any tree or remains of a tree, still standing, 12" or more in its average diameter measured, as specified in Subsection 201.09 - Method of Measurement, and taller than 5 ft measured from the ground at the base of the tree.
 2. A stump is defined as the remains of a single tree 12" or more at its average diameter from which the toppings have been removed and which is less than 5 ft in height measured from the ground at the base of the stump.

201.02 **Materials** - Materials shall conform to the requirements specified in the following Subsection of Section 717.07 – Herbicide.

201.03 **General** - The Resident will verify clearing and selective clearing limit lines and designated items that are to be preserved and to remain.

Unsound or unsightly branches of trees and shrubs, designated to remain and not specified to be removed under another item, shall be removed as directed. Branches of trees extending over the roadbed shall be trimmed to provide a clear height of 20 ft above the road and shoulder surface. Trimming shall be done by skilled workers and in accordance with good tree surgery practices.

Alignment stakes, grade stakes, witness stakes, boundary markers, bench marks and tie points shall be preserved until permission is given for their destruction.

- 201.04 **Clearing** - In areas indicated on the plans, all trees, down timber, brush, bushes, shrubs, plants and debris not designated to remain shall be removed and disposed of.

In areas where the proposed embankment is not designated to be grubbed, as provided in Subsection 203.09 - Preparation of the Embankment Area, all stumps shall be cut off as close to the ground as is practicable. When stumps are to remain in the backslope rounding of cut sections, they shall be cut flush with the final slope line.

All wood in the clearing area, except trees designated to remain, shall become the property of the Contractor, unless otherwise provided.

The Contractor shall take special care to completely dispose of all elm trees removed.

All live hardwood stumps, 1" or more in diameter located between the lines of improvement and the outermost clearing or selective clearing lines shall be treated with an approved herbicides, unless specifically exempted.

In areas where stumps and shrubs are to remain, the surface of the ground shall not be unduly disturbed or compacted. Existing ground cover shall be preserved insofar as possible and the area shall be left neat and clean and in a condition that is reasonably consistent with the surroundings.

- 201.05 **Selective Clearing and Thinning** - In order that trees may be properly marked, the Contractor shall give the Resident at least 2 weeks notice before starting work. Only those trees or bushes designated to be removed shall be cut. In no event shall selective clearing and thinning operations begin until approval is given.

All dead or diseased trees or shrubs, junk, trash, litter or foreign matter of any kind shall be removed from the areas to be enhanced. This shall include uprooted stumps and all branches, tops, trunks and dead wood, resulting from woodcutting operations or from any other causes.

Trees and shrubs to be preserved shall be carefully pruned to remove all dead, diseased and injured wood. In addition, in certain areas, the Resident may require the branches of designated trees to be removed to a height above ground as directed. Complete clearing may be required in certain areas. Such clearing shall be included under this Subsection. Storing logs and pulpwood in thinned areas shall be avoided.

The Contractor shall avoid disturbing or compacting the existing ground surfaces as well as avoiding damage to plant growth. The use of heavy equipment, operating anywhere within the area to be selectively thinned, will not be allowed unless authorized.

Any injury to trees and shrubs that are to be preserved shall be carefully repaired. Disturbed ground surface shall be restored as nearly as possible to natural conditions.

Pruning and repairs to live trees and shrubs shall be done by skilled workers or tree surgeons according to approved arboricultural practice. All stumps, new or old, shall be cut off as close to the ground as is practicable.

Trees falling outside the specified limits of the thinning areas shall be removed and disposed of in a satisfactory manner. Undesirable trees leaning or falling over the highway right-of-way from outside shall be cut at the property line.

- 201.06 **Herbicides** - All herbicides shall be approved by the Department of Transportation Landscape Architect. The herbicides shall be applied by Certified Pesticide Applicators in accordance with State Pesticides Control Board Regulations. With the exception of coniferous (softwood) trees, stumps over 1" in diameter resulting from cutting live hardwood trees and shrubs shall be treated with approved herbicide spray mixture. The spray mixture may be applied at any time until regrowth from the stumps has reached a height of approximately 24" except that it shall not be applied when the stumps are wet or frozen. The herbicide spray mixture shall be sprayed on all exposed surfaces of stumps and the stems of regrowth, until there is complete saturation and run-off. Particular attention to coverage shall be given to the bark and all exposed roots.

All stumps shall receive at least one treatment with the herbicide spray mixture. At the time of final acceptance, live regrowth of hardwood tree seedlings shall have been substantially eliminated. Any remaining regrowth will require another treatment before final acceptance.

Particular care must be taken that the herbicide mix does not come in contact with or too near live trees and shrubs that are to be preserved. Unless otherwise directed the spray mixture shall not be applied closer than 2 ft from the trunk of a tree that is to remain.

When directed, live stumps in specified areas shall be exempted from spraying with herbicides.

The Contractor shall be responsible for maintaining the treated area until final acceptance of the work. All damage or dieback shall be repaired at the Contractor's expense as directed. At the time of final acceptance the area shall be free of all dead, dying or damaged trees and shrubs and litter of any kind as well as free from regrowth.

- 201.07 **Disposal** - All brush, timber, logs and other woody debris shall be disposed of by approved methods. The Contractor shall make every effort to provide useful disposition of woody material that may be marketable. If the Contractor can demonstrate that a reasonably suitable market for the material is not available, other disposal methods may be approved.

Acceptable methods of disposal may include chipping, grinding, and burying. Burning will not be allowed.

- a. **Chipping** - Wood chippers shall reduce woody material to chips, not over ¼" thick by not over 8" long, and the chips shall be spread uniformly over the ground or as directed.
- b. **Burying** - Brush and logs may be disposed of by burying in approved waste dumps or by placing in the portion of the embankments outside a slope 1½ horizontal to 1 vertical extending from the edge of the shoulder to the existing ground and covering with a minimum of 2 ft of earth. Excavation or borrow used to cover the brush and logs in the slopes may be placed in layers at least 2 ft thick and compacted only to the extent that the stability of the slope is assured. For a related provision, see Department of Environmental Protection Code of Maine Regulations 401 Section 7.
- c. **Burning** - Burning is not allowed.

201.08 **Removing Single Trees and Stumps** - When called for on the plans or otherwise designated, complete removal and disposal of single trees and stumps shall be required and shall include the backfilling of stump holes.

Trees, which have been uprooted, shall be removed by cutting the tree and removing the stump from the ground or, where approved, the stumps may be placed back in the hole to present a natural appearance. The area shall be graded to conform to the surrounding terrain.

201.09 **Method of Measurement** - Clearing and selective clearing and thinning will be measured by the acre, determined from horizontal dimensions, acceptably and actually cleared or thinned within the limits shown on the plans or additional areas flagged by the Resident. Areas not shown on the plans or not flagged for clearing or thinning will not be measured for payment.

As an alternative to field measurements, the Contractor and the Resident may agree in writing that the acreage acceptably cleared for payment will be that shown in the Schedule of Items. If such an agreement is reached, no further measuring and computing of quantities will be required and the quantity referred to herein will be final.

Single trees and stumps will be measured by each unit. The size of the tree shall be the average diameter determined by circumferential measurement at a height of 4½ ft above the ground. When trees are removed under this Contract and the removal of the stump is required, the stump size shall be the same size as that determined for the tree. The size of all other stumps shall be the greatest horizontal cross sectional dimension determined at the top of the stump. Trees or stumps, which have multiple trunks protruding from a single base trunk, shall be measured for payment as a single tree or stump.

Individual trunks of multiple trunk trees or stumps having a diameter of less than 12" will not be included to determine the size of a tree or stump.

201.10 **Basis of Payment** - The accepted quantities of clearing, selective clearing and thinning will be paid for at the Contract unit price per acre.

The accepted quantity of single trees and stumps removed will be paid for at the Contract unit price each. Payment for trees shall include removal and disposal of the entire tree except stumps.

All stumps, as defined in Subsection 201.01 d.2 and designated to be removed, will be paid for at the Contract unit price each. Payment shall include removal and disposal of the stumps and roots.

When the Schedule of Items does not contain an estimated quantity for clearing, and it is not noted on the plans as incidental, the work, when authorized, will be paid for under the provisions of Section 109.3 - Extra Work.

When the use of herbicide or tree paint is required to complete the work included under this section, it will not be paid for directly, but will be considered as included in the other Contract Pay Items.

Grubbing, when required, will be measured and paid for as provided in Section 203 - Excavation and Embankment.

Payment for removal of trees and stumps, not defined as Contract Pay Items under Section 201.01d, shall be considered incidental to the Contract and no separate payment will be made.

Removal of unsound and unsightly branches and trimming branches of trees, as specified in Subsection 201.03 - General, will be paid for under the provisions of Sections 109.03 - Extra Work or 631 - Equipment Rental.

Payment will be made under:

Pay Item		Pay Unit
201.11	Clearing	Acre
201.12	Selective Clearing and Thinning	Acre
201.23	Removing Single Tree Top Only	Each

SECTION 202 - REMOVING STRUCTURES AND OBSTRUCTIONS

202.01 **Description** - This work shall consist of removing wholly or in part, and satisfactory disposing of all designated buildings, structures, bituminous pavement, concrete pavement, manholes, catch basins, and other obstructions which are required to be removed, except for the obstructions to be removed and disposed of under other Contract items. It shall also include salvaging designated materials.

202.02 **Removing Buildings** - The Contractor shall remove and dispose of all buildings and foundations indicated in the Contract Documents.

Cavities remaining as a result of foundation or Structure removal shall be filled to the level of the surrounding ground and, if within the limits of embankment or below the subgrade in excavation areas, shall be compacted in accordance with applicable embankment construction requirements.

Details of the ownership of the buildings and all the equipment, fixtures and materials therein, except equipment belonging to a Utility or equipment or fixtures specifically excepted and details relative to the date of availability of the property, will be stated elsewhere in the Contract Documents.

Written notice will be given the Contractor when any building becomes available before the date specified in the Contract Documents. On the above-specified date, or upon notice of availability, ownership of the buildings shall transfer from the State to the Contractor who then shall proceed with the work required under this section. The buildings shall not be used or occupied for any purpose while in the right-of-way and the buildings shall be removed as soon as possible after the date available, unless otherwise allowed.

All debris and unusable materials shall be removed to an approved dump or waste area and buried or removed to an approved landfill. No material shall be disposed of by burning. For a related provision, see Department of Environmental Protection Maine Solid Waste Management Rules, 06-096 CMR Ch. 401, Landfill Siting, Design and Operation.

202.03 ***Removing Existing Superstructure, Structural Concrete, Curbs, Sidewalks, Railings, and Bridges*** - Removing existing superstructures shall consist of removing and disposing of existing superstructure including fill, pavement, railing, and all other material on or over the superstructure unless otherwise specified. Removing existing structural concrete shall be to the limits designated in the Contract Documents and shall be accomplished without damage to the portion of the Structure to remain.

Removing existing bridge shall be to the limits shown in the Contract Documents.

Existing concrete curbs, granite curbs, and concrete sidewalks shall be removed to the limits shown in the Contract Documents using equipment such as chipping hammers or pavement breakers of a size approved by the Resident or any other method approved by the Resident which will not damage the structural integrity of the concrete deck to remain.

Before removal of existing concrete curbs or sidewalks as indicated in the Contract Documents, the fascia removal line, shall be saw cut to a depth of 1" minimum. Care shall be taken not to damage any reinforcing steel that is to remain in the Structure.

When any materials from an existing Structure are to be retained by the Department, the Contractor shall carefully dismantle them, and all materials, except those that may be specified to be reused in the new Structure, shall be loaded on trucks supplied Contractor, transported to the MaineDOT facility

identified elsewhere in the Contract Documents, or as directed by the Resident, and unloaded by the Department, unless otherwise specified in the Contract Documents. The use of any portion of the salvaged material in connection with new or temporary construction shall not be anticipated by the Contractor. The dismantling of metal Structures or railings shall, when explicitly provided, include the removal of all bolts and fasteners necessary to disconnect the members and the matchmarking of these members for future reassembling.

When the material from an existing Structure are designated to become the property of the Contractor, they shall be entirely removed and disposed of out of sight of the highway and beyond the limits of the right-of-way. Such materials shall not be deposited in rivers, streams, or other bodies of water. If the material is to be wasted then it shall be disposed of at an approved location.

When practical, any suitable material removed shall be used in backfilling or for the formation of embankments and no additional allowances for payment will be made. Unsuitable or surplus material shall be disposed of in an approved waste area.

Blasting or other operations necessary for the removal of an existing Structure or obstruction, which might damage new construction, shall be completed before installing the new work. If this is not feasible, the work shall be done only when approved and entirely at the Contractor's risk.

If damage to the structure to remain occurs, repair structural steel in accordance with Section 504.55 - Field Welding and Repairs.

202.031 ***Removing Existing Bituminous Pavement and Concrete Wearing Surface from Bridges*** - The full depth of existing bituminous pavement, or concrete wearing surface shall be removed from curb to curb for the entire length of the bridge. Membrane waterproofing, if present, shall also be removed in a manner approved by the Resident.

Extreme care shall be taken to avoid damaging the top of the concrete deck to remain. All existing deck concrete that is not otherwise specified to be removed or repaired, that is damaged by the Contractor, shall be repaired at the expense of the Contractor.

When repair of the top of the deck is called for in the Contract Documents, the work shall be done in accordance with Standard Specification Section 518 - Structural Concrete Repair.

202.32 ***Removing Concrete Pavement*** - All concrete pavement and concrete base course designated for removal shall be broken into pieces suitable for use in construction of embankment or disposed of as directed by the Resident. When used in construction of embankments, the maximum size of any fragment shall not exceed the thickness of the layer being placed. The Contractor may, at their option and with approval of the Resident, dispose of material in approved waste areas

and replace with an equivalent volume of granular borrow at no cost to the Department.

202.04 **Removing Manholes or Catch Basins** - Where the manhole or catch basin is under a Roadway or embankment, the sides shall be removed to a depth of at least 2 ft below subgrade. When the Contract Documents do not provide for the complete removal of pipe(s) connecting to the catch basin or manhole, said pipe:

- (1) if to be connected to new pipe, shall not be disturbed, or
- (2) if no connection is called for, the pipe shall be tightly plugged with mortared masonry.

Floors of the Structures shall be broken up or removed to permit drainage. The open cavity shall be filled with earth and thoroughly compacted.

202.05 **Removing Bituminous Pavement** - This work involves removing bituminous pavement from Roadways, down to gravel. The equipment for removing the bituminous pavement shall be capable of removing and loading the bituminous pavement without including any gravel, except that adhering to the pavement. The remaining gravel shall be graded to drain as approved by the Resident.

202.051 **Removing Pavement Surface** - The equipment for removing the bituminous surface shall be a power operated milling machine or grinder capable of removing bituminous concrete pavement to the required depth, transverse cross slope, and profile grade using an automated grade and slope control system. The controls shall automatically increase or decrease the pavement removal depth as required, and readily maintain desired cross slope, to compensate for surface irregularities in the existing pavement course. The equipment shall be capable of accurately establishing profile grades by referencing from a fixed reference such as a 30 ft minimum contact ski (floating beam), 24 ft non-contact ski (floating beam) with 3 or more sensors; or 3 non-contact sensors directly affixed at the fore, mid, and aft points of the milling machine. Systems designed to incorporate a contact sensor located at the mid-point of the milling machine in lieu of the non-contact sensor will be permitted. Grade control sensors shall all be located on the same side. A single sensor, contact or otherwise, shall not be permitted unless otherwise approved by the Department.

The rotary drum shall be a minimum of 7 ft in width and utilize carbide tip tools at a minimum triple wrap configuration. The difference in height from the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed $\frac{1}{4}$ ". The forward speed of the milling machine shall be adjusted to produce a milled surface meeting the groove spacing, groove depth, and surface tolerance requirements of this specification. The tools on the revolving cutting drum must be

continually maintained and shall be replaced as warranted to provide a uniform pavement texture. The Department may evaluate the texture of the milled surface for information purposes by performing the Sand Patch test according to ASTM E965.

The Contractor shall locate and remove all objects in the pavement through the work area that would be detrimental to the milling or grinding machine. Any structures or obstructions left within the travel lane or shoulders shall have tapers installed according to Standard Detail 202(01). The finished milled surface will be inspected before being accepted, and any deviations in the profile exceeding ½ inch under a 16 ft string line or straightedge placed parallel to the centerline will be corrected. Any deviations in the cross-slope that exceed ⅜" under a 10 ft string line or straightedge placed transversely to centerline will be corrected. All corrections will be made with approved methods and materials. Any areas that require corrective measures will be subject to the same acceptance tolerances. Excess material that becomes bonded to the milled surface will be removed to the satisfaction of the Resident before the area is accepted.

On roadways with adjoining lanes carrying traffic, the Contractor shall remove the pavement surface in each lane per the conditions in Table 1, unless otherwise noted in Special Provisions.

TABLE 1: MILLING CONDITIONS FOR ADJOINING LANES

Depth (At Centerline)	Milling Conditions
Vertical Longitudinal Joint	
2" and less	The Contractor may remove the pavement on a single travel lane width for each production Day and will be required to mill the adjacent section of travel lane before the end of the following Calendar Day.
Greater than 2"	The Contractor shall remove the pavement over the full width of the traveled way section being paved that Day.
12:1 Tapered Centerline Joint	
1½" to 2"	The Contractor may remove the pavement on a single travel lane width for each production Day and will be required to mill the adjacent section of travel lane before weekend or holiday suspension. A maximum unmatched centerline joint length of 0.5 miles will be permitted over the weekend.
Greater than 2"	The Contractor shall remove the pavement on a single travel lane width for each production Day and will be required to mill the adjacent section of travel lane before the end of the following Calendar Day.

The Contractor will be required to remove the pavement over the full width of the mainline traveled way, regardless of highway type, cut depth, or longitudinal joint type prior to Memorial Day, July 4th, Labor Day, suspensions exceeding 3 Days, or other dates as specified by Special Provision.

The Contractor will also be responsible for installing additional warning signage that clearly defines the centerline elevation differential hazard. Unless otherwise addressed in the Contract, the Contractor shall install additional centerline delineation such as a double RPM application, or temporary painted line. The Traffic Control Plan shall be amended to include this option and the additional requirements. All signs and traffic control devices will conform to Section 719.01, and Section 652, and will be installed prior to the work, at a maximum spacing of 0.50 mile for the entire length of effected roadway section. If this option is utilized, all additional signing, labor, traffic control devices, or incidentals will not be paid for directly, will be considered incidental to the appropriate 652 items.

On roadways with immediately adjacent shoulders, the Contractor shall remove the pavement surface in each lane per the conditions in Table 2, unless otherwise noted in Special Provisions.

TABLE 2: MILLING CONDITIONS FOR THE EDGE OF TRAVELED WAY

Depth (At Edge of Traveled Way)	Conditions
2" and less	The Contractor may leave a vertical edge joint exposed for up to 21 Days after milling is performed. The Contractor shall treat vertical edge joints exposed beyond 21 Days per the criteria below.
Greater than 2"	The Contractor shall treat vertical edge joints exposed per the criteria below.

When required by Table 2, the Contractor shall treat vertical edge joints through one of the options below:

1. The vertical edge shall be tapered to a zero edge by means of milling a 12:1 transition from the edge of traveled way onto the shoulder before opening the lane to traffic. Tapers shall be removed to form a vertical edge prior to the placement of the new pavement course. No additional payment will be made for tapers, or taper removal.
2. An additional 2 ft of pavement shall be removed from the shoulder to eliminate the vertical edge at the edge of travel way before opening the lane to traffic. Unless otherwise

authorized by the Department, no additional payment will be made for the additional milling.

3. A pavement layer shall be placed to reduce the vertical edge to 1" or less before opening the lane to traffic.

As a minimum, the use of temporary painted line, or RPMs placed along the edge of traveled way at 200 ft intervals is required for all elevation differentials. When pavement milling is extended into the shoulder (including milled tapers), appropriate channelization devices shall be placed 2 ft outside the edge of the vertical face at intervals not exceeding 600 ft, and RPMs shall be placed on the remaining pavement surface along the vertical edge at 200 ft intervals. Uneven pavement signs shall be placed at a maximum spacing of ½ mile when any pavement milling operations leaves an exposed uneven pavement surface.

Weepers shall be ground across the full width sections adjacent shoulders or remaining pavement surface matching the milled travel way or shoulder milled depth to minimize water ponding in any lanes carrying traffic. Weepers shall typically be 18-24" in width, installed along each lane, at a frequency of approximately one per half mile at locations as directed by the Resident or in areas that will provide drainage for the milled areas. Installation of weepers will not be paid for directly but will be considered incidental to the pavement removal item. The replacement of mix in the weeper locations shall be performed concurrently within the pavement placement operation closure using the appropriate HMA item produced for the Contract or a MaineDOT approved 9.5mm HMA. There will be no separate payment for repaving the weeper locations as they are considered incidental to the square yard price of the pavement removal item.

The milled surface shall be cleaned of all material resulting from the pavement removal operation. Loaders, skid steers, motorized side cast brooms, sweeper pick up brooms, vacuum pick up machines and hand labor may be used in any number or sequence as determined by the Contractor in order to clean the milled surfaces to the satisfaction of the Department before acceptance and opening the area up to traffic. The use of compressed air may be required to loosen any bonded materials from the surface to aid in cleaning.

Any areas of concern, such as delamination or potholing shall be identified on a continuous basis as milling progresses. Proper corrective action will be determined by the Resident and paid for under the appropriate Contract items, and if required, completed prior to opening lane to traffic. Any issues that arise up to 7 Calendar Days

after being milled will be the responsibility of the Department, unless otherwise noted in Special Provision.

- 202.052 **Pavement Butt Joints** - The equipment for removing the bituminous surface shall be a cold milling machine or a power-operated planer capable of removing the existing pavement to the required depth, width, grade, and slope.

The milled surface shall have a uniform texture and provide acceptable rideability for vehicles. Should resurfacing be delayed, or the resulting milled surface is unsatisfactory for any reason, a bituminous leveling course or temporary pavement may be required. The Contractor shall clean the milled surface and surrounding area of all loose material prior to use by traffic.

- 202.06 **Method of Measurement** - Removing buildings, removing existing superstructures, and removing existing bridges will each be measured by the lump sum.

Removing concrete pavement, removing bituminous pavement, pavement butt joints, and removing pavement surface will be measured by the square yard with no deductions made for areas occupied by existing catch basins and manholes.

Removing existing structural concrete will be measured either by the cubic yard in place before work starts on the particular portion of the Structure to be removed or by the lump sum as specified.

Removing existing railings will be measured by the linear foot in place along the grade and line of the railing from outside to outside of end posts or rail Projections, whichever is greater.

Removing of existing bituminous pavement, removing existing concrete wearing surface, and removing of existing concrete curbs and sidewalks from bridges, will each be measured for payment as one lump sum unit, complete, and accepted.

Removing of existing manholes and catch basins will be measured by each unit removed.

- 202.07 **Basis of Payment** - The accepted quantity of removing building, removing existing superstructure, and removing existing bridge will be paid for at the Contract lump sum price, which price shall be full compensation for removing and disposing of the obstructions and building foundations down to an elevation matching the surrounding ground, as indicated elsewhere in the Contract Documents or as directed by the Resident.

Removing concrete pavement will be paid for at the Contract unit price per square yard which price will be full compensation for removing and disposing of pavement and pavement reinforcement.

Material for backfilling holes resulting from removal of obstructions will be measured and paid for as provided in Section 203 - Excavation and Embankments.

The quantity of structural concrete removed will be paid for, either at the Contract unit price per cubic yard or at the Contract lump sum price which price shall include disposal of the concrete.

The quantity of railing removed will be paid for at the respective Contract unit price per linear foot of railing removed and disposed of, whether it is retained by the Department or becomes the property of the Contractor.

Removing existing concrete wearing surface and removing of existing bituminous pavement from bridges will be paid for at the Contract lump sum price for the respective Contract Pay Item involved. Payment for removing membrane waterproofing, if present on the existing deck, shall be considered incidental to the removing of bituminous pavement.

Removing existing manholes and catch basins will be paid for at the Contract unit bid price each, which price shall include all work, materials, labor, and equipment. New pipe as required by the Contract Documents will be paid for separately under the appropriate Pay Item. Where new pipe is to be connected to existing pipe, the Contractor shall furnish and install, at their expense, pipe necessary to replace any existing pipe damaged beyond the limits of pipe removal shown in the Contract Documents.

Removing bituminous pavement will be paid for at the Contract unit price for the number of square yards removed as required by the Contract Documents or as ordered by the Resident, which price will be full compensation for removing and disposing of the bituminous pavement and re-grading of the remaining material.

The accepted quantity of pavement butt joints will be paid for at the Contract unit price per square yard which price will be full compensation for removing and salvaging the bituminous material. Any bituminous leveling material or temporary pavement required will not be measured for payment directly, but will be considered incidental to the related Contract Pay Items.

The accepted quantity of removing pavement surface will be paid for at the Contract unit price per square yard or at the Contract hourly rental price and will be full compensation for mobilizing to the site, de-mobilizing from the site, labor, supervision, cleaning of the milled surface, and all other incidentals required to complete the work. Hauling and stockpiling of the material will not be paid for directly but will be considered incidental to the milling items.

Trimming to create a vertical face along curb line, guardrail, or around structures will be considered incidental to the milling items. Additional trimming beyond the incidental work described will be paid under the appropriate rental items as listed in the Contract.

Square Yard - Payment will be made at the Contract unit price for the number of square yards removed.

Hourly - Payment will be made at the Contract unit price for the number of hours of operation removing pavement surface as directed by the Resident. The equipment used for pavement removal shall be operated at the minimum speed of 50 fpm, unless the Resident directs otherwise for milled surface quality reasons, or traffic control limitations impact pavement removal operations, or site conditions make operations at the prescribed rate unreasonable.

When the Pay Item calls for material to be retained by the Department, payment shall include the salvage of these materials, custody, preservation, loading and delivery as provided herein.

When the Contract does not include Pay Items for removal of Structures and obstructions as provided in this Section, such work shall be incidental to the various Contract Pay Items and no direct payment will be made except that removal of foundations and concrete pavement will be paid as provided in Section 203 - Excavation and Embankment.

The containment and disposal of pollutants during the removal of materials from any Structure, Roadway or obstruction will not be paid for directly but shall be incidental to the related Contract Pay Item.

The payment for each Contract Pay Item will be full compensation for furnishing all materials, labor, equipment and for all other incidentals necessary to complete the work.

Payment will be made under:

	Pay Item	Pay Unit
202.08	Removing Building No. ____	Lump Sum
202.09	Removing Existing Superstructure: Retained by Department	Lump Sum
202.10	Removing Existing Superstructure: Property of Contractor	Lump Sum
202.11	Removing Concrete Pavement	Square Yard
202.12	Removing Existing Structural Concrete	Cubic Yard
202.121	Removing Existing Structural Concrete ____	Lump Sum
202.127	Removing of Existing Bituminous Pavement from Bridges	Lump Sum
202.128	Removing Existing Curbs & Sidewalks from Bridges	Lump Sum
202.13	Removing Existing Railings: Retained by Department	Linear Foot
202.14	Removing Existing Railings: Property of Contractor	Linear Foot
202.15	Removing Existing Manhole or Catch Basin	Each
202.19	Removing Existing Bridge	Lump Sum
202.20	Removing Bituminous Pavement	Square Yard
202.202	Removing Pavement Surface	Square Yard
202.20201	Removing Pavement Surface (Hourly)	Hour
202.203	Pavement Butt Joints	Square Yard
202.30	Removing Existing Concrete Wearing Surface from Bridges	Lump Sum

SECTION 203 - EXCAVATION AND EMBANKMENT

203.01 **Description** - This work shall consist of excavating, removing, hauling, backfilling and compacting or disposing, as required, of all material not being removed under some other item, encountered for the construction of the Project in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown in the Contract Documents or established by the Department. Excavation under this section will be classified as Common Excavation, Rock Excavation and Unclassified Excavation, as hereinafter defined. Material not classified as excavation that is required to construct embankments and backfill trenches and holes shall be classified as borrow or crushed stone. This work shall also consist of constructing foundation pads of Culvert Bedding Stone in accordance with these specifications and in reasonably close conformity with the width, length, grade and thickness as shown in the Contract Documents or established by the Department.

The following definitions shall apply to this section:

- **Common Excavation** - shall consist of excavation and removal of all material encountered in grading within the Project Limits, which is not otherwise classified and paid for. Common excavation shall include the removal and disposal of boulders, solid mortared stone masonry and concrete masonry when each is less than 2 cy in volume and all soft and disintegrated bedrock which can be removed with ordinary excavating machinery. It shall include grubbing, which consists of the removing and disposing of all stumps, roots, bushes, grass, turf or other objectionable material and it shall include excavation for channels, berm ditches and cut slope downspouts.
- Common Excavation shall include muck removal, which shall consist of excavating and disposing of saturated or unsaturated mixtures of soils and organic matter not suitable for embankment foundation material regardless of moisture content.
- Common Excavation shall also include removing and disposing of all earth material encountered in excavating for permanent stream channel diversion and channel widening or straightening, when designated in the Contract Documents, outside the limits of structural excavation or other classifications.
- **Rock Excavation** - shall consist of removing: Hard igneous, metamorphic and sedimentary bedrock which cannot be excavated with ordinary excavating machinery and cannot be excavated without employing means such as, but not limited to, drilling and blasting, drilling and splitting or hoe-ramming; and all boulders, solid mortared stone masonry and concrete masonry, each having a volume of 2 cy or more.

- **Unclassified Excavation** - shall consist of Common Excavation and Rock Excavation as classified above and not measured separately.
 - When identical unit prices are bid for Common Excavation and for Rock Excavation, such bids shall be considered as a bid for Unclassified Excavation of the combined items and shall be so classified.

203.02 **Materials** - Borrow shall consist of approved material required for the construction of embankments or for other portions of the work as designated by the Department. . Unless otherwise designated in the Contract, the Contractor shall make their own arrangements for obtaining borrow and shall pay all costs involved.

Material shall meet the requirements of the following Subsections of Division 700 - Materials:

Crushed Stone $\frac{3}{4}$ "	703.13
Common Borrow	703.18
Granular Borrow	703.19
Gravel Borrow	703.20
Rock Borrow	703.21

Slope blanket backfill material shall meet the requirements of aggregate for base and subbase, Type D specified in Subsection 703.06 - Aggregate for Base and Subbase, as directed.

Culvert Bedding Stone shall meet the requirements of Type C material, specified in Subsection 703.22 - Underdrain Backfill Material.

203.03 **Unauthorized Use of Materials** - No Common Excavation, Rock Excavation, Unclassified Excavation or Borrow which is designated for use in embankments or backfill may be diverted for the Contractor's own use. Any unauthorized use of such material will be adjusted by deducting quantities, measured by the most appropriate method, as determined by the Department, and 115% of the quantity deducted from the total amount.

203.04 **General** - Prior to beginning excavating, grading, and embankment operations in any area, all necessary clearing in that area shall have been performed in accordance with Section 201 - Clearing Right-of-Way.

Unsuitable material shall be disposed of as directed and no material shall be wasted without the Department's permission.

The Resident may designate as unsuitable those soils which cannot be properly compacted in embankments and all such unsuitable material shall be disposed of in approved waste storage areas or acceptable waste areas as directed.

Suitable material taken from excavation shall be used in the construction of embankment, subgrade, and for backfilling as indicated in the Contract

Documents, or as directed, and no additional payment will be made. Unsuitable or surplus material shall be used as directed or wasted.

The Contractor shall give the Resident sufficient time before beginning excavation to take necessary survey measurements. The Contractor shall not excavate beyond the dimensions, slopes and elevations established, and no material shall be removed prior to surveying the site. Unless otherwise authorized, borrow shall not be placed until after all suitable excavation has been placed in the embankment unless the use of Granular Borrow is called for in the Contract Documents, for use under embankments, in conjunction with the use of excavated material or for the maintenance of traffic. If the Contractor places more borrow than is required and thereby causes a waste of suitable excavation material, the amount of such waste will be measured by the method deemed most appropriate and 100% of the amount deducted from the borrow volume.

When different unit prices are bid for Common Excavation and Rock Excavation, the Contractor will be required to strip earth from the bedrock to provide an opportunity for the Resident to take the necessary measurements. When identical prices are bid for Common Excavation and Rock Excavation, the Contractor will not be required to strip the earth from the bedrock.

When it is necessary to temporarily remove fencing designated to remain, the fencing shall be replaced by the Contractor at their expense in as good a condition as it was originally. The Contractor shall be responsible for the confinement of livestock when a portion of the fence is removed. When new fencing for confinement of livestock is required, it shall be erected before existing fencing is disturbed. Where new fencing cannot be erected in its final location, temporary fencing shall be installed at the Contractor's expense.

The degree of finish for grading ditches and slopes, both fill slopes and cut slopes, shall be that obtainable from machine operations. Ditches shall be constructed to within 6" above or below the grade called for in the Contract Documents, or as otherwise modified, but, in no case, shall the ditch be finished in a condition that will not allow the flow of water. Ditches shall be graded to the extent that puddles will not form.

Unstable slopes subject to sliding and slumping shall be excavated to the lines and grades indicated in the Contract Documents or as directed. Immediately after each location is excavated, approved slope blanket backfill material shall be placed and shaped to match the adjacent slopes.

Rock slopes shall be scaled (cleaned of all loose material) immediately as the excavation proceeds. The rock slope shall then be examined by the Contractor to determine if the slope is stable. If the slope is not deemed stable upon this examination, then immediate steps shall be taken by the Contractor to insure the stability of the slope during construction. There will be no additional payment for any temporary protection required for the construction of the Project.

Culvert Bedding Stone shall be placed and graded as shown in the Contract Documents or as directed by the Resident and shall be compacted as required to ensure that all voids in the stone are filled, as approved by the Resident.

203.041 **Salvage of Existing Hot Mix Asphalt (HMA) Pavement** - All existing HMA pavement designated to be removed under this Contract must be salvaged for utilization. Existing HMA pavement material shall not be deposited in any waste area or be placed below subgrade in any embankment.

Methods of utilization of HMA pavement may be any of the following:

1. Used as a replacement for untreated aggregate surface course on entrances provided the material contains no particles greater than 2" in any dimension. Payment will be made under Pay Item 411.09 - Untreated Aggregate Surface Course or 411.10 - Untreated Aggregate Surface Course, Truck Measure. Material shall be placed, shaped, compacted and stabilized as directed by the Resident.
2. Used as the top 3" of gravel. Recycled Asphalt Pavement (RAP) shall be processed such that the material contains no particles greater than 1½" in any dimension. When this method is utilized, a surcharge will not be required.
3. Stockpiled at commercial facilities or at approved sites for commercial or Department use.
4. Other methods proposed by the Contractor and approved by the Department.

The cost of salvaging HMA material will be incidental to applicable Contract pay items, with no additional allowances made, which will be full compensation for removing, temporarily stockpiling, and rehandling, if necessary, and utilizing the material as listed above.

203.042 **Rock Excavation and Blasting**

1. **General Requirements**
 - a. All blasting operations, including the storage and handling of explosives and blasting agents, shall be performed in accordance with this specification and Standard Specification Section 105.2.7 - Use of Explosives, and other specifications referenced therein.
 - b. In case of conflict between regulations or between regulations and this Specification, the Contractor shall comply with the strictest applicable codes, regulations, or Specifications.

- c. The overburden shall be removed or trenches shall be excavated through the overburden at the intervals directed by the Resident, normally 25 ft, but, in no case, closer than 10 ft apart to permit surveying of the bedrock in its original position. Bedrock removed prior to surveying will be considered Common Excavation.
 - d. The delay elements in blasting caps are known to deteriorate with age. For this reason, it is required that all blasting caps used on the Project be less than 1 year of age. No blasting products will be allowed on the job site if the date codes are missing.
 - e. When, in the opinion of the Resident, any blasting product is either of excessive age or in what appears to be a deteriorated condition, all work will cease until the product's age or quality can be determined.
 - f. No explosives, caps, detonators or fuses shall be stored on the Project site during non-working hours.
 - g. The use of explosives containing perchlorate compounds shall not be allowed.
2. **Controlled Blasting Methods** - Controlled Blasting is defined as a blasting method which utilizes a line of closely spaced, lightly loaded blastholes that are fired either before or after the main production blast to define a break line on the perimeter of the excavation.

The purpose of Controlled Blasting is to create a stable rock face with a fall zone to protect the traveling public from rockfall hazard, and to protect existing structures, adjacent and nearby properties, and the public from damage or injury. Controlled Blasting shall be required on all critical rock slopes.

- a. Production blasting refers to the main fragmentation blasting resulting from widely spaced production holes drilled throughout the main excavation area adjacent to the presplit line. Production holes shall be detonated in a controlled delay sequence.
- b. Presplitting is defined as the establishment of a free surface of a shear plane in bedrock by the controlled usage of explosives and blasting accessories in appropriately aligned and spaced drill holes so that the resulting split bedrock is not affected by subsequent blasting and excavation operations. The purpose of

presplitting is to minimize damage to the rock backslope and to help ensure long term stability. When presplitting, the detonation of the presplit line shall be before the detonation of any production holes.

- i. Prior to drilling, all overburden and all loose and disintegrated rock shall be removed down to solid bedrock in the vicinity of the presplit lines. Potentially dangerous boulders beyond the excavation limits shall also be removed as directed by the Resident.
- ii. Presplitting shall extend a minimum of 30 ft ahead of the limits of production blasting within the section or to the end of the cut, as applicable.
- iii. All drilling equipment used to drill the presplit holes shall have electromechanical or electronic devices affixed to that equipment to accurately determine the angle at which the drill steel enters the bedrock. Presplit hole drilling will not be permitted if these devices are missing or inoperative.
- iv. The length of the presplit holes shall not exceed 30 ft in depth unless approved by the Resident. Bedrock deeper than 30 ft shall usually be presplit in lifts, but no lift shall be less than 10 ft in depth. When the cut height will require more than one lift, a maximum 2 ft offset between lifts shall be permitted to allow for equipment clearance. No payment will be made for additional excavated quantity caused by offsetting of presplit lines for less than 20 ft lifts. Drilling 2 ft below ditch bottom will be allowed to facilitate removal of the toe berm.
- v. Before placing charges, the Contractor shall determine that the hole is free of obstructions for its entire depth. All necessary precautions shall be exercised so that placing the charges will not cause caving of material from the walls of the holes.
- vi. The diameter of the explosives used in presplit holes shall not be greater than $\frac{1}{2}$ the diameter of the hole.
- vii. Continuous column cartridge explosives manufactured especially for presplitting shall be used for all presplitting. The bottom charge of a presplit hole may be larger than the line charges, but shall not be large enough to cause overbreak.

The top charge of the presplitting hole shall be placed far enough below the collar, and reduced sufficiently, to avoid over breaking and heaving. The upper portion of all presplit holes, from the top charge to the hole collar, shall be stemmed.

viii. The presplit slope face shall not deviate more than 1 ft from a plane passing through adjacent drillholes, except where the character of the bedrock is such that, as determined by the Resident, irregularities are unavoidable. The 1 ft plane shall be measured perpendicular to the plane of the slope. In no case shall any portion of the slope encroach on the roadbed.

- c. **Cushion blasting** - Where the horizontal distance from the existing rock face to the cut face is less than 15 ft, or if rock conditions warrant this approach, the Contractor may use cushion blasting in lieu of presplitting. Cushion blasting is similar to presplitting except that the detonation along the cut face occurs after the detonation of all production holes. With the exception of the above criteria, requirements previously given for presplitting shall also apply to cushion blasting.
- d. **Sliver Cuts** - For sliver cuts, pioneering the top of cuts and preparing a working platform to begin the controlled blasting may require unusual work methods and use of equipment. The Contractor may use angle drilled holes during the initial pioneering operations to obtain the desired rock face. Hole spacing shall not exceed 30".

3. **Submittals**

- a. Not less than 2 weeks prior to commencing drilling and blasting operations, or at any time the Contractor proposes to change drilling and blasting methods, the Contractor shall submit a Blasting Plan to the Resident for review. The Blasting Plan shall contain full details of the drilling and blasting patterns and controls the Contractor proposes to use for both the controlled and production blasting. Review of the Blasting Plan by the Department shall not relieve the Contractor of its responsibility for the safety, accuracy and adequacy of

implementing the Plan. The Blasting Plan shall contain the following information:

- i. Station limits of proposed shots.
 - ii. Plan and section views of the proposed drill pattern, including free face, burden, blasthole spacing, blasthole diameters, blasthole angles, lift height, and subdrill depth.
 - iii. Loading diagram showing type and amount of explosives, primers, initiators, and location and depth of stemming.
 - iv. Initiators sequence of blastholes including delay times and delay system.
 - v. Manufacturers' data sheets for all explosives, primers and initiators to be used.
 - vi. Details of the audible advance signal system to be employed at the job site.
 - vii. Precautions to protect nearby structures and cultural features.
- b. **Daily Blasting Logs** - The Contractor shall provide the Resident with a daily log of blasting operations, submitted on a weekly basis. The log shall be updated at the close of each Working Day. The log shall include the number of blasts, times and dates of blasts, the blasting locations and patterns and all information shown below:
- i. Station limits of the shot.
 - ii. Plan and section views of drill pattern, including free face, burden blasthole spacing, blasthole diameters, lift height, and subdrill depth.
 - iii. Loading diagram showing type and amount of explosive, primers and initiators and location and depth of stemming.
 - iv. Initiators sequence of blastholes including delay times and delay system in each blasthole.
 - v. Mats or other protection used.
 - vi. Signature of the Blaster in charge.
 - vii. The Contractor shall report to the Resident in writing all blasting complaints received by the Contractor within 24 hours of receipt. Each blast complaint

report shall include the name and address of the complainant, time received, date and time of blast complained about and a description of the circumstances which led to the complaint.

4. ***Blast Vibration Control and Monitoring***

- a. The Contractor shall be required to monitor blasting vibrations (both ground and air concussions) and shall provide a copy of the Pre-Blast Condition survey of all structures and cultural features that may be affected to the Resident, prior to any blasting activities.
- b. When nearby structures, utilities or adjacent slopes may be subject to damage from blast-induced ground vibrations, the ground vibrations shall be controlled using properly designed delay sequences and appropriate charge weights per delay.
- c. When vibration damage to adjacent structures or cultural features is possible, the Contractor shall monitor each blast with an approved seismograph located between the blast area and the closest structure subject to blast damage, as approved by the Department. The seismograph used shall be capable of recording particle velocity for three mutually perpendicular components of vibration in the range generally found with controlled blasting.

5. ***Flyrock Control*** - Before the firing of any blast in areas where flying rock or debris may result in personal injury or damage to property, the rock to be blasted shall be covered with approved blasting mats, soil, or other equally serviceable material to prevent flyrock. The method of flyrock control shall be subject to approval by the Resident.

203.05 ***Roadway Excavation*** - Roadway excavation shall be maintained in such condition that the excavation surface will be well drained. Temporary drains, drainage ditches and culverts shall be constructed to intercept and divert water that may adversely affect the condition of the excavation and the prosecution of the Work.

Excavation in general, shall proceed in an upgrade direction. Subgrades shall be promptly graded and rolled to minimize absorption of water. Adjacent ditches shall be graded to the extent that puddles will not form. Grubbing areas which cannot be drained shall be promptly filled with approved excavation or borrow to such an elevation that surface drainage will be effective. If, due to unusual circumstances, drainage by gravity cannot be accomplished, the Resident may require the Contractor to provide adequate means of pumping the area. Pumping

may be required on a 24 hour a Day continuous basis, at no additional cost to the Department.

When muck is encountered, either unexpectedly or as indicated in the Contract Documents, it shall be removed in such a manner as to insure its complete removal with no areas remaining or trapped below the embankment. Excavated muck shall be deposited in designated waste storage areas as indicated in the Contract Documents, deposited in waste areas beyond the Project Limits or disposed of as otherwise directed.

Excavation adjacent to roots of trees or shrubs, which are to remain, shall be removed by hand.

When excavating results in a subgrade of unsuitable soil, the Resident may require the Contractor to remove the unsuitable material and backfill the area with approved material. The Contractor shall conduct their operations in such a way that the Resident can take the necessary measurements before the backfill is placed.

Material classified as rock, whether paid for as Rock Excavation or Unclassified Excavation, shall be excavated to the required depth, as shown in the Contract Documents. Care shall be taken that undrained pockets will not be left in the surface of the rock remaining.

The space between the rock remaining and the normal subgrade as indicated in the Contract Documents shall be backfilled with the designated aggregate subbase or aggregate base, pulverized rock or other approved material. The Contractor shall conduct their excavating and hauling work in a manner that will cause as little contamination as possible. Fine grading at the normal subgrade line will be required unless aggregate subbase or aggregate base material is used.

Ditches in bedrock cuts shall be constructed with no protrusions of rock above the designated rock cut pay lines. The space between the rock remaining and the finished surface of the ditch shall be backfilled with broken rock.

For earth and rock backslopes designated to be constructed on a 2 horizontal to 1 vertical slope or flatter, the slope shall be uniformly finished to within 6" above or 6" below the lines designated, but, in no case, shall Projections of rock extend over 6" above the actual finished surface of the slope as constructed. Rock backslopes designated to be constructed on a ¼ horizontal to 1 vertical slope shall be excavated at least to a vertical plane.

Buried structures and other materials , as specified in Section 104.3.13 - Materials and Items Found on the Project, located within the Project Limits, shall be removed as part of the applicable excavation item for type of work being performed. Buried structures and other materials located below or outside the required excavation, whose removal is ordered, shall be removed and such

removal paid for as Common Excavation, Rock Excavation or Unclassified Excavation, whichever is applicable.

203.051 **Drilling and Blasting of Solid Rock Subgrade** - Subgrade areas shall be shattered to the dimensions as indicated in the Contract Documents or as directed by the Resident.

The area of blasted rock subgrade shall extend sufficiently beyond the beginning and end of cut areas to ensure the shattering of all rock to a depth of 4 ft below subgrade elevation to eliminate water pockets.

After detonation, any rock that protrudes above the subgrade elevation after subgrade has been proof rolled, shall be removed. When directed by the Resident, the Contractor shall excavate a trench across the blasted rock to determine if the rock is broken and disarranged to a depth of 4 ft below subgrade to ensure that the rock is not simply fractured. Afterwards, the trench shall be backfilled with the rock removed.

203.06 **Waste Areas** - It shall be the responsibility of the Contractor to obtain necessary permits and approvals from all pertinent State and Federal agencies and from the local municipality before the establishment of waste areas off the Project, or to verify that the landowner has obtained these permits and approvals. In addition, written permission of the property owners shall be obtained by the Contractor, including permission to dispose of waste in the area. Copies of all agreements between the waste area property owner and the Contractor, on the Contractor's letterhead, shall be given to the Resident.

Provisions shall be made for temporary and permanent erosion controls at waste areas, which shall include, but not necessarily be limited to, grading the surface to drain, covering the surface with loam or other earthy material that will support growth and seeding and mulching.

Entrances to waste areas located within wooded areas shall be in accordance with Subsection 203.07 - Haul Roads.

All trees that are damaged, uprooted or otherwise moved because of the waste material, and trees that have had waste material placed around them to the extent that they may die, shall be cut and removed at the expense of the Contractor.

Designated waste areas may be established by the Department. When such waste areas are established, the location and other conditions relating to them will be described in the Contract Documents.

203.07 **Haul Roads** - In wooded areas, haul roads shall be kept to a minimum width and placed at approximately right angles to the road or angled away from view of oncoming traffic.

203.08 **Borrow** - Refer to Section 105.8.6 - Pit or Quarry Requirements.

The Contractor shall notify the Resident sufficiently in advance of opening any borrow areas so that survey measurements of the ground surface after stripping may be taken. The Contractor shall submit borrow material test results to the Department prior to being used. Existing pits shall, when directed, be graded and shaped by the Contractor before being surveyed for initial measurements.

203.09 **Preparation of the Embankment Area** - When the depth of the embankment, measured vertically below subgrade, does not exceed 5 ft, the area on which the embankment is to be placed shall be grubbed as defined in Subsection 203.01 a. When the embankment is more than 5 ft deep, as measured above, all vegetation in the embankment area shall be cut as specified in Section 201 - Clearing Right-of-Way.

When fill material is placed against existing slopes or previously placed fill, the interface shall be continuously benched by excavating steps of sufficient width to permit operations of placing and compacting the additional material. Material removed shall be placed and compacted along with the new embankment material.

203.10 **Embankment Construction - General** - Layers of material for embankments shall start at the deepest portion of the fill and as placement progresses, layers shall be constructed approximately horizontal. Roadway embankment of earth material shall be placed in layers not exceeding 8", loose measure, unless otherwise approved, and the material compacted as specified before the next layer is placed; however, when placing layers of specified thickness is not feasible, such as filling in water, over swampy ground or over cleared areas, the initial layer of embankment may be constructed in one layer to an elevation where bridging will be accomplished. In embankment areas where no grubbing is required, the material placed in the first layer shall be of sufficient depth to cover all stumps.

When the excavation or borrow consists predominantly of fragments of such size that the material cannot be placed in embankments in layers of specified thickness without breaking down the pieces, such material may be placed in layers in thickness not exceeding the approximate average size of the larger rocks but, in no case, shall layers exceed 2 ft. Rocks exceeding this thickness shall be separated and collectively placed in accordance with the requirements for rock embankments. Each layer shall be leveled and smoothed by even distribution of rock spalls and finer rock fragments or earth. The Resident may test any or all layers by moisture and density control as specified in Section 203.12 - Construction of Earth Embankment with Moisture and Density Control, which are constructed in depths exceeding 8". The layers so constructed shall not be placed above an elevation that is 2 ft below the finished subgrade. The remainder of the embankment shall be composed of suitable material smoothed

and placed in layers not exceeding 8", loose thickness, and compacted as specified for earth embankments.

When it is impractical to construct layers over the full width of the cross section, partial width layers may be authorized.

The Contractor shall spread, grade and compact each layer to obtain uniform thickness and produce an embankment surface free from low spots and ridges to provide direct drainage of water. Water shall be added to, or removed from, the material as necessary to obtain required compaction. Construction equipment shall be routed uniformly over the entire surface of each layer.

Embankments within 50 ft of a bridge abutment, structural plate or box culvert type structure shall be compacted by the moisture and density control method as specified in Section 203.12 - Construction of Earth Embankment with Moisture and Density Control, except that rock embankments may be constructed over culverts as specified in Section 203.15 - Construction of Rock Embankments.

Where guardrail is to be installed, rock shall not be placed in the embankment under the location of the guardrail to an elevation 5.5 ft below the finished grade of the shoulder. Rocks, broken concrete and other solid materials shall not be placed in any portions of embankments where piling is to be placed or driven or where Utility facilities are to be placed.

Excess or unsuitable excavated material, including rock and boulders, which cannot be used in embankments, shall be placed in acceptable waste areas.

Excavation that is unsuitable for use due to excessive moisture content may be rendered satisfactory by combining it with Granular Borrow or granular excavation when, and as, approved by the Resident.

If the embankment is required to be deposited on only one side of abutments, wing walls, piers or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted excessively to the extent that it will cause overturning of, or excessive pressure against, the structure. When embankment is to be placed on both sides of a concrete wall, structural plate or box type structure, operations shall be so conducted that the embankment is always at approximately the same elevation on both sides of the structure.

At the close of each Day's work, the embankment surface shall be graded, crowned, smoothed and rolled to minimize infiltration of water.

The portion of the embankment and subbase outside a 1 vertical to 1½ horizontal slope ex-tending from the edge of the finished shoulder to the existing ground, as shown on the Standard Detail 203(01) - Muck Excavation And Waste Disposal, will be required to be compacted only to the extent that stability of the slope is assured. As construction of the embankment progresses, material placed in the portion of the embankment outside the 1 vertical to 1½ horizontal slope shall not

be placed above the elevation of the surface of the main embankment unless provisions are made to allow drainage of surface water from the embankment. The surface of the slopes shall be finished to present a uniform neat appearance.

The portion of the embankment inside the aforementioned 1 vertical to 1½ horizontal slope lines shall be compacted in accordance with the designated embankment compaction requirements specified for the Project.

- 203.11 **Construction of Earth Embankment-Layer Method** - The layer method will be required unless otherwise specified. Unless otherwise approved, the material shall be deposited and spread upon compacted material in full width layers not more than 8" in depth, loose measure. Clay or loam soils shall be compacted by use of sheepsfoot or tamping type roller having a minimum weight on each tamper, under working conditions, of 250 psi of cross sectional bearing area. Sand or gravel soils shall be compacted by vibratory type compaction equipment or by pneumatic tired equipment and, if necessary, by the addition of water. A combination of the above or other methods capable of producing equivalent results may be used. The compacting operations shall be continued until each layer is compacted to its full depth and width.

With approval, the Contractor may place layers in excess of 8" and less than 24", loose measure, providing the Contractor demonstrates that the compaction requirements as specified in Section 203.13 are obtained and the Contractor agrees to make necessary test excavations for testing to determine that the in-place density requirements are met.

- 203.12 **Construction of Earth Embankment with Moisture and Density Control** - The Contract Documents and/or Section 203.10 will designate the areas to be constructed with moisture and density control and the distance below subgrade to which such methods shall be applied. The moisture content at the time of compaction shall be suitable to obtain the required density. The maximum density and required density shall be determined in accordance with Section 203.13.

- 203.13 **Compaction Testing and Requirements** - Where compaction testing is required by this specification or by Special Provision, and unless otherwise specified, the following shall apply:

All field density tests will be performed by the Department in accordance with AASHTO T 310.

The maximum density and compaction requirements shall be determined by one of the following:

- For material where the percent retained on the ¾" sieve is 40%, or less:
The maximum density shall be determined in accordance with AASHTO T 180, Method C or D, correcting for oversize particles as provided in Annex A, except that the material may have a maximum retained on the ¾" sieve

of 40%, or less; each layer placed shall be compacted to not less than 90% of the maximum density determined in this manner.

- For material that exceeds 40% retained on the $\frac{3}{4}$ " sieve: A 300 ft section at the start of the operation will be designated as the control section, unless a shorter section is approved by the Resident; the Contractor shall add or remove water to the control section as directed until the Department determines that optimum moisture has been obtained; the control section shall then be rolled as directed using the specified compaction equipment until the Department determines that four consecutive passes do not increase the dry density by more than 1 lb/ft³; the compaction process shall be repeated for each roller; once the compaction process is complete, the Department will perform several additional density tests; the average of these tests shall be used to determine the maximum density of the control section; each layer placed shall be compacted until a density of not less than 98% of the maximum density has been achieved, as determined in this manner.

203.14 ***Removed***

- 203.15 ***Construction of Rock Embankments*** - The material for rock embankment shall be placed in compacted layers not exceeding 3 ft in depth. Depositing the rock directly over the end of the fill from the hauling equipment will not be permitted; rather, it shall be deposited on the fill and pushed into place. The top of the rock embankment shall be so choked that there will be no infiltration of the earth embankment placed on the top of the rock embankment.

This method shall be used only in fills in excess of 4 ft in depth. In no case shall the rock embankment be placed within 1 ft of subgrade (5.5 ft in guardrail areas).

When structures are located under rock embankment, they shall be covered with not less than 2 ft of earth excavation or borrow before the rock embankment is placed over the structures.

- 203.16 ***Winter Construction of Embankments*** - Frozen material shall not be used in the construction of embankments. The construction of embankments may continue during freezing weather only when all frozen material in the top of the embankments, successive layers of the embankments, or the existing ground under the embankments is removed prior placing additional material. When this procedure results in additional borrow quantity, the additional borrow will not be paid for directly. If allowed by the Resident, the excavated frozen material removed may be placed outside of the limits of an assumed 1.5:1 (horizontal to vertical) slope from the break in the shoulder and inside the design slope line, provided the design slope is flatter than 2:1 (horizontal to vertical).

Excavated frozen material which will be suitable when dry shall be allowed to thaw and then be placed in the embankment. No additional payment will be made for the storing and rehandling of these materials.

Compaction shall be in accordance with the specified method of embankment construction. When the prevailing temperatures are below 30°F, all material used in embankment construction shall have a moisture content, at the time of compaction, equal to or less than the optimum moisture content.

- 203.17 ***Preparation and Protection of the Subgrade*** - Unless otherwise provided, the subgrade shall be brought to a condition of uniform stability and compacted for the full width of the roadway by grading and rolling operations and shall be maintained to no tolerance above, or 3" below, the required grade and cross section. The surface shall be compacted to uniform density and stability and graded to the extent that puddles of water will not form. Additional material required because of low subgrade shall be furnished and placed at the expense of the Contractor.

The required compaction shall be the same as specified for embankments. When the subgrade occurs in cuts, the required compaction shall apply to a depth of 6" below subgrade, unless otherwise specified.

The Contractor shall protect the subgrade from damage. Ditches and drains along the roadway shall be maintained to effectively drain the subgrade. In no case shall vehicles be allowed to travel in a single track and form ruts. No material shall be deposited on a subgrade until the subgrade has been approved.

- 203.18 ***Method of Measurement*** - Except as otherwise provided, excavation and borrow will be measured by the number of cubic yards measured in place by survey measurements. Measurements will include slides in Common Excavation and Unclassified Excavation, not attributable to carelessness of the Contractor, and authorized excavation of earth, bedrock, shale, muck or other unsuitable material. Volumes will be computed by the average end area method or by other methods generally recognized as conforming to good engineering practice.

When Granular Borrow or Gravel Borrow is placed for backfill behind bridge abutments and around structural plate pipes, pipe arches, and plate arches to the lines, grades, and dimensions shown in the Contract Documents, the quantity measured for payment will be that portion of the number of cubic yards shown in the Schedule of Items that is estimated for the structure.

This quantity is considered final, and no adjustments will be made except under the following conditions:

- a. When the structure is founded on bedrock, the quantity measured will be what is actually placed to maximum allowable horizontal dimensions indicated in the Contract Documents.
- b. When changes to the Contract Documents are made by the Resident.

Muck excavation - to be measured for payment as Common Excavation, will be the number of cubic yards of material acceptably excavated from areas shown in the Contract Documents or as authorized by the Department. Muck excavation shall be measured in its original position by survey elevations and the volume

computed by the average end area method or by other methods generally recognized as conforming to good engineering practice. If muck is stored in excess of the maximum slope requirements of any waste storage area, the amount requiring reloading, hauling and disposing of in other waste storage areas or acceptable waste areas will not again be measured for payment.

When it is impractical to measure small quantities of borrow in place, a quantity not exceeding 2,500 cy per item for a single Project may be measured in vehicles at the point of delivery. If a dedicated borrow pit is available for the Project, the entire quantity may be measured pit quantity. When measured in vehicles, the quantity for payment shall be 80% of the quantity determined for earth and 100% of the quantity determined for rock, as shown on delivery slips. When pit measured, the amount for payment shall be 90% of the quantity so measured for earth material and 130% of the quantity so measured for rock.

Unless otherwise authorized, measurement for excavation in earth cuts will be made to the designated slopes. Field changes made by the Resident will be measured by cross-sections or by other acceptable methods. Elevations for final cross-sections shall be determined at the surface of the finished ground with no additional allowance for thickness of loam, sod, riprap, hay mulch, or other type of ground cover, except that excavation for slope blanket backfill will be measured by the cubic yard.

Unless otherwise authorized, measurement for excavation in rock slopes designated to be constructed on a 1 vertical to 2 horizontal slope, or flatter, will be made to the designated slope line providing the finished slope is within tolerances described in Subsection 203.05 - Roadway Excavation. If the finished slope line is not within the tolerances described, payment will be made to the designated cut slope line or to the finished slope line, whichever yields the lesser quantity.

Unless otherwise authorized, measurement for excavation in rock slopes designated to be constructed on a 1 vertical to $\frac{1}{4}$ horizontal slope will be made to the designated slope providing the rock is excavated beyond a vertical plane. There will be no payment for material removed beyond the designated slope line.

Unless authorized, material placed in embankments outside a surface parallel to and 6" beyond the neat line of embankment slope, or 12" beyond the neat line of the waste storage area in which waste has been placed, will not be included in the quantity for payment and will be deducted from the borrow at 100% of the material so measured in place.

Measurements will be made for unsuitable materials actually excavated and removed to obtain proper compaction in cut sections and in foundations for fill sections.

The quantity of Drilling and Blasting of Solid Rock Subgrade to be measured for payment will be the number of square yards of subgrade plan area drilled and detonated in accordance with this Section, measured at subgrade level. The

number of cubic yards of excavation required by the Resident to inspect the depth of shattered and rearranged rock, computed at a maximum width of 30" will be measured for payment as Structural Earth Excavation – Drainage and Minor Structures Below Grade.

When Structural Rock Excavation - Drainage and Minor Structures, and Drilling and Blasting of Solid Rock Subgrade occur at the same location, measurement and payment for Structural Rock Excavation - Drainage and Minor Structures will be made for the required trench. This area will not be included in the measurement and payment for Drilling and Blasting of Solid Rock Subgrade.

Controlled Blasting - shall be paid by the linear foot of presplitting holes and extra drilled holes without explosives, measured from the top of the drill hole at the bedrock surface to the bottom of the hole or to the elevation of the required subgrade (whichever is higher) or to an established bench elevation. Portions of holes not meeting the requirements of Section 203.042 - Rock Excavation and Blasting, Item No. 2, Controlled Blasting Methods, will not be measured. Production holes will not be measured. Presplitting holes and extra drilled holes without explosives drilled where presplitting is not required by this specification will not be measured. Where presplitting is required, excavated rock will be paid for only to the slope and depth lines shown or described in the Contract Documents or as ordered by the Resident. Where the Resident determines that the removal of additional bedrock is necessary due to conditions clearly not attributable to the Contractor's methods of operations, the payment lines will be adjusted to the limits ordered, to include only bedrock actually removed within such limits.

Culvert Bedding Stone will be measured by the cubic yard, complete and in place.

- 203.19 **Basis of Payment** - The accepted quantity of excavation and borrow will be paid for at the Contract unit price per cubic yard for each of the pay items included in the Schedule of Items. Payment shall be full compensation for obtaining borrow when required and for excavating, loading, rehandling, hauling, placing, grading and compacting all material necessary for the formation of embankments. It shall also include full compensation for disposing of unsuitable and surplus material when necessary. It shall also include excavation in embankments for determining compaction density. No payment will be made for unauthorized work done beyond authorized pay limits.

Payment for removal of unstable material below subgrade in cuts will be paid at the Contract unit price per cubic yard for Common Excavation or Unclassified Excavation, whichever is appropriate.

Payment for placing and compacting backfill, except for special fill or backfill, specified under Special Provisions or other Standard Specifications, will not be paid for separately but will be included in the payment for any one of the related excavation items, provided however, there is suitable excavation material

available in its original position at the time of backfilling. When there is no suitable material available for backfilling, the material authorized will be paid for under the Contract item for the class of material used.

When bedrock is encountered and no item is included in the Contract for its removal, the excavation of the bedrock will be paid for at 6 times the Contract unit price for Common Excavation.

The furnishing and placing of backfill material between the bedrock remaining and the normal subgrade line of rock cuts and between the bedrock remaining and the finished surface of ditches in rock cuts will not be paid for directly, but shall be considered incidental to the Work. The quantity of Aggregate Subbase or Aggregate Base for payment in rock cuts shall include only the material placed above the normal subgrade lines.

Costs for furnishing and placing material necessary to backfill and to grade rock cut slopes designated to be constructed on a slope of 1 vertical to 2 horizontal or flatter, will be considered to be included under the payment for the material used, either excavation or borrow.

When muck is encountered, the excavation of the muck will be paid for at the Contract unit price bid for Common Excavation or Unclassified Excavation.

Excavation which requires more than one handling prior to final placement in the embankments, including material placed as backfill and loamy top soil to be stockpiled and reserved for later use on the slopes, will be paid for at the Contract unit price for Common Excavation, Unclassified Excavation or Rock Excavation, as applicable, for each handling approved by the Department. It may be paid for under another Contract item for the second handling when so authorized. Each handling shall be considered to include the operations of excavating, loading, transporting, unloading and disposing of earth or rock material.

Excavation for unstable slopes for slope blanket backfill, as specified in Subsection 203.04 - General, will be paid for at twice the Contract unit price bid for Common Excavation. Backfill material will be paid for as specified in Subsection 304.07 - Basis of Payment.

Excavation for benching to receive embankments will not be paid for directly but shall be incidental to the related Contract items.

Water added to embankment material to aid in compaction will not be paid for directly but shall be considered incidental to related Contract items.

Payment for compacting the soils in the abutment and pier areas, after the topsoil has been removed, will not be made directly but shall be considered incidental to related Contract items.

Removing Portland Cement concrete pavement and Portland Cement concrete base course, when not included in the Contract as a separate pay item, will be paid for under Pay Item 203.21 - Rock Excavation.

Payment for excavating or filling and compacting material in building or other foundation holes, whether existing or created by the removal of structures and obstructions, will be made under the appropriate pay item for excavation or borrow and no additional allowances will be made.

All work and materials required to grade, loam, seed and mulch waste areas and associated haul roads to allow the surfaces to drain and to control erosion will not be paid for directly but will be considered incidental to related Contract items.

Stripping pits to obtain necessary borrow will not be paid for separately but will be considered incidental to related Contract items.

When Common Excavation and Rock Excavation are reclassified as Unclassified Excavation, payment will be made for the reclassified items under Pay Item 203.22 - Unclassified Excavation, at the identical unit bid price.

The accepted quantities of Drilled and Blasted Solid Rock Subgrade will be paid for at the Contract unit price per square yard. Payment will be full compensation for performing the work specified including the removal of blasted bedrock that may swell above subgrade and its disposition on the Project as directed by the Resident. Excavation and backfill required to inspect the depth of broken rock below subgrade will be paid for at the Contract unit price per cubic yard for Structural Rock Excavation – Drainage and Minor Structures.

The accepted quantity of Presplitting Rock will be paid for at the Contract unit price per linear foot. All costs incurred by the Contractor in preparing an approved blasting plan, in maintaining a blasting log, and in adopting revised blasting methods necessary to produce an acceptable test shot shall be considered incidental to related Contract items.

The accepted quantity of Culvert Bedding Stone will be paid for at the Contract unit price per cubic yard, complete and in place.

Payment will be made under:

Pay Item		Pay Unit
203.20	Common Excavation	Cubic Yard
203.21	Rock Excavation	Cubic Yard
203.211	Presplitting Rock	Linear Foot
203.213	Drilling and Blasting of Solid Rock Subgrade	Square Yard
203.22	Unclassified Excavation	Cubic Yard
203.24	Common Borrow	Cubic Yard
203.25	Granular Borrow	Cubic Yard
203.26	Gravel Borrow	Cubic Yard
203.27	Rock Borrow	Cubic Yard
203.35	Crushed Stone $\frac{3}{4}$ "	Cubic Yard
203.55	Culvert Bedding Stone	Cubic Yard

SECTION 204 - SHOULDER REHABILITATION

204.01 **Description** - This work shall consist of rehabilitating existing shoulders by grading and compacting shoulders, and furnishing, placing, grading and compacting new shoulder aggregate to required grade.

204.02 **Aggregates** - New shoulder aggregate for shoulder rehabilitation shall be material meeting the requirements of Section 703.10 - Aggregate for Untreated Surface Course and Leveling Course or Section 703.06b. - Aggregate for Subbase, Type D.

New shoulder aggregate for add shoulder aggregate shall be material meeting the requirements of Section 703.11 - Aggregate for Shoulders or Section 703.06b. - Aggregate for Subbase, Type D.

New shoulder aggregate used for shoulder rehabilitation or add shoulder aggregate will not be required to pass the Washington State Degradation Test.

204.03 **Existing Shoulder** - The existing shoulder for rehabilitate shoulder shall be prepared by grading with power equipment to provide a surface on which to place an aggregate course. All sod, tar-penetrated strips and other unsuitable material shall be removed to the extent required by the Resident. Suitable excavated granular material may be used to fill low areas and to widen out to provide a uniform shoulder width as required. Where required by the Resident the edge of the existing traveled lane shall be cut to provide a uniform edge.

For proposed paved shoulders the surface of the existing shoulder shall be graded and compacted approximately parallel to the proposed finished paved shoulder surface.

Surplus material shall be incorporated into embankments or disposed of in an approved waste area.

Add new shoulder aggregate to existing shoulders shall be to the widths and grades that are required by the typical sections.

- 204.04 **New Aggregate** - After preparation of the existing shoulder and where the thickness of new shoulder aggregate for rehabilitated shoulders to be placed exceeds 4", material meeting the requirements of Aggregate for Subbase, Type D or Aggregate for Untreated Surface Course shall be placed to the required grade. Where the thickness of new shoulder aggregate to be placed is 4" or less, material meeting the requirements of Aggregate for Untreated Surface Course shall be used. The Contractor may, at their option, grade the existing shoulders to an elevation of 4" or more below the proposed finished gravel surface and place material meeting the requirements of Aggregate for Subbase, Type D, full depth.

Where the thickness of new shoulder aggregate for add shoulder aggregate shoulders to be placed exceeds 4", material meeting the requirements of Section 703.06(b) Aggregate for Subbase, Type D, or Section 703.11 - Aggregate for Shoulders shall be placed to the required grade. Where the thickness of new shoulder aggregate to be placed is 4" or less, material meeting the requirements of this provision shall be used. The Contractor may, at their option, grade the existing shoulders to an elevation of 4" or more below the proposed finished gravel surface and place material meeting the requirements of Section 703.06 - Aggregate for Subbase, Type D full depth.

- 204.05 **Surface Tolerance** - The completed surface of the rehabilitated shoulder shall be shaped and maintained to a tolerance, above or below the required cross sectional shape of $\frac{3}{8}$ ".

The completed surface of the add shoulder aggregate shoulder shall be shaped and maintained to a uniform machine finish.

- 204.06 – 204.09 **Removed**

- 204.10 **Method of Measurement** - The quantity of rehabilitation of existing shoulders and add shoulder aggregate measured for payment will be the number of square yards shown in the Schedule of Items in the Contract.

This quantity will be considered final, and no adjustments will be made, except when the quantity shown in the Schedule of Items is added to or deducted from, when changes to the plans are made by the Resident.

- 204.11 **Basis of Payment** - The accepted quantity of rehabilitation of existing shoulder will be paid for at the Contract unit price per square yard. No adjustment will be made to the quantity for payment, except as described under Method of Measurement above. Payment will be full compensation for cutting the edge joint, removing pavement, curb and other unsuitable material, grading and compacting the existing shoulder, disposing of surplus and unsuitable material, and for furnishing, placing, grading, and compacting new aggregate to the required depth, suitable for paving at the time of paving.

The accepted quantity of Add Shoulder Aggregate to existing shoulder will be paid for at the Contract unit price per square yard. No adjustment will be made to the quantity for payment, except as described under Method of Measurement above. Payment will be full compensation for furnishing, placing, grading, and compacting new aggregate to the required depth.

Additional material required as a result of cross-slope variance of the pavement surface will not be paid for directly, but will be considered incidental to the Contract unit price per square yard of rehabilitation of existing shoulder.

Grading, furnishing and placing loam, seed and mulch in required waste areas will be considered incidental to the Contract and no separate payment will be made.

Payment will be made under:

Pay Item		Pay Unit
204.20	Add Shoulder Aggregate to Existing Shoulder, Plan Quantity	Square Yard
204.41	Rehabilitation of Existing Shoulder, Plan Quantity	Square Yard

SECTION 205 - SHOULDER RECONSTRUCTION

205.01 **Description** - This work shall consist of reconstructing or widening existing shoulders by excavating, grading, furnishing, and compacting new shoulder aggregate and fill material if necessary, in accordance with the thickness and typical sections shown on the plans.

205.02 **Aggregates** - New shoulder aggregate shall be material meeting the requirements of Section 703.06a. - Aggregate for Base, Type B.

Fill material shall be existing excavation or common borrow from an outside source.

205.03 **Existing Shoulder** - The area shall be excavated to the depth shown on the typical section and graded to a tolerance, above or below the required cross sectional shape, of $\frac{3}{4}$ ". Where required by the Resident, the edge of the existing travel lane pavement shall be cut to provide a uniform edge.

Excavated material shall be incorporated into embankments, used to flatten existing slopes as directed or disposed of in an approved waste area.

205.04 **New Aggregate** - After excavation, new shoulder aggregate shall be placed and compacted to the required grade.

205.05 **Surface Tolerance** - The completed surface of the shoulder shall be shaped and maintained to a tolerance, above or below the required cross section shape of $\frac{3}{8}$ ".

205.051 **Compaction** - The aggregate shall be compacted to the requirements of Section 304.04.

205.06 **Method of Measurement** - The quantity of reconstruction of existing shoulders and widening of existing shoulders measured for payment will be the number of square yards shown in the Schedule of Items in the Contract.

This quantity will be considered final, and no adjustments will be made, except when the quantity shown in the Schedule of Items is added to or deducted from, when changes to the plans are made by the Resident.

205.07 – 205.10 **Removed**

205.11 **Basis of Payment** - The accepted quantity of reconstruct existing shoulder will be paid for at the Contract unit price per square yard. No adjustment will be made to the quantity for payment, except as described under Method of Measurement above. Payment will be full compensation for cutting the edge joint, removing pavement, curb and other unsuitable material, excavating, grading and compacting the existing shoulder, disposing of surplus and unsuitable material, and for furnishing, placing, grading, and compacting new aggregate to the required depth.

The accepted quantity of widening of existing shoulder will be paid for at the Contract unit price per square yard. Payment will be full compensation for excavating, removal of pavement, and other unsuitable material, and for the cutting of edge joints. Payment will also be full compensation for furnishing, grading, and compacting fill material; disposing of surplus and unsuitable material; and for furnishing, placing, grading, and compacting new aggregate.

Grading, furnishing and placing loam, seed and mulch in required waste areas will be considered incidental to the Contract and no separate payment will be made.

Payment will be made under:

Pay Item		Pay Unit
205.41	Reconstruction of Existing Shoulder, Plan Quantity	Square Yard
205.51	Widening of Existing Shoulder, Plan Quantity	Square Yard

SECTION 206 - STRUCTURAL EXCAVATION

206.01 **Description** - This work shall consist of excavating, removing, hauling backfilling and compacting or disposing, as required, of all material encountered for the installation and construction of Drainage and Minor Structures and for Major Structures in accordance with these specifications and in reasonably close conformity with the lines, grades and typical cross sections shown in the Contract Documents or established by the Department.

Excavating for structures below designated excavation limits as specified or shown in the Contract Documents will be included under this section.

Material which is required to be excavated or paid for under another section shall not be included under this section.

Ditches at inlets and outlets of culverts, special ditches and outlet ditches, all as indicated in the Contract Documents, shall be constructed and paid for under Section 203 - Excavation and Embankment.

The following definitions shall apply to this section:

- **Drainage and Minor Structures** - shall include pipe culverts, pipe arches, underdrains, catch basins, manholes, structural plate units, box culverts, three-sided box culverts, culvert end walls and wingwalls, concrete steps and other minor structures.
- **Major Structures** - shall include abutments and piers for bridges, cast-in place rigid frame structures, and concrete and masonry retaining walls.
- **Special Backfill** - shall consist of obtaining, hauling, and placing selected material suitable for the location where it is to be used. Special Backfill as a Contract item will be called for in the Contract Documents.
- **Structural Earth Excavation** - shall consist of excavation and removal of all material encountered, except for Structural Rock Excavation. Structural Earth Excavation shall also include the removal of:
 - All boulders, solid mortared stone masonry and concrete masonry when each is less than 2 cy in volume; and
 - all soft and disintegrated rock which can be removed with ordinary excavating machinery.
- **Structural Rock Excavation** - shall consist of removing: Hard igneous, metamorphic and sedimentary bedrock which cannot be excavated with ordinary excavating machinery and cannot be excavated without employing means such as, but not limited to, drilling and blasting, drilling and splitting, or hoe-ramming; and all boulders, solid mortared stone masonry; and concrete masonry each having a volume of 2 cy or more.
- **Structural Earth Excavation, Below Grade** - shall consist of the removal of excavation required for unknown or unanticipated subsurface condition. See 206.04 – Method of Measurement for pay limits.

206.02 **Construction Methods** - The Contractor shall notify the Resident a sufficient length of time in advance of the beginning of Structural Excavation so that necessary elevations and measurements may be taken of the undisturbed ground. When solid bedrock is encountered which is to be removed, the Contractor shall uncover the rock and provide ample opportunity for the Resident to take the necessary survey measurements of the undisturbed rock.

When the foundation material is soft or otherwise unsatisfactory and must be removed below the elevation shown in the Contract Documents, the excavation

shall be carried to a depth designated by the Resident and the material shall be removed and replaced with approved granular material and thoroughly compacted; alternately, a lower elevation for the bottom of the structure may be established by, and at the discretion of, the Department.

Suitable material removed from the excavation area, including that material removed from beyond the specified excavation pay limits, shall be used for backfilling or for the formation of embankments and no additional payment will be made. Unsuitable or surplus material shall be disposed of accordingly.

When the structure is to be placed on solid bedrock, the rock shall be excavated to a firm surface, either level, stepped or serrated. When solid or disintegrated rock or boulders are encountered, the rock shall be excavated to a designated depth below the bottom of the proposed structures, as shown in the Contract Documents or as directed by the Resident. Except for installations of underdrain, the material so removed shall be replaced with selected fine compressible material such as sand and uniformly compacted and shaped in accordance with Section 603.04 - Bedding.

When the structure is to rest on an excavated surface other than bedrock, particular care shall be taken not to disturb the bottom of the excavation. If the surface upon which the structure is to rest is disturbed, it shall be regraded and recompacted as directed by the Resident and no additional payment shall be made.

After each excavation is completed, the Contractor shall notify the Resident and no culverts or masonry shall be placed, foundation piles driven or other installations made, until the depth of the excavation and the character of the foundation material has been approved.

Before drainage or underdrain pipe is installed in cut areas where common excavation, unclassified excavation or muck excavation is removed below the subgrade elevation shown on the plans, the undercut roadbed shall be filled with approved granular material to a depth sufficient to support construction equipment. All fill material shall be compacted as required.

- 206.03 **Backfilling** - Backfilling shall consist of placing suitable material in all spaces excavated and not occupied by Drainage and Minor Structures, Major Structures and other permanent structures up to the elevation of the existing ground or other elevations shown in the Contract Documents. Except for underdrain backfill and for structural plate pipe units, backfill material for Drainage and Minor Structures shall be fine readily compressible soil or granular material, at, or near, optimum moisture content, and shall not contain stones larger than 3", frozen lumps, chunks of clay, mineral matter or any other objectionable material. When Granular Borrow is called for in the Contract Documents to be placed around Drainage and Minor Structures, Granular Borrow, Material for Underwater Backfill, shall be used. Backfill material for Major Structures shall be Granular Borrow, Material for Underwater Backfill, or other material indicated in the

Contract Documents and shall be at, or near, optimum moisture content and shall not contain frozen lumps, chunks of clay, mineral matter or any other objectionable matter.

Backfill shall not be placed against gravity sections of any structure, including those comprised of masonry and/or concrete, until the structure has been in place for at least 7 Days or until mortar and/or concrete cubes/cylinders cured with the structure establish that design strength has been reached. For structures other than gravity structures that require reinforcing designed to resist applied dead and live loads, backfill shall not be placed against the structure until the concrete has been in place for at least 14 Days or until concrete cylinders cured with the structure establish that the design strength has been reached. Backfilling around pipes, catch basins and manholes that include joints with cement-based mortar shall not commence until the mortar has been in place at least 12 hours unless methods approved by the Resident are used to protect the mortar from being disturbed.

Except for structural plate units, backfill material shall be uniformly distributed in layers of not more than 8" in depth, loose measure, and each layer thoroughly compacted by use of approved compactors before successive layers are placed. When backfill is being placed around a pipe or structure, operations shall be conducted so that the fill is always at approximately the same elevation on both sides. Water shall be added when necessary to increase the moisture content of the backfill material to obtain compaction. Puddling or jetting of backfill will not be allowed unless specified in the Contract Documents. Structural plate units shall be backfilled in accordance with Section 509 - Structural Plate Pipes, Pipe Arches, Arches, and Metal Box Culverts.

Unless otherwise indicated in the Contract Documents or directed, all sheeting and bracing used during Structural Excavation shall be removed by the Contractor following the completion of the work, and all voids resulting from use of the sheeting and bracing backfilled where necessary, at no additional cost to the Department.

- 206.04 **Method of Measurement** - Structural Excavation will be measured by the number of cubic yards of material removed, measured in its original position, and acceptably excavated in conformity with the Contract Documents or as directed.

When structures are to be installed where roadway excavation is to be removed, only the excavation beyond and below the roadway excavation limits will be classified as Structural Excavation.

Drainage and Minor Structures - For these structures there will be no measurement for Structural Earth Excavation, except for Structural Earth Excavation, Below Grade. When measured for payment, the quantity of Structural Earth Excavation, Below Grade, will be the amount actually excavated, provided the maximum allowable in accordance with the following limits:

- **Vertical pay limits** - Below a plane parallel with and 12" below the bottom of the drainage or minor structure or below the excavation limits shown in the Bid Documents; whichever is greater.
- **Horizontal pay limits** – The maximum allowable horizontal dimensions shall not exceed those bounded by vertical surfaces 18" outside the base, or extreme limits of, the structure, and to the vertical neat lines of underdrain trenches, as shown in the Contract Documents.

When bedrock is required to be excavated for installation of these structures, the depth for measurement will be the actual depth required in accordance with the Contract Documents or as otherwise designated, except:

- For culvert pipe and underdrain, the depth for measurement will be a maximum of 1 ft below the bottom of the invert; and
- for catch basins and manholes, the depth of measurement will be a maximum of 1 ft below the bottom of the base.
- Any removal of solid rock for leveling, stepping or serrating, as shown in the Contract Documents, or as determined, shall be measured within the aforementioned limits. The quantity of rock will be the number of cubic yards actually removed provided the maximum allowable horizontal dimensions do not exceed those bounded by vertical surfaces specified in the preceding paragraph.

Major Structures - For Major Structures, the quantity measured for payment will be the number of cubic yards shown on the Schedule of Items in the Contract Documents. This quantity is considered final and no adjustments will be made, except under the following conditions:

- When the structure is founded on bedrock, the quantity measured will be what is actually excavated to the top of the bedrock and to maximum allowable horizontal dimensions bounded by vertical surfaces 18" outside the neat lines of the base as indicated in the Contract Documents.
- When changes to the Contract Documents are made by the Resident.
- When the outermost limit of French drains exceeds the vertical planes stated above, the limit to be measured for payment will be extended upward from the bottom of the French drain on a vertical plane bounded by the outermost limit of the French drains.
- When bedrock is required to be excavated for the construction of Major Structures to definite elevations as indicated in the Contract Documents, or elevations designated by the Resident after the rock has been exposed, the maximum depth of measurement for payment will be to a horizontal plane or planes located 12" below the elevation shown or designated.

- Removal of solid bedrock, for leveling, stepping or serrating, as indicated in the Contract Documents or determined, shall be measured within the aforementioned limits and paid for as Structural Rock Excavation. When earth is required to be removed to uncover existing rock, it will mean to excavate to undisturbed solid bedrock and will be so measured for payment.

Special Backfill - The quantity measured for payment will be the number of cubic yards of material acceptably placed and measured in place.

206.05 **Basis of Payment** - The accepted quantities of Structural Excavation, when specified to be paid for separately, will be paid for at the Contract unit price per cubic yard. The work, whether paid for separately or incidental to the structure, shall include the placing and compacting of backfill, the formation of any embankments made with material from Structural Excavation and the disposal of all surplus or unsuitable material, unless otherwise specified.

Earth excavation for installation of Drainage and Minor Structures, except that which is defined as “Below Grade”, will not be paid for and all costs for such excavation and disposal of materials will be considered incidental to the Contract unit price per item for the structure being installed or constructed. Rock excavation for the installation of these structures will be paid for at the Contract unit price for Pay Item 206.07 - Structural Rock Excavation - Drainage and Minor Structures.

The accepted quantity of Structural Earth Excavation - Drainage and Minor Structures, Below Grade and of Structural Rock Excavation - Drainage and Minor Structures, will be paid for at the Contract unit price per cubic yard.

When bedrock is encountered and no Structural Rock Excavation - Drainage and Minor Structures item is included in the Contract, the excavation of the rock will be paid for at 16 times the Contract unit price per cubic yard for Common Excavation.

When bedrock is encountered and no Structural Rock Excavation - Major Structures is included in the Contract Documents, the excavation of the rock will be paid for at 6 times the Contract unit price for Structural Earth Excavation.

When it is necessary to excavate below the elevation indicated in the Contract Documents for Major Structures, payment for such excavation will be made at 1½ times the Contract unit price for the item classification applying where the extra depth is required.

Protective systems and/or additional excavation for backsloping required for Structural Excavation will not be measured for payment, but will be considered incidental to related Contract item(s).

When no bid item appears in the Contract for work such as, but not limited to, clearing drainage ways, maintenance of traffic, special detours or cofferdams, payment for such work shall not be made directly, but will be considered

incidental to related Contract pay items. Unless otherwise specified, payment for all pumping, bailing, drainage, sheeting, bracing and incidentals required for proper execution of the work shall be considered incidental to related Contract pay items.

Backfill or bedding materials, except for material used to backfill underdrain, whose source is other than Structural Excavation, will be paid for under the class of material used. Material used to backfill underdrain will not be paid for but shall be considered incidental to the cost of the underdrain.

Special Backfill - will be paid for at the Contract unit price per cubic yard, in place and accepted, but will not include replacement of material excavated beyond the specified pay limits for Structural Excavation.

Payment will be made under:

	Pay Item	Pay Unit
206.061	Structural Earth Excavation – Drainage & Minor Structures Below Grade	Cubic Yard
206.07	Structural Rock Excavation – Drainage & Minor Structures	Cubic Yard
206.082	Structural Earth Excavation – Major Structures, Plan Quantity	Cubic Yard
206.092	Structural Rock Excavation – Major Structures	Cubic Yard
206.14	Special Backfill	Cubic Yard

SECTION 207 - BRUSH MATTING - Reserved

SECTION 208 - SAND DRAINS - Reserved

SECTION 209 - WICK DRAINS - Reserved

SECTION 210 – Removed

SECTION 211 - DITCH AND INSLOPE EXCAVATION

- 211.01 **Description** - This work shall consist of removing winter sand build-up and other earth material from existing inslopes and ditches. New ditch areas consist of removing all material encountered including backslopes as needed.
- 211.02 **Inslope Excavation** - From the edge of shoulder to the subgrade break, the inslope will be graded to the original template, or as directed by the typical or construction notes. From the subgrade break to a location on the slope that does

not create a hinge point, the inslope shall be machine graded and finished to a smooth condition so that the flow of water is unimpeded.

- 211.03 ***Inslope Excavation - Guardrail*** - Winter sand and other earth materials shall be removed from all paved areas. From the edge of shoulder to the subgrade break, the inslope will be graded to the original template, or as directed by the typicals or construction notes. From the subgrade break to a location on the slope that does not create a hinge point, the inslope shall be machine graded and finished to a smooth condition so that the flow of water is unimpeded.
- 211.04 ***Inslope Rehabilitation*** - Material shall be excavated from or placed on inslopes. All inslopes shall be built, from the edge of shoulder to the toe of slope, to provide a 3 horizontal to 1 vertical minimum slope (1¾ horizontal to 1 vertical in guardrail sections), or as directed by the typicals or construction notes. Added material shall be capable of attaining a growth of grass and shall be approved by the Resident
- 211.05 ***Ditch Excavation*** - Ditches and adjacent slopes will be graded to the original template from the edge of shoulder to the top of the backslope, or as directed by the typicals or construction notes.
- 211.06 ***New Ditch Excavation*** - Ditches and adjacent slopes will be graded from the edge of shoulder to the top of the backslope as directed by the typicals or construction notes.
- 211.07 ***Method of Measurement*** - The quantity of work done will be measured by the linear foot. Measurements will be made along the ground parallel to the roadway centerline. Payment for inslope rehabilitation will include excavation and fill areas.
- 211.08 ***Basis of Payment*** - Payment will be full compensation for excavating, removing brush, trees and stumps, placing waste material in designated areas, disposing excess materials, rehabilitating waste areas including seed and mulch, and for grading and finishing the work.

In inslope rehabilitation areas, any borrow material needed to complete the rehabilitation of the inslopes will not be paid for separately, but will be considered incidental to this item.

When rock is encountered in new ditch excavation areas and new ditch excavation rock is not included in the Contract, the excavation of the rock will be paid for at 6 times the Contract unit price for new ditch excavation.

The work will not be accepted for payment until inspected and approved by the Resident or authorized personnel. Conditions of approval will include, but are not limited to, grade and smoothness, flow of runoff, proper functioning of the drainage system, and cleanup of all disturbed areas including waste disposal areas. Seed, mulch, and erosion control blanket applied on the Project will be paid for under appropriate Contract items.

Payment will be made under:

Pay Item		Pay Unit
211.20	Inslope Excavation	Linear Foot
211.21	Inslope Rehabilitation	Linear Foot
211.22	Inslope Excavation - Guardrail	Linear Foot
211.221	Inslope Excavation - Guardrail Plan Quantity	Linear Foot
211.30	Ditch Excavation	Linear Foot
211.40	New Ditch Excavation	Linear Foot
211.41	New Ditch Excavation - Ledge	Linear Foot

DIVISION 300 - BASES

SECTIONS 301, 302, 303 - Vacant

SECTION 304 - AGGREGATE BASE AND SUBBASE COURSE

304.01 **Description** - This work shall consist of furnishing and placing one or more courses of aggregates on a prepared surface in accordance with the specifications in reasonably close conformity with the lines, grades, thickness and typical cross sections, as shown on the plans or established.

304.02 **Aggregate** - Aggregates shall conform to the requirements specified in the following subsections of Division 700 - Materials:

Aggregate Base	Type A & B	703.06 a
Aggregate Base	Type C	703.06 b
Aggregate Subbase	Type D & E	703.06 c

Aggregate for base or subbase courses shall be material meeting the aggregate type requirements specified in the following table:

Material		Aggregate Type (Subsection 703.06)
Base Course, Crushed		¹ A, B or C
Subbase Course, Gravel		² D
¹	Will be designated on the plans	
²	When designated on the plans, Subbase Course, Gravel-Type E may be use below the top 9" of the subbase layer at Contractor's option.	

For the various types of base and subbase, all shall conform to the gradation requirements of the Contract at the time it is deposited on the roadbed. The Department will obtain samples from the roadbed for Acceptance prior to compaction. Oversized stones shall be removed from the aggregate before depositing on the roadway. Oversized stones for the various types are as follows:

- Type A will not pass a 2" square mesh sieve
- Type B and Type C will not pass a 4" square mesh sieve
- Type D and E will not pass a 6" square mesh sieve

The top 3" of Aggregate Base Course-Type C shall consist of Recycled Asphalt Pavement (RAP) or Untreated Aggregate Surface Course-Type B.

304.03 **Placing** - The maximum compacted thickness of any base or subbase course layer shall not exceed 12" unless the Contractor demonstrates by a test section that the required compaction can be obtained. If compacted layers more than

12" are allowed, the Contractor shall agree to make the necessary excavations and backfilling in the course for the Resident to determine the density.

When layers are constructed of differently graded aggregate, fine grading of the lower layer will not be required except when millings are placed as the upper most layer. In this case the coarse graded base layer shall be fine graded to +/- 3/4" and compacted to the required specification prior to placing the layer of millings. The layer of millings shall then be placed, shaped, and compacted within the tolerances specified below.

Each layer of aggregate shall be placed over the full width of the section except, the Resident may authorize the Contractor to place less than full width layers, when existing traffic or other conditions restrict operations over the full width of the section. When the Contractor places material to complete the full width, the exposed edge of the previously placed aggregate shall be cleaned of all contamination before additional base or subbase aggregate is placed adjacent to it.

The material as spread shall be well mixed with no pockets of either fine or coarse material. Segregation of large or fine particles will not be allowed.

304.04 ***Shaping, Compacting and Stabilizing*** - Compaction of each layer of base and subbase shall continue until a density of not less than 95% of the maximum density has been achieved for the full width and depth of the layer. The maximum density shall be determined in accordance with AASHTO T 180, Method C or D, correcting for oversize particles except mixtures may have 40% or less retained on the 3/4" sieve. Field density tests will be performed by the Department in accordance with AASHTO T 310.

Compaction of each layer of base or subbase material that exceeds 40% retained on the 3/4" sieve shall continue until a density of not less than 98% of the maximum density has been achieved for the full width and depth of the layer. Density tests and the maximum density determined by a field proctor shall be performed by the Department.

The surface, compaction and stability, shall be satisfactorily maintained until the pavement course has been placed. If required, additional water and fine material shall be applied to prevent checking, raveling or rutting.

If the top of any layer becomes contaminated by degradation of the aggregate or addition of foreign material, the contaminated material shall be removed and replaced with the specified material.

All layers of base and subbase course shall be compacted to the required density immediately after placing. As soon as the compaction of any layer has been completed, the next layer shall be placed unless otherwise authorized.

The Contractor shall bear full responsibility for and make all necessary repairs to the subbase course and the subgrade until the full depth of the subbase course

is placed and compacted. Repairs shall be considered incidental to other Contract items.

The top of any base or subbase course layer shall be scarified and loosened for a minimum depth of 1" immediately prior to the placing of the next layer of aggregate base or subbase. This scarifying shall be considered incidental to placing the course, and no separate payment will be made.

The surface of each layer shall be maintained during compaction operations in such a manner that a uniform texture is produced and the aggregate firmly keyed. The moisture content of the material shall be maintained at the proper percent to attain the required compaction and stability.

If voids remain on the surface after the subbase course has been constructed to grade, compacted, checked and approved, sand-leveling material shall be dumped and spread as directed. The quantity of sand leveling material shall be limited to the amount necessary to fill the voids and the minor low areas on the subbase surface. After the sand leveling material has been spread, it shall be completely rolled by a rubber-tired roller with water applied, if necessary. The surface of this material shall be maintained in its compacted and graded condition until the hot mix asphalt pavement has been placed. The furnishing, spreading, compacting and maintaining of sand leveling material will be considered included in the measurement and payment of the subbase course and no separate payment will be made.

If the Contractor wishes to route public traffic over the completed Aggregate Base-Type A and B or Aggregate Subbase Course for a period of time greater than 48 hours, the Aggregate Base and Aggregate Subbase Course shall be constructed with a minimum 2" surcharge above the design grade. Surcharge shall be constructed with material meeting the requirements of Section 703.06(b), Subbase Aggregate-Type D. Whenever the surcharge is used, it shall be placed on all the Aggregate Base and Aggregate Subbase Course subjected to public traffic. When the surcharge is removed, it may be placed in driveways, sidewalks, approach roads, or the outer portions of the shoulders. Removal of the surcharge shall be followed immediately in succession by the fine grading of the aggregate base or subbase and construction of the HMA base layer. As per Subsection 203.041 - Salvage of Existing Hot Mix Asphalt Pavement, Recycled Asphalt Pavement (RAP) may be used as the top 3" of aggregate. If RAP is utilized as the top 3", a surcharge is not required.

The furnishing, placing, maintaining, and removal of the surcharge will not be paid for directly, but will be considered incidental to the Aggregate Base or Aggregate Subbase course pay item.

- 304.05 **Surface Tolerance** - The completed surface of the subbase or base course shall be shaped and maintained to a tolerance, above or below the required cross sectional shape, of $\frac{3}{8}$ ".

304.06 **Method of Measurement** - Except as otherwise provided, base course subbase course to the level of subgrade will be measured by the cubic yard in place unless designated by pay item to be measured by truck measure. When measured in place, the width and thickness for measurement will be the width and thickness of base or subbase as shown on the plans or as modified. The length will be along the centerline unless modified by other methods generally recognized as conforming to good engineering practice. All measurements will be in accordance with Section 108.1 - Measurement of Quantities for Payment. When designated by pay item to be measured by truck measure, the measurement will be made in vehicles at the point of delivery as shown on delivery slips in accordance with Section 108.1.3 F - Delivery Slips.

As an alternative to in-place measurement, the Contractor and the Resident may agree in writing that the quantities of base or subbase for payment will be that shown in the Schedule of Items. If such an agreement is reached, no further measuring and computing of quantities will be required and the quantity referred to herein will be final.

Aggregate base course and aggregate subbase course designated by pay item to be measured in place and used for driveways and other locations difficult to accurately measure in place, may be measured in vehicles at 80% of the number of cubic yards accepted and used, at the point of delivery as shown by "Delivery Slips" in accordance with Section 108.1.3 F. The quantity so measured shall not exceed 1,250 yd³ per Contract, after shrinkage.

Pit measured items will be measured by the cubic yard in its' original position by ground modeling or other approved surveying methods. The final quantity will be the amount actually removed from the pit and used on the Project. Tailings, screenings, overburden, material used as other pay items, waste, and unauthorized use of the material will be deducted from the final quantity amount.

304.07 **Basis of Payment** - The accepted quantities of base course and subbase course of the type specified will be paid for at the respective Contract unit price per cubic yard complete in place.

When aggregate is required for slope blanket backfill, bedding under drainage structures and other foundations, it shall be paid for at twice the Contract unit price for the respective aggregate base or subbase course item used.

Payment for base and subbase courses shall be full compensation for purchasing material, stripping pits, excavating, crushing, screening, hauling, placing, compacting and other necessary processes which are required to furnish acceptable material under this item.

Water and/or fines added to material to aid compaction and stabilization to prevent raveling and rutting shall be incidental to the work.

The quantity for payment of base and subbase placed on rock subgrade shall include only that material placed above the normal subgrade line.

Furnishing and placing base and sub base backfill material between the rock and the normal subgrade line will not be paid for directly but shall be considered incidental to the work.

Payment will be made under:

Pay Item		Pay Unit
304.10	Aggregate Subbase Course-Gravel	Cubic Yard
304.103	Aggregate Subbase Course-Gravel, Truck Measure	Cubic Yard
304.104	Aggregate Subbase Course-Gravel, Plan Quantity	Cubic Yard
304.14	Aggregate Base Course - Type A	Cubic Yard
304.15	Aggregate Base Course - Type B	Cubic Yard
304.16	Aggregate Base Course - Type C	Cubic Yard

SECTION 305 – Removed

SECTION 306 - RECLAIMED MATERIAL FOR STABILIZED BASE - Reserved

SECTION 307 - FULL DEPTH RECYCLING (UNTREATED OR TREATED WITH EMULSIFIED ASPHALT STABILIZER)

- 307.01 **Description** - This work shall consist of pulverizing a portion of the existing roadway structure into a homogenous mass, adding an emulsified asphalt stabilizer (if required) to the depth of the pulverized material specified in the Contract, placing and compacting this material to the lines, grades, and dimensions shown on the plans or established by the Resident.

MATERIALS

- 307.02 **Pulverized Material** - Pulverized material shall consist of the existing asphalt pavement layers and 1" or more as specified of the underlying gravel, pulverized and blended into a homogenous mass. Pulverized material will be processed to 100% passing a 2" square mesh sieve.
- 307.021 **New Aggregate and Additional Recycled Material** - New aggregate, if required by the Contract, shall meet the requirements of Subsection 703.10 - Aggregate for Untreated Surface Course and Leveling Course, Type A. Aggregate Subbase Course Gravel Type D processed to 100% passing a 2" square mesh sieve and meeting the requirements of 703.06 – Aggregate for Base and Subbase may be used in areas

requiring depths greater than 2". New aggregate, will be measured and paid for under the appropriate item.

Recycled material, if required, shall consist of salvaged asphalt material from the Project or from off-site stockpiles that has been processed before use to 100% passing a 2" square mesh sieve. Recycled material shall be conditionally accepted at the source by the Resident. It shall be free of winter sand, granular fill, construction debris, or other materials not generally considered asphalt pavement.

Recycled material generated and salvaged from the Project shall be used within the roadway limits to the extent it is available as described in 307.09. No additional payment will be made for material salvaged from the Project.

Recycled material supplied from off-site stockpiles shall be paid for as described in the Contract, or by Contract modification.

- 307.022 **Emulsified Asphalt Stabilizer** - If required, the emulsified asphalt stabilizer shall be grade MS-2, MS-4, SS-1, or CSS-1 meeting the requirements of Subsection 702.04 - Emulsified Asphalt.
- 307.023 **Water** - Water shall be clean and free from deleterious concentrations of acids, alkalis, salts or other organic or chemical substances.
- 307.024 **Portland Cement** - If required, Portland Cement shall be Type I or II meeting the requirements of AASHTO M 85.
- 307.025 **Hydrated Lime** - If required, Hydrated Lime shall meet the requirements of AASHTO M 216.

EQUIPMENT

- 307.03 **Pulverizer** - The pulverizer shall be a self-propelled machine, specifically manufactured for full-depth recycling work and capable of reducing the required existing materials to a size that will pass a 2" square mesh sieve. The machine shall be equipped with standard automatic depth controls and must maintain a consistent cutting depth and width. The machine also shall be equipped with a gauge to show depth of material being processed.
- 307.04 **Liquid Mixer Unit or Distributor** - If treatment of the recycled layer with emulsified asphalt is required by the Contract, a liquid mixing unit or distributor shall be used to introduce the emulsified asphalt stabilizer into the pulverized material. The mixing unit shall contain a liquid distribution and mixing system which has been specifically manufactured for full-depth recycling work, capable of mixing the pulverized material with an evenly metered distribution of emulsified asphalt into a homogeneous mixture, to the depth and width required.

The mixing unit shall be designed, equipped, maintained, and operated so that emulsified asphalt stabilizer at constant temperature may be applied uniformly

on variable widths of pulverized material up to 6 ft at readily determined and controlled rates from 0.01 to 1.06 gal/yd² with uniform pressure and with an allowable variation from any specified rate not to exceed 0.01 gal/yd². Mixing units shall include a tachometer, pressure gages, and accurate volume measuring devices or a calibrated tank and a thermometer for measuring temperatures of tank contents.

- 307.041 **Cement or Lime Spreader** - If required by the Contract, spreading of the Portland Cement or Hydrated Lime shall be done with a spreader truck designed to spread dry particulate (such as Portland Cement or Lime) or other approved means to insure a uniform distribution across the roadway and minimize fugitive dust. Pneumatic application, including through a slotted pipe, will not be permitted. Other systems that have been developed include fog systems, vacuum systems, etc. Slurry applications may also be accepted. The Department reserves the right to accept or reject the method of spreading cement. The Contractor shall provide a method for verifying that the correct amount of cement is being applied.
- 307.05 **Placement Equipment** - Placement of the Full Depth recycled material to the required slope and grade shall be done with an approved highway grader or by another method approved by the Resident.
- 307.06 **Rollers** - The full depth recycled material shall be rolled with a vibratory pad foot roller, a vibratory steel drum soil compactor and a pneumatic tire roller. The pad foot roller drum shall have a minimum of 112 tamping ft 3" in height, a minimum contact area per foot of 17 in², and a minimum width of 84". The vibratory steel drum roller shall have a minimum 84" width single drum. The pneumatic tire roller shall meet the requirements of Section 401.10 and the minimum allowable tire pressure shall be 85 psi.

MIX DESIGN

If treatment of the recycled layer with emulsified asphalt is required by the Contract, the Department will supply a mix design for the emulsified asphalt stabilized material based on test results from pavement and soil analysis taken to the design depth. The Department will provide the following information prior to construction:

1. Percent of emulsified asphalt to be used.
2. Quantity of lime or cement to be added.
3. Optimum moisture content for proper compaction.
4. Additional aggregate (if required).

After a test strip has been completed or as the work progresses, it may be necessary for the Resident to make necessary adjustments to the mix design. Changes to compensation will be in accordance with the Mix Design Special Provision.

CONSTRUCTION REQUIREMENTS

- 307.06 **Pulverizing** - The entire depth of existing pavement shall be pulverized together with 1" or more of the underlying gravel into a homogenous mass. All pulverizing shall be done with equipment that will provide a homogenous mass of pulverized material, processed in-place, which will pass a 2" square mesh sieve.
- 307.07 **Weather Limitations** - Full depth recycled work shall be performed when;
- Recycling operations will be allowed between May 15th and September 15th inclusive in Zone 1 - Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais. Recycling will be allowed between May 1st and September 30th inclusive in Zone 2 - Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.
 - The atmospheric temperature, as determined by an approved thermometer placed in the shade at the recycling location, is 50°F and rising.
 - When there is no standing water on the surface.
 - During generally dry conditions, or when weather conditions are such that proper pulverizing, mixing, grading, finishing and curing can be obtained using proper procedures, and when compaction can be accomplished as determined by the Resident.
 - When the surface is not frozen and when overnight temperatures are expected to be above 32°F.
 - Wind conditions are such that the spreading of lime or cement on the roadway ahead of the recycling machine will not adversely affect the operation.
- 307.08 **Surface Tolerance** - The complete surface of the Full Depth Recycled course shall be shaped and maintained to a tolerance, above or below the required cross sectional shape, of $\frac{3}{8}$ ".
- 307.09 **Full Depth Recycling Procedure** - New aggregate or recycled material meeting the requirements of Section 307.021 - New Aggregate and Additional Recycled Material, shall be added as necessary to restore cross-slope and/or grade before pulverizing. Locations will be shown on the plans or described in the construction notes. The Resident may add other locations while construction of the Project is in progress. The Contractor will use recycled material to the extent it is available, in lieu of new aggregate. The material shall then be pulverized, processed, and blended into a homogeneous mass passing a 2" square mesh sieve. Material found not pulverized down to a 2" size will be required to be reprocessed by the recycler with successive passes until approved by the Resident.

Should the Contractor be required to add new aggregate or recycled material to restore cross-slope and/or grade after the initial pulverizing process, those areas will require re-processing to blend into a homogenous mass passing a 2" square mesh sieve.

Sufficient water shall be added during the recycling process to maintain optimum moisture for compaction.

The resultant material from the initial pulverizing processes shall be graded and compacted to the cross-slope and profile shown on the plans or as directed by the Resident. The Contractor will also be responsible for re-establishing the existing profile grade. The completed surface of the full depth recycled course shall be shaped and maintained to a tolerance, above or below the required cross sectional shape, of $\frac{3}{8}$ ". Areas not meeting this tolerance will be repaired as described in Section 307.091. The initial pulverizing process density requirements will be the same as Section 307.101 unless otherwise directed by the Resident.

Additives, if required, shall be introduced following completion of the initial pulverizing and blending process. Emulsified asphalt stabilizer shall be incorporated into the top of the processed material as specified in section 307.04 to the depth specified in the Contract by use of the liquid mixer unit or a distributor, at the rate specified in the mix design. The emulsified asphalt shall then be uniformly blended into a homogeneous mass until an apparent uniform distribution has occurred. The rate of application may be adjusted as necessary by the Resident. Cement or lime shall be introduced as described in section 307.041. The resultant material shall be graded and compacted to the cross-slope and profile shown on the plans or as directed by the Resident. The Contractor will also be responsible for re-establishing the existing profile grade.

After final compaction, the roadway surface shall be treated with a light application of water and rolled with pneumatic-tired rollers to create a close-knit texture. The finished final completed layer shall be free from:

- A. Surface laminations.
- B. Portions exhibiting Segregation of fine and coarse aggregate.
- C. Corrugations, centerline differential, potholes, or any other defects that may adversely affect the performance of the layer, or any layers to be placed upon it.

The Contractor shall protect and maintain the recycled layer until a lift of pavement is applied. Any damage or defects in the layer shall be repaired immediately. An even and uniform surface shall be maintained. The recycled surface shall be swept prior to hot mix asphalt overlay placement.

307.091 **Repairs** - Repairs and maintenance of the recycled layers, resulting from damage caused by traffic, weather or environmental conditions, or resulting from damage caused by the Contractor's operations or

equipment, shall be completed at no additional cost to the Department.

For recycled layers stabilized with emulsified asphalt, low areas will be repaired using a hot mix asphalt shim. Areas up to 1" high can be repaired by milling or shimming with hot mix asphalt. Areas greater than 1" high will be repaired using a hot mix asphalt shim. All repair work will be done with the Resident's approval at the Contractor's expense.

TESTING REQUIREMENTS

- 307.10 **Quality Control** - The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The QCP shall meet the requirements of Section 106.4 - Quality Control and this Section. The Contractor shall not begin recycling operations until the Department approves the QCP in writing.

Prior to performing any recycling process, the Department and the Contractor shall hold a Pre-recycle conference to discuss the recycling schedule, type and amount of equipment to be used, sequence of operations, and traffic control. A copy of the QC random numbers to be used on the Project shall be provided to the Resident. All field supervisors including the responsible onsite recycling process supervisor shall attend this meeting.

The QCP shall address any items that affect the quality of the Recycling Process including, but not limited to, the following:

- A. Sources for all materials, including New Aggregate and Additional Recycled Material.
- B. Make and type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers.
- C. Testing Plan.
- D. Recycling operations including recycling speed, methods to ensure that segregation is minimized, grading and compacting operations.
- E. Methods for protecting the finished product from damage and procedures for any necessary corrective action.
- F. Method of grade checks.
- G. Examples of Quality Control forms.
- H. Name, responsibilities, and qualifications of the Responsible Onsite Recycling Supervisor experienced and knowledgeable with the process.
- I. A note that all testing will be done in accordance with AASHTO and MaineDOT/ACM procedures.

The Project Superintendent shall be named in the QCP, and the responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall sample, test, and evaluate the full depth reclamation process in accordance with the following minimum frequencies:

MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Density	1 per 1000 ft / lane	AASHTO T 310
Air Temperature	4 per Day at even intervals	
Surface Temperature	At the beginning and end of each Days operation	
Yield of all materials (Daily yield, yield since last test, and total Project yield.)	1 per 1000 ft/lane	

The Department may view any QC test and request a QC test at any time. The Contractor shall submit all QC test reports and summaries in writing, signed by the appropriate technician, to the Department's onsite representative by 1:00 p.m. on the next Working Day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make all test results, including randomly sampled densities, available to the Department onsite.

The Contractor shall cease recycling operations whenever one of the following occurs:

- A. The Contractor fails to follow the approved QCP.
- B. The Contractor fails to achieve 98% density after corrective action has been taken.
- C. The finished product is visually defective, as determined by the Resident.
- D. The computed yield differs from the mix design by 10% or more.

Recycling operations shall not resume until the Department approves the corrective action to be taken.

307.101 **Test Strip** - The Contractor shall assemble all items of equipment for the recycling operation on the 1st Day of the recycling work. The Contractor shall construct a test strip for the Project at a location approved by the Resident. The Responsible onsite Recycling Supervisor will work with Department personnel to determine the suitability of the mixed material, moisture control within the mixed material, and compaction and surface finish. The test strip section is required to:

- A. Demonstrate that the equipment and processes can produce recycled layers to meet the requirements specified in these special provisions.

- B. Determine the effect on the gradation of the recycled material by varying the forward speed of the recycling machine and the rotation rate of the milling drum.
- C. Determine the optimum moisture necessary to achieve proper compaction of the recycled layer.
- D. Determine the sequence and manner of rolling necessary to obtain the compaction requirements and establish a target density. The Contractor and the Department will both conduct testing with their respective gauges at this time.

The test strip shall be at least 300 ft in length of a full lane-width (or a half-road width). Full recycling production will not start until a passing test strip has been accomplished. If a test strip fails to meet the requirements of this specification, the Contractor will be required to repair or replace the test strip to the satisfaction of the Resident. Any repairs, replacement, or duplication of the test strip will be at the Contractor's expense.

After the test strip has been pulverized, and the roadway brought to proper shape, the Contractor shall add water until it is determined that optimum moisture has been obtained. The test strip shall then be rolled using the specified compaction equipment as directed until the density readings show an increase in dry density of less than 1 pcf for the final four roller passes of each roller. The Contractor and Department will each determine a target density using their respective gauges by performing several additional density tests and averaging them. The average of these tests will be used as the target density of the recycled material for QC and Acceptance purposes.

Following completion of the test strip, compaction of the material shall continue until a density of not less than 98% of the test strip target density has been achieved for the full width and depth of the layer. During the construction and compaction of the Full Depth Recycled base, should 3 consecutive Acceptance test results for density fail to meet a minimum of 95% of the target density, or exceed 102% of target density, a new test strip shall be constructed.

ACCEPTANCE TEST FREQUENCY

Property	Frequency	Test Method
In-place Density	1 per 2000 ft / lane	AASHTO T 310

- 307.102 **Curing** - No new pavement shall be placed on the full depth recycled pavement until curing has reduced the moisture content to 1% or less by total weight of the mixture, or a curing period of 4 Days has elapsed, whichever comes first.

307.11 **Method of Measurement** - Full Depth Recycled Pavement (Untreated or Treated with Emulsified Asphalt Stabilizer) will be measured by the square yard.

307.12 **Basis of Payment** - The accepted quantity of Full Depth Recycled Asphalt Pavement (Untreated or Treated with Emulsified Asphalt Stabilizer) will be paid for at the Contract unit price per square yard, complete in-place which price will be full compensation for furnishing all equipment, materials and labor for pulverizing, blending, placing, grading, compacting, and for all incidentals necessary to complete the work.

The addition of materials to restore profile grade and/or cross-slope in areas shown on the plans or described in the construction notes will be paid separately under designated pay items within the Contract. No additional payment will be made for materials salvaged from the Project.

Payment will be made under:

Pay Item		Pay Unit
307.331	Full Depth Recycled Pavement (Untreated)	Square Yard
307.332	Full Depth Recycled Pavement (with Emulsified Asphalt Stabilizer) 5" depth	Square Yard
307.33	Full Depth Recycled Pavement (with Emulsified Asphalt Stabilizer) 6" depth	Square Yard

SECTION 308 - FULL DEPTH RECYCLING WITH CEMENT

308.01 **Description** - This work shall consist of pulverizing a portion of the existing roadway structure into a homogenous mass, stabilizing the material with cement and placing and compacting this material to the lines, grades, and dimensions shown on the plans or established by the Resident.

MATERIALS

308.02 **Pulverized Material** - Pulverized material shall consist of the existing asphalt pavement and 1" or more as specified of the underlying gravel, pulverized, and blended into a homogenous mass. Pulverized material will be processed to 100% passing a 2" square mesh sieve.

308.021 **New Aggregate and Additional Recycled Material** - New aggregate, if required by the Contract, shall meet the requirements of Subsection 703.10 - Aggregate for Untreated Surface Course and Leveling Course, Type A. Aggregate Subbase Course Gravel Type D processed to 100% passing a 2" square mesh sieve and meeting the requirements of 703.06 – Aggregate for Base and Subbase may be used in areas requiring depths greater than 2". New aggregate will be measured and paid for under the appropriate item.

Recycled material, if required, shall consist of salvaged asphalt material from the Project or from off-site stockpiles that has been processed before use to 100% passing a 2" square mesh sieve. Recycled material shall be conditionally accepted at the source by the Resident. It shall be free of winter sand, granular fill, construction debris, or other materials not generally considered asphalt pavement.

Recycled material generated and salvaged from the Project shall be used within the roadway limits to the extent it is available as described in 308.09. No additional payment will be made for material salvaged from the Project.

Recycled material supplied from off-site stockpiles shall be paid for as described in the Contract, or by Contract modification.

308.022 **Portland Cement** - The Portland Cement shall be Type I or II meeting the requirements of AASHTO M 85.

308.023 **Water** - Water shall be clean and free from deleterious concentrations of acids, alkalis, salts or other organic or chemical substances.

EQUIPMENT

308.03 **Pulverizer** - The pulverizer shall be a self-propelled machine, specifically manufactured for full-depth recycling work and capable of reducing the required existing materials to a size that will pass a 2" square mesh sieve. The machine shall be equipped with standard automatic depth controls and must maintain a consistent cutting depth and width. The machine also shall be equipped with a gauge to show depth of material being processed.

308.031 **Cement Spreader** - Spreading of the Portland Cement shall be done with a spreader truck designed to spread dry particulate (such as Portland Cement or Lime) or other approved means to insure a uniform distribution across the roadway and minimize fugitive dust. Pneumatic application, including through a slotted pipe, will not be permitted. Other systems that have been developed include fog systems, vacuum systems, etc. Slurry applications could also be accepted. The Department reserves the right to accept or reject the method of spreading cement based on the concerns specified herein. The Contractor shall provide a method for verifying that the correct amount of cement is being applied.

Health and Safety/Right-to-Know - Portland Cement is considered a hazardous chemical under US OSHA Hazard Communication Rule 29 CFR 1910.120, therefore, all Contractors and Subcontractors are required to notify their workers of the potential health hazards associated with working with Portland Cement.

In no area of the work site, where cement or cement-pavement-gravel combination is being applied, re-worked with reclaimer, rolled or graded, shall respirable dust be allowed to exceed the NIOSH [1974] established respirable dust standard (RDS) recommended exposure limit (REL) of 0.05 mg/m³ (for up to a 10 hour workday during a 40 hour work week).

The Contractor shall notify the Resident before commencing any work that involves Portland Cement application, reclaiming, rolling, or grading.

The Contractor shall designate a Hazardous Waste Operations "Competent Person" to provide direct on-site supervision plus health and safety monitoring for work in the Portland Cement impacted sections of the Project. The Competent Person shall have certified training and experience in field implementation of the aforementioned regulations.

Submittals - The Contractor shall submit a site specific Health and Safety Plan (HASP) to the Resident at least 2 weeks in advance of any Portland Cement related work on the Project.

Health and Safety Monitoring - In any area of the Project where Portland Cement is being worked, the Contractor's designated Competent Person shall monitor the worker breathing zone for respirable dust. In the event the OSHA respirable dust REL is exceeded, the Contractor's Competent Person shall direct operations to cease. Operations will not recommence until the situation is corrected and respirable air returns to acceptable levels. The Contractor shall provide all required health and safety monitoring equipment.

308.04 **Placement Equipment** - Placement of the Full Depth recycled material to the required slope and grade shall be done with an approved highway grader or by another method approved by the Resident.

308.05 **Rollers** - The full depth recycled material shall be rolled with a vibratory pad foot roller, a vibratory steel drum soil compactor and a pneumatic tire roller. The pad foot roller drum shall have a minimum of 112 tamping foot 3" in height, a minimum contact area per foot of 17 in², and a minimum width of 84". The vibratory steel drum roller shall have a minimum 84" width single drum. The pneumatic tire roller shall meet the requirements of Section 401.10 and the minimum allowable tire pressure shall be 85 psi.

MIX DESIGN

The Department will supply a mix design for the recycling work based on test results from pavement and soil analysis taken to the design depth. The Department will provide the following information prior to construction:

1. Percent of Portland Cement to be used.
2. Optimum moisture content for proper compaction.
3. Additional aggregate (if required).

After a test strip has been completed or as the work progresses, it may be necessary for the Resident to make necessary adjustments to the mix design. Changes to compensation will be in accordance with the Mix Design Special Provision.

CONSTRUCTION

308.06 **Pulverizing** - The entire depth of existing pavement shall be pulverized together with approximately 1" or more of the underlying gravel into a homogenous mass. All pulverizing shall be done with equipment that will provide a homogenous mass of pulverized material, processed in-place, which will pass a 2" square mesh sieve.

308.07 **Weather Limitations** - When Portland Cement is used, full depth recycled work shall be performed when;

- a. Cement stabilizing operations will be allowed between May 15th and September 15th inclusive in Zone 1 - Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais. Cement stabilizing will be allowed between May 1st and September 30th inclusive in Zone 2 - Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.
- b. The atmospheric temperature, as determined by an approved thermometer placed in the shade at the recycling location, is 50°F and rising.
- c. When there is no standing water on the surface.
- d. During generally dry conditions, or when weather conditions are such that proper pulverizing, adding, mixing, and curing can be obtained using proper procedures, and when compaction can be accomplished as determined by the Resident.
- e. When the surface is not frozen and when overnight temperatures are expected to be above 32°F.
- f. Wind conditions as such that the spreading of cement on the roadway ahead of the recycling machine will not adversely affect the operation (cement will not be blown away).

308.08 **Surface Tolerance** - The complete surface of the Full Depth Reclamation course shall be shaped and maintained to a tolerance, above or below the required cross sectional shape, of $\frac{3}{8}$ ".

308.09 **Full Depth Recycling Procedure** - New aggregate or recycled material meeting the requirements of Section 308.021 - New Aggregate and Additional Recycled Material shall be added as necessary to restore cross-slope and/or grade before pulverizing. Locations will be shown on the plans or described in the construction notes; the Resident may add other locations while construction of the Project is in progress. The Contractor will use recycled material to the extent it is available, in lieu of new aggregate. The material shall then be pulverized, processed, and blended into a homogeneous mass passing a 2" square mesh sieve. Material found not pulverized down to a 2" size will be required to be reprocessed by the recycler with successive passes until approved by the Resident.

Should the Contractor be required to add new aggregate or recycled material to restore cross-slope and/or grade after the initial pulverizing process, those areas will require re-processing to blend into a homogenous mass passing a 2" square mesh sieve.

The resultant material shall be graded and compacted to the cross-slope and profile shown on the plans or as directed by the Resident. The Contractor will also be responsible for re-establishing the existing profile grade. The completed surface of the full depth recycled course shall be shaped and maintained to a tolerance, above or below the required cross sectional shape, of $\frac{3}{8}$ ". The initial reclaiming process density requirements will be the same as Section 308.101 unless otherwise directed by the Resident.

Following completion of the initial reclaiming process cement shall be spread uniformly over the full width of roadway to be recycled just prior to each pass of the stabilizing operation, in a continuous process by means of a mechanical spreader. Dry stabilizing agents shall be spread at the prescribed rate in the mix design as provided by the Department. These additives shall then be uniformly blended into a homogeneous mass until an apparent uniform distribution has occurred. The Resident may adjust the rate of application as necessary.

Sufficient water shall be added through the recycler head during the recycling process to ensure thorough blending to meet the optimum moisture for compaction as specified. Water shall be added only by means of a controlled system on the recycling machine. Care shall be taken to prevent any portion of the work from excessive wetting. A second water truck may be required during recycling operations to assist in the compaction and water control efforts. The rate of water supplied shall be kept constant unless changed due to Project material changes.

The resultant material shall be graded and compacted to the cross-slope and profile shown on the plans or as directed by the Resident. The Contractor will

also be responsible for re-establishing the existing profile grade. The completed surface of the full depth recycled course shall be shaped and maintained to a tolerance, above or below the required cross sectional shape, of $\frac{3}{8}$ ". Areas not meeting this tolerance will be repaired as described in Section 308.091.

After compaction, the roadway surface shall be treated with a light application of water, and rolled with pneumatic-tired rollers to create a close-knit texture. The finished final completed layer shall be free from:

- A. Surface laminations,
- B. Portions exhibiting segregation of fine and coarse aggregate,
- C. Corrugations, centerline differential, potholes, or any other defects that may adversely affect the performance of the layer.

The Contractor shall protect and maintain the recycled layer until a lift of pavement is applied. Frequent light watering shall be performed to keep the finished cement stabilized material moist for at least 48 hours. Watering will continue from 48 hours to 1 week if the equipment is available on-site. Any damage or defects in the layer shall be repaired immediately. An even and uniform surface shall be maintained. The recycled surface shall be swept prior to hot mix asphalt placement.

308.091 **Repairs** - Repairs and maintenance of the recycled layers, during and after the curing period, resulting from damage caused by traffic, weather or environmental conditions, or resulting from damage caused by the Contractor's operations or equipment, shall be completed at no additional cost to the Department.

Low areas will be repaired using a hot mix asphalt shim. Areas up to 1" high can be repaired by either milling the high area or shimming the low areas adjacent to the high area with hot mix asphalt areas greater than 1" high will be repaired by shimming the low areas adjacent to the high area with hot mix asphalt. All repair work will be done with the Resident's approval at the Contractor's expense.

TESTING REQUIREMENTS

308.10 **Quality Control** - The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The QCP shall meet the requirements of Section 106.4 - Quality Control and this Section. The Contractor shall not begin recycling operations until the Department approves the QCP in writing.

Prior to performing any recycling process, the Department and the Contractor shall hold a Pre-recycle conference to discuss the recycling schedule, type and amount of equipment to be used, sequence of operations, and traffic control. A copy of the QC random numbers to be used on the Project shall be provided to

the Resident. All field supervisors including the responsible onsite recycling process supervisor shall attend this meeting.

The QCP shall address any items that affect the quality of the Recycling Process including, but not limited to, the following:

- A. Sources for all materials, including New Aggregate and Additional Recycled Material.
- B. Make and type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers.
- C. Testing Plan.
- D. Recycling operations including recycling speed, yield monitoring, procedures for avoiding recycling and curing in inclement weather, methods to ensure that segregation is minimized, procedures for mix design modification, grading and compacting operations, and methods to introduce water throughout the cement treated layer, and cement application procedure.
- E. Methods for protecting the finished product from damage and procedures for any necessary corrective action.
- F. Method of grade checks.
- G. Examples of Quality Control forms.
- H. Name, responsibilities, and qualifications of the Responsible Onsite Recycling Supervisor experienced and knowledgeable with the process.
- I. A note that all testing will be done in accordance with AASHTO and MaineDOT/ACM procedures.

The Project Superintendent shall be named in the QCP, and the responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall sample, test, and evaluate the full depth reclamation process in accordance with the following minimum frequencies:

MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Density	1 per 1000 ft / lane	AASHTO T 310
Air Temperature	4 per Day at even intervals	
Surface Temperature	At the beginning and end of each Days operation	
Yield of all materials (The daily yield, yield since last test, and total Project yield.)	1 per 1000 ft / lane	

The Department may view any QC test and request a QC test at any time.

The Contractor shall submit all QC test reports and summaries in writing, signed by the appropriate technician, to the Department's onsite representative by 1:00 p.m. on the next Working Day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make all test results, including randomly sampled densities, available to the Department onsite.

The Contractor shall cease recycling operations whenever one of the following occurs:

- A. The computed yield differs from the mix design by 10% or more.
- B. The Contractor fails to follow the approved QCP.
- C. The Contractor fails to achieve 98% density after corrective action has been taken.
- D. The finished product is visually defective, as determined by the Resident.

Recycling operations shall not resume until the Department approves the corrective action to be taken.

308.101 **Test Strip** - The Contractor shall assemble all items of equipment for the recycling operation on the first Day of the recycling work. The Contractor shall construct a test strip for the Project at a location approved by the Resident. The Responsible Onsite Recycling Supervisor will work with Department personnel to determine the suitability of the mixed material, cement dispersion within the mixed material, moisture control within the mixed material, and compaction and surface finish. The test strip section is required to:

- A. Demonstrate that the equipment and processes produce recycled layers to meet the requirements specified requirements.
- B. Determine the effect on the gradation of the recycled material by varying the forward speed of the recycling machine and the rate of rotation rate of the milling drum.
- C. Determine the optimum moisture necessary to achieve proper compaction of the recycled layer.
- D. Determine the sequence and manner of rolling necessary to obtain the compaction requirements and establish a target TMD. The Contractor and the Department will both conduct testing with their respective gauges at this time.

The test strip shall be at least 300 ft in length of a full lane-width (or a half-road width). Full recycling production will not start until a passing test strip has been accomplished. If a test strip fails to meet the requirements of this specification, the Contractor will be required to repair or replace the test strip to the satisfaction of the Resident. Any repairs, replacement, or duplication of the test strip will be at the Contractor's expense.

After the test strip has been pulverized, and the roadway brought to proper shape, the Contractor shall add water until it is determined that optimum moisture has been obtained. The test strip shall then be rolled using the specified compaction equipment as directed until the density readings show an increase in dry density of less than 1 pcf for the final four roller passes of each roller. The Contractor and Department will each determine a target density using their respective gauges by performing several additional density tests and averaging them. The average of these tests will be used as the target density of the recycled material for QC and Acceptance purposes.

Following completion of the test strip, compaction of the material shall continue until a density of not less than 98% of the test strip target density has been achieved for the full width and depth of the layer. During the construction and compaction of the Full Depth Recycled base, should three consecutive Acceptance test results for density fail to meet a minimum of 95% of the target density, or exceed 102% of target density, a new test strip shall be constructed.

ACCEPTANCE TEST FREQUENCY

Property	Frequency	Test Method
In-place Density	1 per 2000 ft / lane	AASHTO T 310

- 308.11 **Miscellaneous** - No new pavement shall be placed on the full depth recycled pavement until a curing period of 48 hours has elapsed. If inclement weather occurs, the Department reserves the right to extend the curing period. Between 24 and 48 hours after compaction, the finished course shall be vibrated with between 2 and 4 passes of a 12 ton minimum weight steel-wheel vibratory roller, traveling at a speed of approximately 2 mph and vibrating at maximum amplitude (or as directed by Resident). The section shall have 100% coverage exclusive of the outside 1 ft to induce minute cracks in the treated base course. Additional passes may be required to achieve the desired crack pattern or section modulus as directed by the Resident.
- 308.12 **Method of Measurement** - Full Depth Recycled Pavement with Cement will be measured by the square yard.
- 308.13 **Basis of Payment** - The accepted quantity of Full Depth Recycled Asphalt Pavement with Cement will be paid for at the Contract unit price per square yard, complete in-place which price will be full compensation for furnishing all equipment, materials and labor for pulverizing, blending, placing, grading, compacting, and for all incidentals necessary to complete the work.

The addition of materials to restore profile grade and/or cross-slope in areas shown on the plans or described in the construction notes will be paid separately under designated pay items within the Contract. No additional payment will be made for materials salvaged from the Project.

Payment will be made under:

Pay Item		Pay Unit
308.36	Full Depth Recycling with Cement	Square Yard

SECTION 309 - FOAMED ASPHALT

FULL DEPTH RECYCLED PAVEMENT (With Foamed Asphalt)

- 309.01 **Description** - This work shall consist of pulverizing a portion of the existing roadway structure into a homogenous mass, treating the pulverized material with the foamed asphalt process, and placing and compacting this material to the lines, grades, and dimensions shown on the plans or established by the Resident.

MATERIALS

- 309.020 **Pulverized Material** - Pulverized material shall consist of the existing asphalt pavement and 1" or more as specified of the underlying gravel, pulverized and blended into a homogenous mass. Pulverized material will be processed to 100% passing a 2" square mesh sieve.

- 309.021 **New Aggregate and Additional Recycled Material** - New aggregate, if required by the Contract, shall meet the requirements of Section 703.10 - Aggregate for Untreated Surface Course and Leveling Course, Type A. Aggregate Subbase Course Gravel Type D processed to 100% passing a 2" square mesh sieve and meeting the requirements of 703.06 - Aggregate for Base and Subbase may be used in areas requiring depths greater than 2". New aggregate required to restore grade and/or cross-slope shall be measured and paid for under the appropriate item. Crusher dust required as part of the job mix shall be considered part of the 309 item and will not be measured for payment.

Recycled material, if required, shall consist of salvaged asphalt material from the Project or from off-site stockpiles that has been processed, prior to use to 100% passing a 2" square mesh sieve. Recycled material shall be conditionally accepted at the source by the Resident. It shall be free of winter sand, granular fill, construction debris, and other materials not generally considered asphalt pavement.

Recycled material generated and salvaged from the Project shall be used within the roadway limits to the extent it is available as described in 309.06. No additional payment will be made for material salvaged from the Project.

Recycled material supplied from off-site stockpiles shall be paid for as described in the Contract, or by Contract modification.

- 309.022 **Asphalt Binder** - The asphalt binder used in the foamed asphalt process shall be Performance Grade 64-28 or 58-28 meeting the requirements of AASHTO M 320.
- 309.023 **Portland Cement** - The Portland Cement shall be Type I or II meeting the requirements of AASHTO M 85.
- 309.024 **Hydrated Lime** - Hydrated Lime shall meet the requirements of AASHTO M 216.
- 309.025 **Crusher Dust** - Crusher dust, if required by the mix design, shall be free from friable or deleterious material, including excessive mica, and shall meet the following gradation requirements:

Sieve Size	Percent Passing
12.5 mm [½"]	100
0.075 mm [No. 200]	10 - 20

- 309.026 **Water** - Water shall be clean and free from deleterious concentrations of acids, alkalis, salts or other organic or chemical substances.

EQUIPMENT

- 309.030 **Pulverizer** - The modified milling or recycling machine shall, as a minimum, have the following features:
- A minimum power capability of 600 horsepower.
 - Two microprocessor-controlled systems, complete with 2" dependent pumping systems and spray bars, to regulate the application of foamed asphalt stabilizing agent, separate from water (for increasing the moisture content of the recycled material's moisture content), both in relation to the forward speed and mass of the material being recycled.
 - Two spray bars shall each be fitted with self-cleaning nozzles at a maximum spacing of one nozzle for each 6" width of the chamber.
 - The foamed asphalt shall be produced at the spray bar in individual expansion chambers into which both hot asphalt and water are injected under pressure through individual and separate small orifices that promote atomization. The rate of addition of water into hot asphalt shall be kept at a constant (percentage by mass of asphalt) by the same microprocessor.
 - An inspection (or test) nozzle shall be fitted at one end of the spray bar that produces a representative sample of foamed asphalt.

- f. An electrical heating system shall be incorporated that is capable of maintaining the temperature of all asphalt flow components above 300°F.
 - g. A single asphalt feed pipe installed between the modified milling or recycling machine and the supply tanker shall be employed. Circulating systems that incorporate a return pipe to the supply tanker shall not be used.
 - h. The recycler shall be fitted with a front breaker bar system to ensure that the reclaimed material is broken down to the sizing outlined in 309.020.
- 309.031 **Liquid Mixer Unit or Distributor** - Only tankers with a capacity exceeding ten 2,500 gal shall be used employed to supply the recycling machine with asphalt. Each tanker shall be fitted with two recessed pin-type tow hitches, one in front and the other behind, thereby allowing the tanker to be pushed from behind by the recycling machine, and to push a water tanker in front. No leaking tanker will be permitted on the job site. In addition, each tanker shall be equipped with the following:
- a. A thermometer to show the temperature of the contents in the bottom third of the tank.
 - b. A rear feed valve, with a minimum internal diameter of 3", that is capable of draining the contents of the tank.
 - c. Insulation to retain heat.
 - d. A calibrated dipstick marked at intervals of no more than 25 gal, for measuring the contents of the tank.
- 309.032 **Cement or Lime Spreader** - Spreading of the Portland Cement or Hydrated Lime shall be done with a spreader truck designed to spread dry particulate (such as Portland Cement or Lime) or other approved means to insure a uniform distribution across the roadway and minimize fugitive dust. Pneumatic application, including through a slotted pipe, will not be permitted. Other systems that have been developed include fog systems, vacuum systems, etc. Slurry applications may also be accepted. The Department reserves the right to accept or reject the method of spreading cement. The Contractor shall provide a method for verifying that the correct amount of cement is being applied.
- 309.033 **Placement Equipment** - Placement of the full depth recycled material to the required slope and grade shall be done with an approved highway grader or by another method approved by the Resident.
- 309.034 **Rollers** - The full depth recycled material shall be rolled with a vibratory pad foot roller, a vibratory steel drum soil compactor and a pneumatic tire roller. The pad foot roller drum shall have a minimum of 112 tamping foot 3" in height, a minimum contact area per foot of 17 in², and a minimum width of 84". The vibratory steel drum roller shall

have a minimum 84" width single drum. The pneumatic tire roller shall meet the requirements of Section 401.10 and the minimum allowable tire pressure shall be 85 psi.

MIX DESIGN

The Department will supply a mix design for the foamed asphalt based on test results from pavement and soil analysis taken to the design depth. The Department will provide the following information prior to construction:

1. Percent of asphalt to be used.
2. Percent of water to be used in the foaming process.
3. Quantity (if any) of crusher dust to be used.
4. Quantity of lime or cement to be added.
5. Optimum moisture content for proper compaction and dispersion of foamed asphalt.
6. Additional aggregate (if required).

After a test strip has been completed or as the work progresses, it may be necessary for the Resident to make necessary adjustments to the mix design. Changes to compensation will be in accordance with the Mix Design Special Provision.

CONSTRUCTION REQUIREMENTS

- 309.04 **Pulverizing** - The entire depth of existing pavement shall be pulverized together with approximately 1" or more of the underlying gravel into a homogenous mass. All pulverizing shall be done with equipment that will provide a homogenous mass of pulverized material, processed in-place, which will pass a 2" square mesh sieve.
- 309.05 **Weather Limitations** - When foamed asphalt is used, full depth recycled work shall be performed when;
- a. Foaming operations will be allowed between May 15th and September 15th inclusive in Zone 1 - Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais. Foaming operations will be allowed between May 1st and September 30th inclusive in Zone 2 - Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.
 - b. The atmospheric temperature, as determined by an approved thermometer placed in the shade at the recycling location, is 50°F and rising.
 - c. When there is no standing water on the surface.
 - d. During generally dry conditions, or when weather conditions are such that proper pulverizing, adding, mixing, and curing can be obtained using

proper procedures, and when compaction can be accomplished as determined by the Resident.

- e. When the surface is not frozen and when overnight temperatures are expected to be above 32°F.
- f. Wind conditions as such that the spreading of lime or cement on the roadway ahead of the recycling machine will not adversely affect the operation.

309.06 Full Depth Recycling Procedure - New aggregate or recycled material meeting the requirements of Section 309.021 - New Aggregate, and Recycled Material shall be added as necessary to restore cross-slope and/or grade before initial pulverizing. Locations will be shown on the plans or described in the construction notes; the Resident may add other locations while construction of the Project is in progress. The Contractor will use recycled material to the extent it is available, in lieu of new aggregate. The material shall then be pulverized, processed, and blended into a homogeneous mass passing a 2" square mesh sieve. Material found not pulverized down to a 2" size will be required to be reprocessed by the recycler with successive passes until approved by the Resident.

Should the Contractor be required to add new aggregate or recycled material to restore cross-slope and/or grade after the initial pulverizing process, those areas will require re-processing to blend into a homogenous mass passing a 2" square mesh sieve.

The resultant material from the initial pulverizing processes shall be graded and compacted to the cross-slope and profile shown on the plans or as directed by the Resident. The Contractor will also be responsible for re-establishing the existing profile grade. The completed surface of the full depth recycled course shall be shaped and maintained to a tolerance, above or below the required cross sectional shape, of $\frac{3}{8}$ ". The initial pulverizing process density requirements will be the same as Section 309.08 unless otherwise directed by the Resident.

Following completion of the initial pulverizing and blending process the dry stabilizing agents (lime or cement) shall be spread uniformly over the full width of roadway to be recycled prior to each pass of the foaming operation, and in a continuous process by means of a mechanical spreader. Dry stabilizing agents shall be spread at the prescribed rate of application provided by the Department.

If required by the mix design, a uniform layer of crusher dust or other aggregate specified shall be spread over the full width of the roadway just prior to the foaming procedure. Foamed asphalt shall be incorporated into the material to a depth determined by the pavement design. These additives shall then be uniformly blended into a homogeneous mass until an apparent uniform distribution has occurred. The Resident may adjust the rate of application as necessary.

Asphalt binder shall be added to the milling or recycling process by pumping from a mobile bulk tanker that is pushed from behind by the recycling machine. Tankers shall be equipped with a built-in thermometer to ensure that the bituminous stabilizing agent is maintained at 375°F + 10°F. The system employed to add the foamed asphalt to the recycling process shall conform to the equipment requirements specified in this Section.

Sufficient water shall be added through the recycler head during the recycling process to ensure thorough blending to meet the optimum moisture for compaction as specified. Water shall be added only by means of a controlled system on the recycling machine. Care shall be taken to prevent excessive wetting. A second water truck may be required during recycling operations to assist in the compaction and water control efforts. The rate of water supplied shall be kept constant unless changed due to Project material changes.

The resultant material shall be graded and compacted to the cross-slope and profile shown on the plans or as directed by the Resident. The Contractor will also be responsible for re-establishing the existing profile grade. The completed surface of the full depth recycled course shall be shaped and maintained to a tolerance, above or below the required cross sectional shape, of $\frac{3}{8}$ ". Areas not meeting this tolerance will be repaired as described in Section 309.061.

After compaction, the roadway surface shall be treated with a light application of water, and rolled with pneumatic-tired rollers to create a close-knit texture. The finished final completed layer shall be free from:

- a. Surface laminations.
- b. Segregation of fine and coarse aggregate.
- c. Corrugations, centerline differential, potholes, or any other defects that may adversely affect the performance of the layer.

The Contractor shall protect and maintain the completed recycled layer until a lift of pavement is applied. In addition to frequent light watering shall be performed to prevent the surface from drying out. maintenance shall include the immediate repair of any damage to or defects in the layer and shall be repaired immediately repeated as often as it is necessary. Repairs shall be made so as to ensure that an even and uniform surface shall be maintained is restored after completion of the repair work. The recycled surface shall be swept prior to hot mix asphalt placement.

309.061 **Repairs** - Repairs and maintenance of the recycled layers, during and after the curing period, resulting from damage caused by traffic, weather or environmental conditions, or resulting from damage caused by the Contractor's operations or equipment, shall be completed at no additional cost to the Department.

Low areas will be repaired using a hot mix asphalt shim. Areas up to 1" high can be repaired by either milling the high area or shimming the low areas adjacent to the high area with hot mix asphalt. Areas greater

than 1" high will be repaired by shimming the low areas adjacent to the high area with hot mix asphalt. All repair work will be done with the Resident's approval at the Contractor's expense.

TESTING REQUIREMENTS

309.07 **Quality Control** - The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The QCP shall meet the requirements of Section 106.4 - Quality Control and this Section. The Contractor shall not begin recycling operations until the Department approves the QCP in writing.

Prior to performing any recycling process, the Department and the Contractor shall hold a Pre-recycle conference to discuss the recycling schedule, type and amount of equipment to be used, sequence of operations, and traffic control. A copy of the QC random numbers to be used on the Project shall be provided to the Resident. All field and plant supervisors including the responsible onsite recycling process supervisor shall attend this meeting.

The QCP shall address any items that affect the quality of the Recycling Process including, but not limited to, the following:

- a. Sources for all materials, including New Aggregate and Additional Recycled Material.
- b. Make and type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers.
- c. Testing Plan.
- d. Recycling operations including recycling speed, yield monitoring, procedures for avoiding recycling and curing in inclement weather, methods to ensure that segregation is minimized, procedures for mix design modification, grading and compacting operations, and cement and lime application procedure.
- e. Methods for protecting the finished product from damage and procedures for any necessary corrective action.
- f. Method of grade checks.
- g. Examples of Quality Control forms.
- h. Name, responsibilities, and qualifications of the Responsible Onsite Recycling Supervisor experienced and knowledgeable with the process.
- i. A note that all testing will be done in accordance with AASHTO and MaineDOT/ACM procedures.

The Project Superintendent shall be named in the QCP, and the responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall sample, test, and evaluate the full depth reclamation process in accordance with the following minimum frequencies:

MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Density	1 per 1000 ft / lane	AASHTO T 310
Air Temperature	4 per Day at even intervals	
Surface Temperature	At the beginning and end of each Days operation	
Yield of all materials (The daily yield, yield since last test, and total Project yield.)	1 per 1000 ft / lane	

The Department may view any QC test and request a QC test at any time.

The Contractor shall submit all QC test reports and summaries in writing, signed by the appropriate technician, the Department's onsite representative by 1:00 p.m. on the next Working Day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make all test results, including randomly sampled densities, available to the Department onsite.

Penalties for QCP non-compliance will be in accordance with Standard Specification 106.4.6

The Contractor shall cease recycling operations whenever one of the following occurs:

- a. The computed yield differs from the mix design by 10% or more.
- b. The Contractor fails to follow the approved QCP.
- c. The Contractor fails to achieve 98% density after corrective action has been taken.
- d. The finished product is visually defective, as determined by the Resident.

Recycling operations shall not resume until the Department approves the corrective action to be taken.

309.08 **Test Strip** - The Contractor shall assemble all items of equipment for the recycling operation on the first Day of the foamed asphalt work. The Contractor shall construct a test strip for the Project at a location approved by the Resident. The Responsible Onsite Recycling Supervisor will work with Department personnel to determine the suitability of the mixed material, bitumen dispersion within the mixed material, moisture control within the mixed material, and compaction and surface finish. The test strip section is required to:

- A. Demonstrate that the equipment and processes produce recycled layers to meet in requirements specified requirements.
- B. Determine the effect on the gradation of the recycled material by varying the forward speed of the recycling machine and the rotation rate of the milling drum.

- C. Determine the sequence and manner of rolling necessary to obtain the compaction requirements and establish a target density. The Contractor and the Department will calibrate their respective gauges at this time.

The test strip shall be at least 300 ft in length of a full lane-width (or a half-road width). Full recycling production will not start until a passing test strip has been accomplished. If a test strip fails to meet the requirements of this specification, the Contractor will be required to repair or replace the test strip to the satisfaction of the Resident. Any repairs, replacement, or duplication of the test strip will be at the Contractor's expense.

After the test strip has been pulverized, and the roadway brought to proper shape, the Contractor shall add water until it is determined that optimum moisture has been obtained. The test strip shall then be rolled using the specified compaction equipment as directed until the density readings show an increase in dry density of less than 1 pcf for the final four roller passes of each roller. The Contractor and Department will each determine a target density using their respective gauges by performing several additional density tests and averaging them. The average of these tests will be used as the target density of the recycled material for QC and Acceptance purposes.

Following completion of the test strip, compaction of the material shall continue until a density of not less than 98% of the test strip target density has been achieved for the full width and depth of the layer. During the construction and compaction of the Full Depth Recycled base should three consecutive Acceptance test results for density fail to meet a minimum of 95% of the target density, or exceed 102% of target density, a new test strip shall be constructed.

ACCEPTANCE TEST FREQUENCY

Property	Frequency	Test Method
In-place Density	1 per 2000 ft / lane	AASHTO T 310

- 309.09 **Miscellaneous** - No new pavement shall be placed on the full depth recycled pavement until a curing period of 48 hours has elapsed. If inclement weather occurs, the Department reserves the right to extend the curing period.
- 309.10 **Method of Measurement** - Full Depth recycled material (with Foamed Asphalt) will be measured by the yd².
- 309.11 **Basis of Payment** - The accepted quantity of Full Depth Recycled Pavement with Foamed Asphalt shall be paid for at the Contract unit price per yd², complete in-place to the specified limits, which price shall be full compensation for furnishing all equipment and labor for pulverizing, blending, placing, grading, compacting and for all incidentals necessary to complete the work including asphalt binder, water, Portland Cement, lime, and crusher dust.

The addition of materials to restore profile grade and/or cross-slope in areas shown on the plans or described in the construction notes will be paid separately

under designated pay items within the Contract. No additional payment will be made for materials salvaged from the Project.

Payment will be made under:

Pay Item		Pay Unit
309.35	Full Depth Recycled Pavement with Foamed Asphalt - 5" depth	Square Yard
309.36	Full Depth Recycled Pavement with Foamed Asphalt - 6" depth	Square Yard

SECTION 310 - PLANT MIXED RECYCLED ASPHALT PAVEMENT

- 310.01 **Description** - This work shall consist of the removal of all bituminous pavement from the existing roadway, hauling the bituminous pavement to an approved location, and processing as per Section 310.020. The gravel base of the existing roadway shall be regraded and compacted to the tolerances shown on the typicals, or as directed by the Resident.

All plant mixed recycled asphalt pavement shall be placed in one or more courses on an approved base and in accordance with these specifications, and in reasonably close conformity with the lines, grades and thicknesses indicated on the plans, or as established by the Resident. Excess recycled material not used in the PMRAP process will become the property and responsibility of the Contractor.

- 310.020 **Composition of Mixture** - The mixture shall be composed as directed in the job mix formula. The recycled asphalt pavement shall be processed by the Contractor so all material will be no larger than 1½" and stockpiled so as to minimize segregation. The stockpile shall be free of any materials not generally considered to be asphalt pavement. If additional material is required, the material will be supplied by the Department or acquired from the Contractor through the Contract Modification process.

A job mix formula shall be furnished by the Department establishing the percentage of emulsified asphalt cement, Portland Cement, aggregate, and water to be used in the mixture. The JMF additive proportions will be verified by taking a second recycled material sample once the stockpiles have been constructed.

Emulsion, water, aggregate and Portland Cement shall be added in percentage by weight and verified by tank checks done in accordance with the minimum quality control frequencies. Cement additive may be done in dry form or introduced as a cement slurry.

- 310.021 **Emulsified Asphalt** - The emulsified asphalt shall be grade MS-2, MS-4, CSS-1, or HFMS-2 meeting the requirements of Section 702.04 - Emulsified Asphalt.

- 310.02 **Portland Cement** - Portland Cement shall be Type I or II meeting the requirements of AASHTO M 85.
- 310.023 **Water** - Water shall be clean and free from deleterious concentrations of acids, alkalis, salts or other organic or chemical substances.
- 310.024 **New Aggregate** - New aggregate, if required by the Contract or job mix, shall meet the requirements of Section 411.02 - Untreated Aggregate Surface Course.
- 310.030 **Mixing Plant** - The mixing plant shall be of sufficient capacity and coordinated to adequately handle the proposed construction. Either a continuous pugmill mixer or a continuous drum type mixing plant shall be used. If a drum mixing plant is used it shall meet the requirements of Section 401.07. The mixing plant shall be capable of producing a uniform mixture meeting the requirements of the job mix formula.
- 310.031 **Hauling Equipment** - Trucks used for hauling the mixture shall meet the requirements of Section 401.08.
- 310.032 **Pavers** - Pavers shall meet the requirements of Section 401.09.
- 310.033 **Rollers** - Rollers shall meet the requirements of Section 401.10.
- Mix Design** - The Department will supply a mix design for the PMRAP material prior to construction which includes the following information:
1. Percent of emulsified asphalt to be used.
 2. Quantity of cement to be added.
 3. Optimum moisture content for proper compaction.
 4. Additional aggregate (if required).
- After a test strip has been completed or as the work progresses, it may be necessary for the Resident to make necessary adjustments to the mix design. Changes to compensation will be in accordance with the Mix Design Special Provision.
- 310.040 **Mixing** - The recycled asphalt pavement shall be delivered to the mixer at a temperature of not less than 50°F. The emulsified asphalt shall meet the mixing temperature requirements listed in Section 702.05 - Application Temperatures. Recycled pavement and emulsified asphalt, and cement shall be proportioned and the mixing time set to produce a mixture in which uniform distribution of the emulsified asphalt and coating of the recycled pavement is obtained.
- If a drum type mixing plant is used, the recycled asphalt pavement may be heated prior to being mixed with the emulsified asphalt to a temperature not to exceed 195°F.

Following mixing, the recycled asphalt pavement material shall be stockpiled and incorporated into the work. The material must be stockpiled, but not for longer than 48 hours.

310.041 ***Weather Limitations*** - The plant mixed recycled asphalt pavement shall be performed when:

- a. PMRAP operations will be allowed between May 15th and September 15th inclusive in Zone 1 - Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais. PM-RAP will be allowed between May 1st and September 30th inclusive in Zone 2 - Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.
- b. The atmospheric temperature, as determined by an approved thermometer placed in the shade at the recycling location, is 500°F and rising.
- c. When there is no standing water on the surface.
- d. During generally dry conditions, or when weather conditions are such that proper pulverizing, adding, mixing, and curing can be obtained using proper procedures, and when compaction can be accomplished as determined by the Resident.
- e. When the surface is not frozen and when overnight temperatures are expected to be above 320°F.

310.042 ***Spreading and Finishing*** - The mixture shall be spread and finished in accordance with Section 401.15. Total layer thicknesses greater than 4" shall be placed in 2 lifts.

310.043 ***Compaction*** - Compaction of the mixture shall be in accordance with Section 401.16. Rolling may be delayed to avoid lateral displacement as directed by the Resident. See also Section 310.051.

310.044 ***Joints*** - Joints shall be constructed in accordance with Section 401.17.

310.045 ***Surface Tolerances*** - The surface tolerances shall be as specified in Section 401.101, except that the maximum allowable variation shall be $\frac{3}{8}$ ". The surface tolerance in existing gravel areas covered by PMRAP, with no additional gravel, shall be $\pm \frac{3}{8}$ ".

310.050 ***Quality Control*** - The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The QCP shall meet the requirements of Section 106.4 – Quality Control and this Section. The Contractor shall not begin recycling operations until the Department approves the QCP in writing.

Prior to performing any recycling process, the Department and the Contractor shall hold a Pre-recycle conference to discuss the recycling schedule, type and amount of equipment to be used, sequence of operations, and traffic control. A copy of the QC random numbers to be used on the Project shall be provided to the Resident. All field and plant supervisors including the responsible onsite recycling process supervisor shall attend this meeting.

The QCP shall address any items that affect the quality of the Recycling Process including, but not limited to, the following:

- a. JMF(s).
- b. Mixing details, pugmill type, production rates, material processing.
- c. Make and type of paver(s).
- d. Make and type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers.
- e. Testing Plan.
- f. Transportation including process for ensuring that truck bodies are clean and free of debris or contamination that could adversely affect the finished product, type of release agent used (if required)
- g. Laydown operations including procedures for mix design modification, avoiding recycling and curing in inclement weather, material yield monitoring, methods to ensure that segregation is minimized, longitudinal joint construction, procedures to determine the maximum rolling and placing speeds based on field quality control, and achieving the best possible smoothness.
- h. Methods for protecting the finished product from damage and procedures for any necessary corrective action.
- i. Method of grade checks.
- j. Examples of Quality Control forms.
- k. Name, responsibilities, and qualifications of the Responsible Onsite Recycling Supervisor experienced and knowledgeable with the process.
- l. Method for calibration/verification of density gauge.
- m. A note that all testing will be done in accordance with AASHTO and MaineDOT/ACM procedures.
- n. Stockpile procedures including method of moisture control.

The Project Superintendent shall be named in the QCP, and the responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall sample, test, and evaluate the PMRAP process in accordance with the following procedures and minimum frequencies:

MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Density	1 per 1000 ft / lane	ASTM D2950
Air Temperature	4 per Day at even intervals	
Surface Temperature	At the beginning and end of each Days operation	
Yield of all materials (Both the daily yield and yield since last test)	4 per Day at even intervals	

The Department may view any QC test and request a QC test at any time. The Contractor shall submit all QC test reports and summaries in writing, signed by the appropriate technician, to the Department's onsite representative by 1:00 p.m. on the next Working Day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make all test results, including randomly sampled densities, available to the Department onsite.

Penalties for QCP non-compliance will be in accordance with Standard Specification 106.4.6

The Contractor shall cease recycling operations whenever one of the following occurs:

- a. The computed yield differs from the approved Job Mix Formula by 10% or more.
- b. The Contractor fails to follow the approved QCP.
- c. The Contractor fails to achieve 98% density after corrective action has been taken.
- d. The finished product is visually defective, as determined by the Resident.

Recycling operations shall not resume until the Contractor and the Department agree on the corrective action to be taken.

310.051 **Test Strip** - The Contractor shall assemble all items of equipment for the recycling operation on the first Day of the recycling work and process a section of the roadway to the Contractor shall construct a the test strip control section on for the Project at a location approved by the Resident. The Responsible Onsite Recycling Supervisor will work with Department personnel to determine the suitability of the mixed material, moisture control within the mixed material, and compaction and surface finish. The control section:

- a. Demonstrate that the equipment and processes that are proposed to be can be employed are capable of constructing the produce recycled layers to meet in conformance with the specified requirements;
- b. Determine the effect on the grading of the recycled material by varying the forward speed of the paving machine; and

- c. Determine the sequence and manner of rolling necessary to obtain the compaction requirements and establish a target density. The Contractor and the Department will both conduct testing with their respective gauges at this time.

The demonstration section test strip shall be at least 300 ft in length of a full lane-width (or a half-road width). Full PMRAP production will not begin until an acceptable test strip has been constructed. If a test strip control section fails to meet the requirements of this specification, the Contractor will be required to repair or replace the control section control section to the satisfaction of the Resident. Any repairs, replacement, or duplication of the control section control section will be at the Contractor's expense.

The test strip shall be rolled using the specified compaction equipment as directed until the density readings show an increase in dry density of less than 1 pcf for the final four roller passes of each roller. The Contractor and Department will each determine a target density using their respective gauges by performing several additional density tests and averaging them. The average of these tests will be used as the target density of the recycled material for QC and Acceptance purposes.

Following completion of the test strip, compaction of the material shall continue until a density of not less than 98% of the test strip target density has been achieved for the full width and depth of the layer. During the construction and compaction of the PMRAP, should three consecutive Acceptance test results for density fail to meet a minimum of 95% of the target density, or exceed 102% of target density, a new test strip shall be constructed.

ACCEPTANCE TEST FREQUENCY

Property	Frequency	Test Method
In-place Density	1 per 2000 ft / lane	ASTM D2950

- 310.052 **Repairs** - Repairs and maintenance for the PMRAP layers, during and after the curing period, resulting from damage caused by traffic, weather or environmental conditions, or caused by the Contractor's operations or equipment, shall be completed at no additional cost to the Department.

Low areas will be repaired using a hot mix asphalt shim course. Areas up to 1" high can be repaired by milling or shimming with hot mix asphalt. Areas higher than 1" will be repaired using a hot mix asphalt shim. All repair work will be done with the Resident's approval at the Contractor's expense.

- 310.06 **Curing** - No new hot mix asphalt pavement or additional layers of PMRAP shall be placed on the recycled asphalt pavement until a curing period of 4 Days has elapsed. The curing period starts once the PMRAP has been placed in the roadway. When weather conditions are unfavorable, the curing period may be extended by the Resident.
- 310.07 **Method of Measurement** - Plant Mixed Recycled Asphalt Pavement shall be measured by the square yard.
- 310.08 **Basis of Payment** - The accepted quantity of Plant Mixed Recycled Asphalt Pavement will be paid for at the Contract unit price per square yard, complete in-place which price will be full compensation for furnishing all equipment and labor for removing existing pavement, regrading and compacting existing gravel base, processing, mixing, testing, placing, and compacting, excess material relocation, and for all incidentals necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
310.23	3" Plant Mixed Recycled Asphalt Pavement	Square Yard
310.24	4" Plant Mixed Recycled Asphalt Pavement	Square Yard
310.25	5" Plant Mixed Recycled Asphalt Pavement	Square Yard
310.26	6" Plant Mixed Recycled Asphalt Pavement	Square Yard

SECTION 311 - COLD IN-PLACE RECYCLED ASPHALT PAVEMENT (Traveling Pugmill)

- 311.01 **Description** - The Contractor shall construct a Cold In-place Recycled Pavement base course in accordance with the Contract documents and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or as established by the Resident. This work will consist of milling 3 to 7" of existing bituminous pavement, pulverizing and sizing the millings, the addition of emulsified asphalt and Portland Cement or hydrated lime to the proportions specified, the mixing and placement of the mixture full width as required in the Contract, (including shoulders) and compacting the mixture as one continuous operation to the lines, grades and thicknesses indicated on the plans or as established by the Resident. Excess recycled material not used in the CIP process will become the property of the State.

MIX DESIGN

- 311.02 **Composition of Mixture** - The Contractor shall provide the Resident with a proposed mix design a minimum of 2 weeks prior to commencing work. The proposed mixed design shall include the emulsified asphalt binder application percentage, type and supplier, the percentage of Portland Cement or hydrated

lime to be added, and the percentage of any supplemental aggregates to be added.

- a. The aim for air voids in the final product is 8 to 11%.
- b. The Contractor may add water as needed to the sized material to facilitate uniform mixing and compaction.
- c. Included in the mix design will be the product information from the supplier of the asphalt emulsion binder and any product information regarding the Portland Cement or hydrated lime.
- d. The Contractor will be responsible for deciding and conducting investigative work to determine the properties of the existing in place bituminous mixes which the Contract documents do not describe. Any cores or laboratory testing the Contractor performs to establish the recycled mix design will be incidental to the Cold in Place Recycle pay item and not paid for separately. A copy of all test results on the pavement samples shall be included with the mix design.

The addition of hydrated lime, or Portland Cement at 0.50% to 1.0% by weight is required and is to be included in the mix design criteria. Emulsion, water, aggregate, cement shall be added in percentage by weight and verified by tank checks according to the Quality Control Plan. Cement or lime may be added in dry form or in a slurry.

MATERIALS

311.030 **Pulverized Material** - Recycled bituminous pavement, after milling and sizing, will meet the following gradation requirements:

Sieve Size	% Passing Limits
1½"	100
1"	95-100

- 311.031 **Emulsified Asphalt** - The emulsified asphalt binder shall be a high float asphalt emulsion grade HFMS-2, or a cationic slow-set grade CSS-1H, that meets the requirements of Section 702.04.
- 311.032 **Portland Cement** - The Portland Cement shall be Type 1 or 2 that meets the requirements of AASHTO M 85.
- 311.033 **Hydrated Lime** - The hydrated lime shall meet the requirements of AASHTO M 216.
- 311.034 **Added Aggregates** - New aggregate, if required by the Contract or job mix, shall meet the requirements of Section 411.02 - Untreated Aggregate Surface Course.

- 311.035 **Added Water** - Water shall be clean and free from deleterious concentrations of acids, alkalis, salts or other organic or chemical substances.

EQUIPMENT

- 311.040 **Equipment** - The existing bituminous pavement shall be recycled in a continuous operation using a recycling train consisting of the following major components. The recycling equipment and operations may be combined onto one unit:

311.041 **Mainline Cold Milling Machine** - The unit shall be self-propelled with a down cutting drum, or an approved up-cutting drum, and be automated to continuously adjust and maintain treatment depth and cross slope. The cutting drums shall be a minimum of 10 ft in width, with the ability to add 1 or 2 ft extensions to the drum or have hydraulically extendable milling heads with a 12 ft width. Dust suppression systems are required. The unit should be capable of recycling the pavement for the entire lane width to the required dimensions in one pass.

311.042 **Shoulder Cold Milling Machine** - If required, the shoulder unit shall have a minimum cutting drum of 6½ ft in width or equal to the shoulder width to be recycled. This unit shall precede the larger mainline milling machine to remove existing pavement off any existing paved shoulders. The material will be placed via a lift conveyor onto the existing mainline roadway surface to be incorporated and processed by the mainline milling machine.

311.043 **Screening and Sizing Unit** - This unit shall be capable of reducing and sizing the recycled asphalt pavement to the specified gradations prior to mixing with the asphalt emulsion, and cement or lime additives. Oversize particles shall not be included in the final mix. The manufacture of excessive waste through the screening process will be prohibited. If more than 5% of the recycled material is screened off as waste, the Contractor will be required, at no additional compensation, to re-introduce the material ahead of the train to be reprocessed.

311.044 **Portable Mixing Unit** - The unit shall be capable of producing a uniform, thoroughly mixed, cold mix asphalt product.

The material feed system to the mixing unit shall be equipped with a computer controlled weigh bridge that will determine the mass of recycled material, by weight, being deposited into the mixing unit prior to the addition of the emulsified liquid asphalt. The scales shall be calibrated to the manufacturer's tolerance at the start of the Contract and will be checked for conformance to Section 401.074.

This mixing unit shall be of a dual shaft pugmill design, equipped with a metering device which will continuously meter and maintain the amount of emulsified asphalt being added to the process to a tolerance of + 0.25% of the total, by weight.

The emulsion control unit shall be equipped with a flow meter and a total delivery meter. A positive displacement pump capable of accurately metering the required quantity of emulsion down to a rate of 4 gal/min into the recycled material is required.

The pump shall be equipped with a positive interlock system that will shut off automatically when material is not present in the mixing chamber.

Each mixing machine shall be equipped with a meter capable of registering the rate of flow and total delivery of the emulsion introduced into the mixture.

The unit shall be designed to either deposit the mixed product onto the roadway in a sized windrow, or capable of depositing the product directly into a paver hopper.

Only tankers with a capacity exceeding ten 2,500 gal shall be used employed to supply the recycling machine with bitumen. No leaking tanker will be permitted on the job site. In addition, each tanker shall be equipped with the following:

- a. A thermometer to show the temperature of the contents in the bottom third of the tank.
- b. Insulation to retain heat.
- c. A calibrated dipstick marked at intervals of no more than 25 gal, for measuring the contents of the tank.

311.045 **Placing Equipment** - If a pick up conveyor is to be utilized to transfer the windrow into a paver hopper, the pickup conveyor machine shall be capable of removing the entire windrow down to the underlying material. The paver utilized to place the recycled product shall conform to Section 401.09.

311.046 **Compaction Equipment** - Compaction equipment shall meet the requirements of Standard Specification 401, Subsection 401.10 – Rollers, with the following additional requirements:

- a. Minimum compaction equipment shall consist of two 10 ton double drum steel wheel vibratory rollers; and
- b. one 20 ton pneumatic tired roller. The minimum allowable tire pressure shall be 85 psi. The Contractor shall furnish a suitable tire gauge for determining air pressure in the tires.

Additional equipment may be required in sufficient numbers and weight to obtain the required compaction.

CONSTRUCTION REQUIREMENTS

- 311.05 **Removal of Existing Pavement** - The existing pavement surface, including cracks, shall be visibly free from all foreign matter before recycling commences. The Contractor is responsible for removing any deleterious materials or crack sealants decided to be an interference with the cold recycle process. In areas where paved shoulders exist, the shoulders will be milled just ahead of the mainline milling and removed material incorporated into the recycle process.

When areas of the pavement surface are inaccessible because of the physical constraints of the equipment, the pavement shall be removed by other means and replaced by an approved source of hot mix asphalt.

- 311.06 **Weather and Temperature Limitations** - The Cold In-Place Recycled process shall be performed when:
- a. CIP operations will be allowed between May 15th and September 15th inclusive in Zone 1 - Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais. CIP operations will be allowed between May 1st and September 30th inclusive in Zone 2 - Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.
 - b. The atmospheric temperature, as determined by an approved thermometer placed in the shade at the recycling location, is 500F and rising.
 - c. When there is no standing water on the surface.
 - d. During generally dry conditions, or when weather conditions are such that proper pulverizing, adding, mixing, and curing can be obtained using proper procedures, and when compaction can be accomplished as determined by the Resident.
 - e. When the surface is not frozen and when overnight temperatures are expected to be above 32°F.
 - f. Wind conditions as such that the spreading of lime or cement on the roadway ahead of the recycling machine will not adversely affect the operation.
- 311.061 **Curing** - No new hot mix asphalt pavement or additional layers of CIP shall be placed on the recycled asphalt pavement until a curing period of 4 Days has elapsed. The curing period starts once the CIP process has been completed in the roadway. When weather conditions are unfavorable, the curing period may be extended by the Resident.
- 311.07 **Surface Tolerances** - The completed recycled pavement surface will be shaped, compacted, smoothed and true to required line and grade. Deviations in the

finished surface shall not exceed $\frac{3}{8}$ in in any direction using a 10 ft minimum straight edge. Any repairs required to correct surface deviations are at the Contractor's expense using Department approved material and methods.

The Contractor shall protect the completed surface from damage caused by construction vehicles and equipment. The recycled pavement surface shall be protected and closed to traffic until it is determined that surface damage no longer occurs when a test vehicle is passed over it. The contractor is responsible for determining when the completed surface is suitable for traffic loading without damage. Any repairs to correct damage will be at the Contractor's expense.

311.071 **Joints** - Joints shall be constructed in accordance with Section 401.17.

311.08 **General Procedure** - Mainline milling is to be accomplished full width, one pass, and the material will be conveyed into a sizing and crushing unit. Once sized, the material is conveyed to a mixing unit where the specified percentage of asphalt emulsion, Portland Cement, or lime is introduced for the coating and mixing process.

The thoroughly mixed recycled product will either be deposited, (a) in a windrow behind the mixing unit and picked up via a conveyor, or (b) directly conveyed into a paver hopper for laydown. The mix will be laid full width, including shoulders where paved shoulders existed, to the specified grade and slope.

Water shall be used as necessary to assist the compaction effort.

TESTING REQUIREMENTS

311.09 **Quality Control** - The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The QCP shall meet the requirements of Section 106.6 - Acceptance and this Section. The Contractor shall not begin recycling operations until the Department approves the QCP in writing.

Prior to performing any recycling process, the Department and the Contractor shall hold a Pre-recycle conference to discuss the recycling schedule, type and amount of equipment to be used, sequence of operations, and traffic control. A copy of the QC random numbers to be used on the Project shall be provided to the Resident. All field and plant supervisors including the responsible onsite recycling process supervisor shall attend this meeting.

The QCP shall address any items that affect the quality of the Recycling Process including, but not limited to, the following:

- a. JMF(s).
- b. Make and type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers.
- c. Make and type of equipment in recycling train.

- d. Testing Plan.
- e. Laydown operations including joint construction, yield monitoring, procedures for avoiding recycling and curing in inclement weather, methods to ensure that segregation is minimized, and procedures for mix design modification.
- f. Methods for protection the finished product from damage and procedures for any necessary corrective action.
- g. Method of grade checks.
- h. Examples of Quality Control forms.
- i. Name, responsibilities, and qualifications of the Responsible Onsite Recycling Supervisor experienced and knowledgeable with the process.
- j. Method for calibration/verification of density gauge.
- k. A note that all testing will be done in accordance with AASHTO and MaineDOT/ACM procedures.
- l. Description of the Cold In-place recycled verification procedure.

The Project Superintendent shall be named in the QCP, and the responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall sample, test, and evaluate the cold in-place recycling process in accordance with the following minimum:

MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Density	1 per 1000 ft / lane	ASTM D2950
Air Temperature	4 per Day at even intervals	
Surface Temperature	Beginning and end each Day	
Yield of all materials (daily)	1 per 1000 ft/ lane	
New Aggregate Gradations	2 per Day	AASHTO T 30

The Contractor shall submit all QC test reports and summaries in writing, signed by the appropriate technician, and present them to the Department's onsite representative by 1:00 p.m. on the next Working Day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make all test results, including randomly sampled densities, available to the Department onsite.

During the Cold in-place recycling procedure the Contractor shall take verification samples of the recycled material prior to adding the emulsion at a rate of one per 26,000 lane ft, or a minimum of one per Project. The samples will mixed to the proportions specified in the job mix formula, and tested by the Contractor for conformance to the Contract specifications.

Penalties for QCP non-compliance will be in accordance with Standard Specification 106.4.6

The Contractor shall cease recycling operations whenever one of the following occurs:

- a. The computed yield differs from the approved Job Mix Formula by 10% or more.
- b. The Contractor fails to follow the approved QCP.
- c. The Contractor fails to achieve 98% density after corrective action has been taken.
- d. The Contractor's verification samples show the air void content of the recycled product is outside the 8-11% range.
- e. The finished product is visually defective, as determined by the Resident.

Recycling operations shall not resume until the Contractor and the Department agree on the corrective action to be taken.

311.10 Control Section - The Contractor shall assemble all items of equipment for the recycling operation on the first Day of the recycling work. The Contractor shall construct a control section for the Project at a location approved by the Resident. The Contractor shall have on site a pavement engineer expert in CIP work to direct construction of the control section, advise on suitability of mixed material, bitumen dispersion within the mixed material, moisture control within the mixed material, compaction and surface finish. The control section is required to:

- a. Demonstrate that the equipment and processes can produce recycled layers to meet the requirements specified in these special provisions.
- b. Determine the effect on the grading of the recycled material by varying the forward speed of the recycling machine and the rotation rate of the milling drum.
- c. Determine the sequence and manner of rolling necessary to obtain a target TMD. The Contractor and the Department will calibrate their respective gauges at this time.

The control section shall be at least 750 ft in length of a full lane-width (or a half-roadway section width).

The Contractor shall repeat the control section process until parameters of the material properties conform to the requirements specified herein and as directed by the Resident. If a control section fails to meet the requirements outlined in this Special Provision, the Contractor will be required to take corrective action to remedy the test strip defect to the satisfaction of the Resident at no additional cost to the Department. The repeated process of the control section construction shall be done at the Contractor's expense. The corrective method shall be determined by the Contractor, as directed by the Resident.

Quality Assurance densities of the recycled material will be determined by the Department using the nuclear method. The test strip section will be rolled as directed until the nuclear density readings show an increase in dry density of less than 1 pcf for the final four roller passes. This density will be used as the target density for the recycled material. The remaining full depth recycled material shall be compacted to a minimum density of 98% of the target density as determined in the control section.

ACCEPTANCE TEST FREQUENCY

Property	Frequency	Test Method
In-place Density	1 per 2000 ft / lane	AASHTO T 310

- 311.11 **Measurement and Payment** - The accepted quantity of Cold in Place Recycled Pavement will be measured and paid for by the square yard complete and in place to the limits specified in the Contract documents. The unit price shall include all materials, equipment, supervision, and labor and tools incidental thereto.

No additional payment will be made for hot mix required to replace material that cannot be compacted to the specified density, or used to replace damaged or raveled sections. The removal of existing pavement, placement, and compaction of any hot mix asphalt required in areas that are inaccessible due to the limitations of equipment shall be paid for as Cold in place Recycle mix per square yard.

Payment to be made under:

Pay Item		Pay Unit
311.33	3" Cold in-Place Recycled Asphalt Pavement	Square Yard
311.34	4" Cold in-Place Recycled Asphalt Pavement	Square Yard
311.35	5" Cold in-Place Recycled Asphalt Pavement	Square Yard

DIVISION 400 - PAVEMENTS

SECTION 401 - HOT MIX ASPHALT PAVEMENT

- 401.01 **Description** - The Contractor shall furnish a uniformly blended, homogeneous mixture placed as one or more courses of Hot Mix Asphalt Pavement (HMA) on an approved base in accordance with the Contract documents and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by the Resident. The Department will accept this work under Quality Assurance provisions, in accordance with these specifications and the requirements of Section 106 – Quality, the provisions of AASHTO M 323 except where otherwise noted in Sections 401 and 703 of these specifications, and the MaineDOT Policies and Procedures for HMA Sampling and Testing.
- 401.02 **Materials** - Materials shall meet the requirements specified in Section 700 - Materials:
- | | |
|-----------------------------|--------|
| Asphalt Cement | 702.01 |
| Aggregates for HMA Pavement | 703.07 |
| RAP for HMA Pavement | 703.08 |
| HMA Mixture Composition | 703.09 |
- 401.03 **Composition of Mixtures** - The Contractor shall compose the Hot Mix Asphalt Pavement with aggregate, Performance Graded Asphalt Binder (PGAB), and mineral filler if required. HMA shall be designed and tested according to AASHTO R 35 and the volumetric criteria in Table 1. The Contractor shall size, uniformly grade, and combine the aggregate fractions in proportions that provide a mixture meeting the grading requirements of the Job Mix Formula (JMF). Unless otherwise noted in Special Provision 403 - Hot Mix Asphalt Pavement, the design, verification, Quality Control, and Acceptance tests for this mix will be performed at 65 gyrations (see Table on next page).

TABLE 1 - VOLUMETRIC DESIGN CRITERIA

Design ESAL's (Millions)	Required Density (Percent of G _{mm})			Voids in the Mineral Aggregate (VMA)(Minimum Percent)					Voids Filled with Binder (VFB) (Minimum %)	Fines/Eff. Binder Ratio
				Nominal Maximum Aggregate Size (mm)						
	N _{initial}	N _{design}	N _{max}	25	19	12.5	9.5	4.75		
<0.3	<91.5	96.0	<98.0	13.0	14.0	15.0	16.0	16.0	70-80	0.6-1.2
0.3 to <3	<90.5								65-80	
3 to <10	<89.0								65-80*	
10 to <30										
> 30										
* For 9.5 mm nominal maximum aggregate size mixtures, the maximum VFB is 82. For 4.75 mm nominal maximum aggregate size mixtures, the maximum VFB is 84.										

The Contractor shall submit for Department approval a JMF to the Asphalt Pavement Engineer for each mixture to be supplied. The JMF will be approved by the Department in accordance with the MaineDOT HMA Policies and Procedures for HMA Sampling and Testing Manual. At the time of JMF submittal, the Contractor shall identify and make available the stockpiles of all proposed aggregates at the plant site. There must be a minimum of 150 ton for coarse aggregate stockpiles and 75 ton for fine aggregate stockpiles before the JMF may be submitted. The Contractor shall provide aggregate samples to the Department unless otherwise required. The Contractor shall also make available to the Department the PGAB proposed for use in the mix in sufficient quantity to test the properties of the asphalt and to produce samples for testing of the mixture. The first Day's production shall be monitored, and the approval may be withdrawn if the mixture exhibits undesirable characteristics such as checking, shoving or displacement. The Contractor shall be allowed to submit aim changes for a JMF as outlined in the MaineDOT HMA Policies and Procedures for HMA Sampling and Testing Manual: Mix Design Approval Section.

The Contractor shall submit a new JMF for approval each time a change in material source or materials properties is proposed. The same approval process shall be followed. The cold feed percentage of any aggregate may be adjusted up to 10 percentage points from the amount listed on the JMF, however no aggregate listed on the JMF shall be eliminated. The cold feed percentage for RAP may be reduced up to 10 percentage points from the amount listed on the JMF and shall not exceed the percentage of RAP approved in the JMF or for the specific application under any circumstances.

401.031 **Warm Mix Technology** - The Contractor may place Hot Mix Asphalt Pavement produced with an accepted WMA technology if approved by the Department. Methods or technologies shall generally be at the

Contractors option, but will be limited to proven, Agency and Industry accepted practice. Mixture production, placement and volumetric testing details, including temperatures, shall be included in the Project specific QCP, and submitted to the Department for approval prior to any work.

- 401.04 **Temperature Requirements** - The temperature of the mixture shall conform to the tolerances in Table 2 as measured at the truck at the mixing plant and at the paver unless otherwise authorized by the Department.

TABLE 2: ALLOWABLE TEMPERATURE RANGES

PGAB Grade(s)	Temperature Range (°F)
PG58-28 / PG64-28	275-325
PG64E-28 / PG70E-28	285-335

- 401.05 **Performance Graded Asphalt Binder** - The Contractor shall utilize either a PG58-28, PG64-28, PG64E-28, PG70E-28, or other grade as specified in the 403 Special Provision. The Contractor shall utilize a PG64-28 if no liquid grade is specified within the 403 Special Provision.
- 401.06 **Weather and Seasonal Limitations** - The State is divided into two paving zones as follows (see Table on next page):
- Zone 1** - Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais.
 - Zone 2** - Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.

TABLE 3: SEASONAL AND TEMPERATURE LIMITATIONS

Use	Minimum Ambient Air Temperature	Zone 1 Allowable Placement Dates	Zone 2 Allowable Placement Dates
Surface course (travelway & adjacent shoulders) less than 1" thick placed during conditions defined as "Night Work"	50°F	June 1 to Saturday following September 1	
Surface course (travelway & adjacent shoulders) less than 1" thick	50°F	May 15 to Saturday following September 15	
Travelway surface course greater than or equal to 1" thick	50°F	May 1 to Saturday following October 1	April 15 to Saturday following October 15
HMA for surface course on bridge decks	50°F	May 1 to Saturday following October 1	April 15 to Saturday following October 15
HMA for base or shim course on bridge decks	50°F	April 15 to November 15	
HMA for use other than travelway surface course	40°F	April 15 to November 15	
HMA for curb, driveways, sidewalks, islands, or other incidentals	40°F	N/A	N/A
HMA produced with an approved WMA technology for base or shim course	35°F	April 15 to November 15	

The ambient air temperature shall be determined by an approved thermometer placed in the shade at the paving location. Unless otherwise specified, the Contractor shall not place Hot Mix Asphalt Pavement on a wet or frozen surface regardless of the ambient air temperature. The Hot Mix Asphalt Pavement produced with an approved WMA technology shall meet the requirements of section 401.04 - Temperature Requirements, unless otherwise approved by the Department. For the purposes of this Section, the traveled way includes truck lanes, ramps, approach roads and auxiliary lanes.

401.07 **Hot Mix Asphalt Plant**

401.071 **General Requirements** - HMA plants shall conform to AASHTO M 156, Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures with exception of Section 4.2.1, 4.2.2, 4.3.4, 4.3.5, and 4.12.2.

All HMA plants will be inspected annually by the Department prior to producing HMA for Department Projects. The Contractor shall provide the Department at least 72 hour's notice that the plant is ready for inspection. The HMA plant will be equipped with ladders and

platforms that are accessible and safe to obtain belt and binder samples. The HMA plant will have a sampling platform to perform HMA sampling from the back of haul units. Silo storage time of mixtures shall not exceed 36 hours.

- 401.072 **Stockpiles** - HMA plants shall have sufficient space for stockpiles, with a minimum of supply for 2 Days production of all aggregate products used in MaineDOT approved mix designs currently under production for the facility at all times. A minimum stockpile supply of 100 ton (70 yards) shall be maintained always no matter the production rate for the HMA plant. Stockpiles shall be separated and built to minimize segregation. All aggregate stockpiles of products used in MaineDOT approved mix designs shall be labelled with signage made of weather-proof material. Stockpile identification signs shall be a minimum size of 12" high and 24" wide with reflective lettering that is a minimum of 2" in height. The sign shall be placed so that it is easily readable from outside the stockpile area.
- 401.073 **Cold Feeds** - Cold Feed Bins will have bin dividers to keep aggregate from intermingling between bins. Adequate means must be provided for obtaining samples of the complete and combined flow of all Cold feed bins. Cold feed bins will not be required to have individual sampling locations.
- 401.074 **Dryer** - Dryer shall be capable of heating aggregate to required mixing temperature and shall be in good operation and condition. Dryer shall be subject to annual inspection prior to start-up. The Contractor shall dry and heat the aggregates for the HMA to the required temperature. The Contractor shall properly adjust flames to avoid physical damage to the aggregate and to avoid depositing soot on the aggregate. The Contractor shall provide the Department the opportunity to inspect the dryer prior to the annual inspection. The Contractor shall provide the Department a minimum period of 72 hours to inspect the dryer and provide at least 24 hour's notice that the dryer is ready for inspection.
- 401.075 **Asphalt Binder** - Asphalt binder heating system shall heat binder to proper mixing temperature. A thermometer shall be provided in the asphalt binder line. Indirect asphalt binder heating system shall be used and no direct flame may come in contact with tank. The temperature of asphalt binder shall be uniformly maintained using insulation or another approved method. An asphalt binder sampling valve shall be provided in the circulation line. The sampling valve shall be provided downstream of any binder additive used. The use of a different sampling location may be approved by the Department. The Contractor shall drain down the asphalt as low as safely possible in any tank that will be switched to a new source or grade prior to adding the new PGAB.

401.076 **Additives** - Additives (WMA, anti-strip, etc.) not directly introduced into the binder at the terminal shall be introduced into the HMA plant per the supplier's recommendations and shall be approved by the Asphalt Pavement Engineer, Pavement Quality Manager, or their authorized representative. The system for introducing additives shall be interlocked with the aggregate feed or weigh system to maintain correct proportions for all rates of production and batch sizes. Additive introduction systems shall be controlled by a proportioning device to the amount required on the JMF plus or minus 0.1% of the target. Additive introduction systems shall be interlocked with the plant and the recordation (batch tickets or drum recordation) shall display the additive and the weight and percentage added. A means for sampling any mixture additives will be provided. The sampling point shall be after the additive is mixed with the PGAB before entering the drum or mixer unit.

401.077 **Batch Plants**

Hot Bins - Hot bins shall provide uniform continuous operation and be in good working condition. The plant shall be able to provide samples of hot bins upon request. Overflow shall be provided for each hot bin. Hot bin gates shall close without leaking. Bin walls must prevent intermingling between bins. Each hot bin shall have telltale devices ("low level indicator") which will alert the operator when the bin is empty.

Mixer Unit - Clearance between blades and liner shall be adjusted to 1" maximum, unless the aggregate exceeds 1¼" then the clearance shall be 1½". The spray bar length shall be at least 75% of the mixer length. The mixer unit shall be a twin pug mill-type mixer capable of mixing continuously for at least 45 seconds after all materials have been introduced into the mixer. The blades in the mixer shall be of sufficient number and size, capable of producing a homogenous mixture. If the mixer is not enclosed, it shall be equipped with an adjustable hood to prevent loss of dust by dispersion. The mixer unit shall be subject to annual inspection prior to removal of safety features and being readied for service. The Contractor shall provide the Department the opportunity to inspect the mixer unit prior to the annual inspection. The Contractor shall provide the Department a minimum period of 72 hours to inspect the mixer unit and provide at least 24 hour's notice that the mixer unit is ready for inspection.

Mineral Filler - Mineral filler and fiber shall utilize separate bins and feed systems to store and proportion the required quantity into the mixture. The feed systems shall be accurate to no more than 10% of the required weight with a convenient and accurate means of calibration. Mineral filler and fiber shall be introduced in the weigh

hopper and uniformly distributed prior to the injection of the asphalt binder.

Automation - The HMA batch plant shall automatically batch materials, mixes and discharges mixes. The batch plant shall accurately proportion the various materials in the proper order by weight. The entire batching and mixing cycle shall be continuous and shall not require any manual operations. The batch plant shall use auxiliary interlock circuits to trigger an audible alarm whenever an error exceeding the acceptable tolerance occurs. Along with the alarm, the printer shall print an asterisk on the delivery slip in the same row containing the out-of-tolerance weight. The automatic proportioning system shall be capable of consistently delivering material within the full range of batch sizes. When RAP is being used, the plant must be capable of automatically compensating for the moisture content of the RAP.

The HMA batch plant shall be operated within the following tolerances:

- Each aggregate component: +/-1.5% cumulative, per bin
- Mineral Filler: +/- 0.5%
- Bituminous Material: +/- 0.1%
- Zero return (aggregate): +/- 0.5%
- Zero Return (AC): +/- 0.1%
- Additives: +/- 0.1%

Recordation - All plants shall be equipped with an approved digital recording device. The printer shall mark any weight on the ticket that exceeds tolerance. The delivery slip load ticket shall contain information required under Section 108.1.3 - Provisions Relating to Certain Measurements, Mass and paragraphs a, b, and c of Section 401.078.

401.078 **Drum Plants**

Cold Feeds and Delivery System - A scalper screen shall be used to remove oversize material. The accuracy of the belt scale shall be within +/- 1.0% of the actual weight being measured. The HMA drum plant shall be capable of correcting for aggregate moisture. Mineral filler and fiber shall utilize separate bin(s) and feeder systems to store and proportion the required quantity into the mixture. The feed systems shall be accurate to no more than +/- 10% of the required weight with a convenient and accurate means of calibration. The plant shall be equipped with a single control to change all feed rates. Mineral filler and fiber shall be introduced such that dry mixing is accomplished no less than 18" prior to the injection of the asphalt

binder. The Contractor shall ensure that the mineral filler does not become entrained in the exhaust stream of the dryer.

Binder System - The flow of asphalt binder shall adjust automatically with dry aggregate weights. The Department will conduct an asphalt flow meter check annually and after each plant change of location. The flow meter check must be performed prior to receiving approval to produce for Department Projects. The plant must be configured to provide a convenient means to check accuracy of the flow meter. The flow meter will be considered accurate if the measured weight is within 1% of actual weight.

Drum Mixer - The HMA drum plant shall be equipped with a diversion system where mix can be diverted at startup/shutdown and any time. The drum mixer shall be subject to annual inspection prior to removal of safety features and being readied for service. The Contractor shall provide the Department a minimum period of 72 hours to inspect the drum mixer while providing at least 72 hour's notice that the drum mixer is ready for inspection.

Recordation - An approved automatic ticket printer system shall be used with all approved HMA drum plants. The requirements for delivery slips for payment of materials measured by weight, as given in the following Sections, shall be waived: 108.1.3 a., 108.1.3 b., 108.1.3 c., and 108.1.3 d. The automatic printed ticket will be considered as the Weight Certificate. The dry aggregate weights and binder flow shall be recorded as well as mineral filler and all binder additives. The recordation of materials shall be printed a minimum of every 10 minutes while in production.

The requirements of Section 108.1.3 f. - Delivery Slips, shall be met by the weigh slip or ticket, printed by the automatic system, which accompanies each truckload, except for the following changes:

- a. The quantity information required shall be individual weights of each batch or total net weight of each truckload.
- b. Signatures (legible initials acceptable) of Weighmaster (required only in the event of a malfunction as described in 401.074 c.).
- c. The MaineDOT designation for the JMF.

401.079 **Scales and Weight Checks** - When the HMA is to be weighed on scales meeting the requirements of Section 108 - Payment, the scales shall be inspected and sealed by the State Sealer (or approved alternative) as often as the Department deems necessary to verify their accuracy. Plant scales shall be checked prior to the start of the paving season, and each time a plant is moved to a new location.

Subsequent checks will be made as determined by the Resident. The Contractor will have at least ten 50 lb masses for scale testing at batch plants. At Contractor's option, the Contractor can use one single test weight that has been checked on sealed scales. This weight shall be 1,000 lb or greater. At least twice during each 5 Days of production either of the following checks will be performed:

- a. A loaded truck may be intercepted and weighed on a platform scale that has been sealed by the State Sealer of Weights and Measures within the past 12 months. The inspector will notify the producer to take corrective action on any discrepancy over 1.0%. The producer may continue to operate for 48 hours under the following conditions.

1. If the discrepancy does not exceed 1.5%; payment will still be governed by the printed ticket.
2. If the discrepancy exceeds 1.5%, the plant will be allowed to operate as long as payment is determined by truck platform scale net weight.

If, after 48 hours the discrepancy has not been addressed and reduced below 1.0%, than plant operations will cease. Plant operation may resume after the discrepancy has been brought within 1.0%.

- b. Where platform scales are not readily available, a check will be made to verify the accuracy and sensitivity of each scale within the normal weighing range and to assure that the interlocking devices and automatic printer system are functioning properly. If platform scales are not readily available, a weight with a known mass-verified and sealed annually by a licensed scale company, may be used by hanging weight from silo or surge hopper, at lower middle and upper third levels upon request to verify scale accuracy.
- c. In the event of a malfunction of the automatic printer system, production may be continued without the use of platform truck scales for a period not to exceed the next 2 Working Days, providing total weights of each batch are recorded on weight tickets and certified by a Licensed Public Weighmaster.

401.08 **Hauling Equipment** - Units hauling HMA shall have tight, clean, and smooth metal bodies, which have been thinly coated with a small amount of approved release agent to prevent the mixture from adhering to the bodies. Release agents that dissolve or strip asphalts, including diesel fuel, will not be allowed.

All mix haul units shall have a cover of canvas or other water repellent material capable of heat retention, which completely covers the mixture. The cover shall be securely fastened on the truck, unless unloading. All mix haul units shall have an opening on both sides, which will accommodate a thermometer stem. The opening shall be located near the midpoint of the body, at least 12" above the bed.

- 401.09 **Pavers** - The Contractor shall use pavers meeting the requirements of this section unless otherwise authorized by the Department. Pavers shall be self-contained, self-propelled units with an activated heated screed capable of placing courses of Hot Mix Asphalt Pavement in full lane widths specified in the Contract on the main line, shoulder, or similar construction.

Pavers shall be of sufficient class and size to place Hot Mix Asphalt Pavement over the full width of the mainline travel way with a 10 ft minimum main screed with activated extensions. The Contractor shall place Hot Mix Asphalt Pavement on the main line with a paver using an automatic grade and slope controlled screed, unless otherwise authorized by the Department. The controls shall automatically adjust the screed and increase or decrease the layer thickness to compensate for irregularities in the preceding course. The controls shall maintain the proper transverse slope and be readily adjustable so that transitions and superelevated curves can be properly paved. The controls shall operate from a fixed or moving reference such as a grade wire or ski type device (floating beam) with a minimum length of 30 ft, a non-contact grade control with a minimum span of 24 ft, except that a 40 ft reference shall be used on Expressway Projects.

The Contractor shall operate the paver in such a manner as to produce a visually uniform surface texture and a thickness within the requirements of Section 401.11 - Surface Tolerances. The paver shall have a receiving hopper with sufficient capacity for a uniform spreading operation and a distribution system to place the mixture uniformly, without segregation in front of the screed. The screed assembly shall produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screeds shall have auger extensions and tunnel extenders as per the manufacturer's recommendations, a copy of which shall be available if requested.

The Contractor shall have the paver at the Project site sufficiently before the start of paving operations to be inspected and approved by the Department. The Contractor shall repair or replace any paver found worn or defective, either before or during placement, to the satisfaction of the Department. Pavers that produce an unevenly textured or non-uniform mat will be repaired or replaced before continuing to place HMA on MaineDOT Projects. On a daily basis, the Contractor shall perform density testing across that mat as detailed in Section 401.191 - Quality Control - Method A, B & C.

401.10 **Rollers** - Rollers shall be static steel, pneumatic tire, oscillatory, or approved vibrator type. Rollers shall be in good mechanical condition, capable of starting and stopping smoothly, and be free from backlash when reversing direction. Rollers shall be equipped and operated in such a way as to prevent the picking up of hot mixed material by the roller surface. The use of rollers, which result in crushing of the aggregate or in displacement of the HMA will not be permitted. Any Hot Mix Asphalt Pavement that becomes loose, broken, contaminated, shows an excess or deficiency of Performance Graded Asphalt Binder, or is in any other way defective shall be removed and replaced at no additional cost with fresh Hot Mix Asphalt Pavement, which shall be immediately compacted to conform to the adjacent area.

The Contractor shall repair or replace any roller found to be worn or defective, either before or during placement, to the satisfaction of the Department. Rollers that produce grooved, unevenly textured or non-uniform mat will be repaired or replaced before continuing to place HMA on MaineDOT Projects. The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided specification densities are attained and with the following requirements:

- a. On variable-depth courses, the first lift of pavement over gravel, reclaimed pavement, on irregular or milled surfaces, or on bridges, at least one roller shall be 16 ton pneumatic-tired. Pneumatic-tired rollers shall be equipped with skirting to minimize the pickup of HMA materials from the paved surface. When required by the Resident, the roller shall be ballasted to 20 ton.
- b. Compaction with a vibratory or steel wheel roller shall precede pneumatic-tired rolling, unless otherwise authorized by the Department.
- c. Vibratory rollers shall not be operated in the vibratory mode when checking or cracking of the mat occurs, or on bridge decks.
- d. Any method, which results in cracking or checking of the mat, will be discontinued and corrective action taken.
- e. The use of an oscillating steel roller shall be required to compact all mixtures placed on bridge decks.

The maximum operating speed for a steel wheel or pneumatic roller shall not exceed the manufacturer's recommendations, a copy of which shall be available if requested.

401.11 **Surface Tolerances** - The Department will check the following surface tolerances:

- a. **Longitudinally** - The pavement surface profile shall be free of deviations in excess of $\pm 1/4$ " from the required pavement surface profile grade. To verify the surface tolerance a straight plane shall be established using 16

ft straight edge or a taught string line placed parallel to the direction of travel and checked continuously across the width of the lane.

- b. ***Transversely*** - The pavement surface profile shall be free of deviations in excess of 0" below and ¼" above the required cross sectional profile grade. To verify the surface tolerance a straight plane shall be established using a 10 ft straight edge or taught string line placed perpendicular to the direction of travel and checked continuously along the length of the lane.

The Contractor shall correct defective areas by removing defective work and replacing it with new material as directed by the Department. The Contractor shall furnish a 10 ft straightedge for the Department's use.

401.12 ***Preparation of Existing Surface*** - The Contractor shall thoroughly clean the surface upon which Hot Mix Asphalt Pavement is to be placed of all objectionable material. When the surface of the existing base or pavement is irregular, the Contractor shall bring it to uniform grade and cross section. All surfaces shall have a tack coat applied prior to placing any new HMA course. Tack coat shall conform to the requirements of Section 409 – Bituminous Tack Coat, Section 702 – Bituminous Material, and all applicable sections of the Contract.

401.13 ***Spreading and Finishing*** - On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the Contractor shall spread, rake, and lute the HMA with hand tools to provide the required compacted thickness. Release agents that dissolve or strip asphalts, including diesel fuel, will not be allowed. On roadways with adjoining lanes carrying traffic, the Contractor shall place each course per the conditions in Table 4, unless otherwise noted by the Department in Section 403 - Hot Mix Asphalt Pavement. (See Table on next page.)

TABLE 4: PLACEMENT CONDITIONS FOR ADJOINING LANES

Depth (at centerline)	Placement Conditions
Vertical Longitudinal Joint	
$\frac{3}{4}$ " and less (incl. shim)	The Contractor may place the HMA course over the full single travel lane width for each production Day.
1" to 1 $\frac{1}{4}$ "	The Contractor may place the HMA course over the full single travel lane width for each production Day and will be required to place a matching course of HMA over the adjacent section of travel lane before weekend or holiday suspension.
1 $\frac{1}{2}$ " to 2"	The Contractor may place the HMA course over the full single travel lane width for each production Day and will be required to place a matching course of HMA over the adjacent section of travel lane before the end of the following Calendar Day.
Greater than 2"	The Contractor shall place each course over the full width of the traveled way section being paved that Day.
Notched-Wedge Longitudinal Joint	
1 $\frac{1}{2}$ " to 2"	The Contractor may place the HMA course over the full single travel lane width for each production Day and will be required to place a matching course of HMA over the adjacent section of travel lane before weekend or holiday suspension. A maximum unmatched centerline joint length of 0.5 miles will be permitted over the weekend.
Greater than 2"	The Contractor may place the HMA course over the full single travel lane width for each production Day and will be required to place a matching course of HMA over the adjacent section of travel lane before the end of the following Calendar Day.

The Contractor will be required to place the specified course over the full width of the mainline traveled way being paved, regardless of use, depth, or longitudinal joint type prior to Memorial Day, July 4th, Labor Day, paving suspensions exceeding 3 Days, or other dates as specified by special provision.

The Contractor shall install additional warning signage that clearly defines the centerline elevation differential hazard. Unless otherwise addressed in the Contract, the Contractor shall install additional centerline delineation such as a double RPM application at 100 ft intervals, or temporary painted line. For any exposed vertical edge between the shoulder and traveled way, at a minimum, the use of temporary painted line, or RPMs placed along the edge of traveled way at 200 ft intervals is required. The Traffic Control Plan shall be amended to include this option and the additional requirements. All signs and traffic control devices will conform to Section 719.01, and Section 652, and will be installed prior to the work, at a maximum spacing of 0.50 mile for the entire length of effected roadway section. If this option is utilized, all additional signing, labor, traffic

control devices, or incidentals will not be paid for directly, will be considered incidental to the appropriate 652 items.

401.14 **Hot Mix Asphalt** - Placement on Bridge Decks Hot mix asphalt pavement placed on bridges shall also conform to Section 508.04 and the following requirements.

- a. The bottom course shall be placed with an approved rubber mounted paver of such type and operated in such a manner that the membrane waterproofing will not be damaged in any way.
- b. The top course shall not be placed until the bottom course has cooled sufficiently to provide stability.
- c. The Contractor will not be required to cut sample cores from the compacted pavement on the bridge deck, unless otherwise directed by Special Provision.
- d. After the top course has been placed, the shoulder areas shall be sealed 3 ft wide with two applications of an emulsified bituminous sealer meeting the requirements of Section 612.03 – Sealing and Section 702.12 - Emulsified Bituminous Sealing Compound. The first application shall be pre-mixed with fine, sharp sand, similar to mortar sand, as needed to fill all voids in the mix in the area being sealed. The second application may be applied without sand. The sealer shall be carried to the curb at the gutter line in sufficient quantity to leave a bead or fillet of material at the face of the curb. The area to be sealed shall be clean, dry and the surface shall be at ambient temperature.
- e. The furnishing and applying of the required quantity of sealer for the bridge shoulder areas shall be incidental to placing the hot mix asphalt pavement.
- f. The minimum production and placement temperature for the Hot Mix Asphalt placed over membrane shall conform to the manufacturer's recommendations.

The area between the edge of the membrane and the vertical surface shall be completely sealed with hot-applied rubberized asphalt material, meeting the requirements of Type 4 crack seal; shall be applied to form a complete seal between the membrane and the vertical surface and shall extend up the vertical surface to within ½" of the top of the HMA wearing surface. This work shall be considered incidental to the Contract pavement items unless 508 membrane items are included in the Contract.

401.15 **Compaction** - Immediately after the Hot Mix Asphalt Pavement has been spread, struck off, and any surface irregularities adjusted, the Contractor shall thoroughly and uniformly compact the HMA by rolling.

The Contractor shall roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving.

The Contractor shall prevent adhesion of the HMA to the rollers or vibrating compactors without the use of fuel oil or other petroleum based release agents. Solvents designed to strip asphalt binders from aggregates will not be permitted as release agents on equipment, tools, or pavement surfaces.

The Contractor shall immediately correct any displacement occurring as a result of the reversing of the direction of a roller or from other causes to the satisfaction of the Department. Any operation other than placement of variable depth shim course that results in breakdown of the aggregate shall be discontinued. Any new pavement that shows obvious cracking, checking, or displacement shall be removed and replaced for the full lane width as directed by the Resident at no cost to the Department.

Along forms, curbs, headers, walls, and other places not accessible to the rollers, the Contractor shall thoroughly compact the HMA with mechanical vibrating compactors. The Contractor shall only use hand tamping in areas inaccessible to all other compaction equipment. On depressed areas, the Contractor may use a trench roller or cleated compression strips under a roller to transmit compression to the depressed area.

Any HMA that becomes unacceptable due to cooling, cracking, checking, segregation or deformation as a result of an interruption in mix delivery shall be removed and replaced with material that meets Contract specifications at no cost to the Department.

- 401.16 **Joints** - The Contractor shall construct wearing course transverse and longitudinal joints in such a manner that minimum tolerances shown in Section 401.11 - Surface Tolerances are met when measured with a straightedge. The paver screed shall maintain a uniform head of HMA during transverse and longitudinal joint construction. The HMA shall be free of segregation and meet temperature requirements outlined in Section 401.04. Transverse joints of the wearing course shall be straight and neatly trimmed. The Contractor may form a vertical face exposing the full depth of the course by inserting a header, by breaking the bond with the underlying course, or by cutting back with hand tools. The Contractor shall apply a coating of emulsified asphalt immediately before paving all joints to the vertical face and 3" of the adjacent portion of any pavement being overlaid except those formed by pavers operating in echelon. The Contractor shall use an approved spray apparatus designed for covering a narrow surface. The Department may approve application by a brush for small surfaces, or in the event of a malfunction of the spray apparatus, but for a period of not more than 1 Working Day.

Where pavement under this Contract joins an existing pavement, or when the Department directs, the Contractor shall cut the existing pavement along a smooth line, producing a neat, even, vertical joint. The Department will not permit broken or raveled edges. The cost of all work necessary for the preparation of joints is incidental to related Contract pay items. Longitudinal

joints shall be generally straight to the line of travel and constructed in a manner that best ensure joint integrity. Methods or activities that prove detrimental to the construction of straight, sound longitudinal joints will be discontinued.

The Contractor may utilize an approved notched wedge joint device on all HMA layers 1½" in depth or greater. A notched wedge joint shall be constructed as shown in Figure 1 using a device that is attached to the paver screed and is capable of independently adjusting the top and bottom vertical notches.

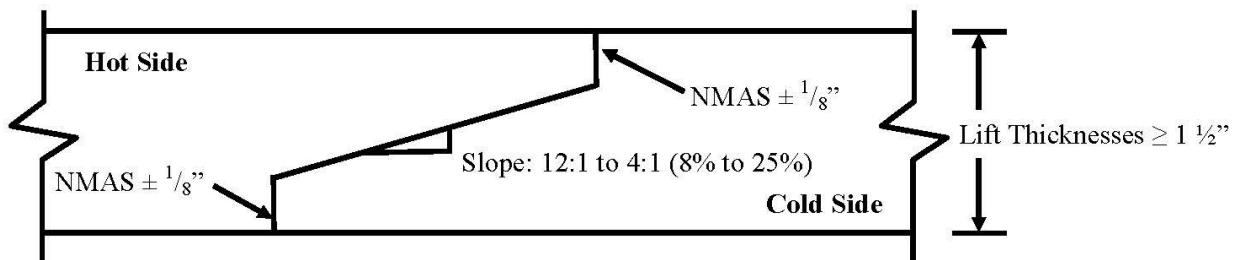


FIGURE 1: Notched Wedge Joint

Notes:

1. An emulsified tack coat shall be applied to the vertical edges and the wedge surface so that the total rate is 0.05 G/SY plus the normal specified rate prior to placing the adjacent layer. The Contractor may elect to apply the emulsified tack coat in one or multiple passes.
2. Dimensions shown are compacted depths (after rolling is complete).

The Department reserves the right to have centerline cores cut by the Contractor's QC personnel for informational purposes to monitor the density along the joint. Informational cores at the centerline joint will be taken centered over the tapered part of the wedge joint.

Any notched wedge joint constructed areas that become cracked or broken shall be trimmed back to the limits affected prior to placing the adjoining lane. Any materials that become unbound or separated from the wedge or tapered joint section, or contaminated by materials determined by the Department as being detrimental to the construction of a sound construction joint, shall be removed by sweeping, compressed air and lance, or by hand tools as required. This work, if necessary, will not be paid for directly, but shall be considered incidental to the related Contract items.

The Contractor shall apply a coating of emulsified asphalt on the vertical and tapered surface of the longitudinal centerline joint immediately before paving if the notched wedge joint device is used. The total rate of application shall be 0.050 G/SY plus the normal specified tack coat rate. The Contractor shall use an approved spray apparatus designed for covering a narrow surface. The Department may approve application by a brush for small surfaces.

- 401.17 **Hot Mix Asphalt Documentation** - The Contractor and the Department shall agree on the amount of Hot Mix Asphalt Pavement that has been placed each Day. All delivery slips shall conform to the requirements of 401.078.
- 401.18 **Prepave Meeting** - Prior to placing any mix, the Department and the Contractor shall hold a Prepaving conference to discuss the paving schedule, source of mix, type and amount of equipment to be used, sequence of paving pattern, rate of mix supply, random sampling, Project lots and sublots and traffic control. A copy of the density QC random numbers to be used on the Project shall be provided to the Resident. The Departments' random numbers for Acceptance testing shall be generated and on file with the Resident and the Project Manager. All personnel of the Department and the Contractor who have significant information relevant to the paving items shall attend, including the responsible onsite paving supervisor for the Contractor. The Resident will prepare minutes of the conference and distribute them to all attendees. Any requests to revise the minutes must be made to the Resident within 7 Days of Receipt. These minutes will constitute the final record of the Prepaving conference. On the first Day of paving and whenever there is a change in the onsite paving foreman or paving inspector, the Department and the Contractor shall hold an informal onsite meeting to review the minutes of the Prepaving conference, Project Specific QCP, Plans, Typicals, Special Provisions and communication process. This meeting shall be held prior to placing any mix. The onsite paving supervisor, QCT, Superintendent, Resident and/or paving inspector shall attend. Prepave meetings shall not be required on Projects designated as Acceptance Method D unless otherwise noted in Section 403 - Hot Mix Asphalt Pavement.
- 401.19 **Contractor Quality Control** - The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The Contractor shall not begin paving operations until the Department approves the QCP in writing. Failure to comply with the approved QCP will result in work suspension and pay reductions as outlined in Section 106.4.6. The Quality Control Plan Value shall be the total bid value for all items covered by the QCP as identified in Special Provision 403.
- 401.191 **Quality Control Method A, B & C** - The QCP shall meet the requirements of Section 106.6 - Acceptance and this Section. The QCP shall address any items that affect the quality of the Hot Mix Asphalt Pavement including, but not limited to, the following:
- a. JMF(s)
 - b. Hot mix asphalt plant details
 - c. Stockpile Management (to include provisions for how the requirements of 401.071b will be met)
 - d. Make and type of paver(s)

- e. Make and type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers
- f. Name of QCP Administrator, and certification number
- g. Name of Process Control Technician(s) and certification number(s)
- h. Name of Quality Control Technicians(s) and certification number(s)
- i. Mixing & transportation including process for ensuring that truck bodies are clean and free of debris or contamination that could adversely affect the finished pavement
- j. Testing Plan
- k. Laydown operations including longitudinal joint construction, procedures for avoiding paving in inclement weather, type of release agent to be used on trucks tools and rollers, compaction of shoulders, tacking of all joints, methods to ensure that segregation is minimized, procedures to determine the maximum rolling and paving speeds based on best engineering practices as well as past experience in achieving the best possible smoothness of the pavement.
- l. Examples of Quality Control forms including a daily plant report, daily paving report, and delivery slip template for any plant to be utilized.
- m. Silo management and details
- n. Provisions for varying mix temperature due to extraordinary conditions or production limitations. If a warm-mix technology is utilized, a proposed target production temperature range (not to exceed 50°F) will be provided for each mix design.
- o. Name and responsibilities of the Responsible Onsite Paving Supervisor.
- p. Method for calibration/verification of Density Gauge
- q. A note that all testing will be done in accordance with AASHTO and the MaineDOT Policies and Procedures for HMA Sampling and Testing.
- r. A detailed description of RAP processing, stockpiling and introduction into the plant as well as a note detailing conditions under which the percent of RAP will vary from that specified on the JMF.
- s. A detailed procedure outlining when production will be halted due to QC or Acceptance testing results.
- t. A plan to address the change in PGAB source or supplier and the potential co-mingling of differing PGAB's.
- u. A procedure to take immediate possession of acceptance samples once released by MaineDOT and deliver said samples to the designated acceptance laboratory.

- v. Provisions for how the QCP will be communicated to the Contractor's field personnel

The QCP shall include the following technicians together with following minimum requirements:

- a. **QCP Administrator** - A qualified individual shall administer the QCP. The QCP Administrator must be a full-time employee of or a consultant engaged by the Contractor or paving Subcontractor. The QCP Administrator shall have full authority to institute any and all actions necessary for the successful operation of the QCP. The QCP Administrator (or its designee in the QCP Administrator's absence) shall be available to communicate with the Department at all times. The QCP Administrator shall be certified as a Quality Assurance Technologist certified by the New England Transportation Technician Certification Program (NETTCP).
- b. **Process Control Technician(s) (PCT)** - shall utilize test results and other quality control practices to assure the quality of aggregates and other mix components and control proportioning to meet the JMF(s). The PCT shall inspect all equipment used in mixing to assure it is operating properly and that mixing conforms to the mix design(s) and other Contract requirements, and that delivery slips and plant recordation accurately reflects the mix being produced with all the required information. The QCP shall detail how these duties and responsibilities are to be accomplished and documented, and whether more than one PCT is required. The Plan shall include the criteria to be utilized by the PCT to correct or reject unsatisfactory materials. The PCT shall be certified as a Plant Technician by the NETTCP.
- c. **Quality Control Technician(s) (QCT)** - shall perform and utilize quality control tests at the job site to assure that delivered materials meet the requirements of the JMF(s). The QCT shall inspect all equipment utilized in transporting, laydown, and compacting to assure it is operating properly and that all laydown and compaction conform to the Contract requirements. The QCP shall detail how these duties and responsibilities are to be accomplished and documented, and whether more than one QCT is required. The QCP shall include the criteria utilized by the QCT to correct or reject unsatisfactory materials. The QCT shall be certified as a Paving Inspector by the NETTCP.

The QCP shall detail the coordination of the activities of the Plan Administrator, the PCT and the QCT. The Project Superintendent shall be named in the QCP, and the responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall have a testing lab at the plant site, equipped with all testing equipment necessary to complete the tests in Table 5. The Contractor shall

locate an approved Gyratory Compactor at the plant testing lab. The Contractor shall generate QC sampling random numbers for each approved mix design. A copy of the random numbers shall be emailed to the QC.mainedot@maine.gov email address and remain on-file (in print) and be available for inspection at the QC laboratory. The Contractor shall sample, test, and evaluate Hot Mix Asphalt Pavement in accordance with the following minimum frequencies per each approved mix design:

TABLE 5: MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Temperature of mix	6 per Day at street and plant	-
Temperature of mat	4 per Day	-
%TMD (In-Place Density - Surface)	1 per 125 ton	AASHTO T 355 or AASHTO T 343
%TMD (In-Place Density - Base)	1 per 250 ton	AASHTO T 355 or AASHTO T 343
Fines / Effective Binder	1 per 500 ton	AASHTO T 312*
Gradation	1 per 500 ton	AASHTO T 30
PGAB Content	1 per 500 ton	AASHTO T 164 or AASHTO T 308
Voids at Ndesign	1 per 500 ton	AASHTO T 312*
VMA at Ndesign	1 per 500 ton	AASHTO T 312*
Rice Specific Gravity	1 per 500 ton	AASHTO T 209
Coarse Aggregate Angularity	1 per 5,000 ton	ASTM D5821
Flat and Elongated Particles	1 Per 5,000 ton	ASTM D4791
Fine Aggregate Angularity	1 Per 5,000 ton	AASHTO T 304
* Method A and B only		

The Contractor shall monitor plant production on each approved mix design using running average of three control charts as specified in Section 106 - Quality. Control limits shall be as noted in Table 6 below. The UCL and LCL, shall not exceed the allowable gradation control points for the particular type of mixture as outlined in Table 1 of Section 703.09.

TABLE 6: CONTROL LIMITS

Property	UCL and LCL
Percent Passing 4.75 mm and larger sieves	Target +/-4.0
Percent Passing 2.36 mm sieve	Target +/-2.5
Percent Passing 0.075 mm sieve	Target +/-1.0
PGAB Content	Target +/-0.25
VMA at Ndesign	LCL = LSL + 0.2
Voids at Ndesign	JMF Target +/-1.2
Theoretical Maximum Specific Gravity	JMF Target +/-0.020

The Contractor shall submit all HMA QC test reports, inspection reports and updated control charts to the Resident and QC.mainedot@maine.gov by email. The HMA QC test reports, inspection reports and updated control charts shall be signed by the appropriate technician and be submitted to the Department by 1:00 p.m. on the next Working Day, except when otherwise noted in the QCP and approved by the Department.

The Contractor shall also retain splits of the previous 5 QC tests, with QC results enclosed for random selection and testing by the Department during inspections of the HMA production facility. Test results of splits that do not meet the Dispute Resolution Variance Limits in Table 14 shall trigger an investigation by the MaineDOT Independent Assurance Unit, and may result in that lab losing NETTCP certification and the ability to request a dispute [Section 401.24 - Process for Dispute Resolution (Methods A, B and C only)].

The Contractor shall make density test results, including randomly sampled densities, available to the Department onsite. Summaries of each Day's results, including a daily paving report, shall be recorded and signed by the QCT and provided to the QC.mainedot@maine.gov email address and Resident in writing by 1:00 p.m. the next Working Day. The Contractor shall fill all holes in the pavement resulting from cutting cores by the Contractor or the Department with a properly compacted, acceptable mixture no later than the following Working Day. Before filling, the Contractor shall carefully clean the holes and apply a coating of emulsified asphalt. The Contractor may only cut additional cores for verification of the densometer, at a rate not to exceed 3 per Day or 2 per 1,000 ton placed.

If the Contractor's control chart shows the process for a given mix design to be out of control (defined as a single point outside of the control limits on the running average of three chart) on any property listed in Table 6: Control Limits, the Contractor shall notify the Resident of all affected Projects in writing of the corrective action by 1:00 p.m. the next Working Day. The written description shall detail what action is being taken by the Contractor to bring the property in question back within control limits. Subsequent quality control results are expected to demonstrate an improvement and regression towards the aim. The Department reserves the right to take action, to include cessation of production, in the case of repeated results outside the Table 6 control chart control limits.

On a daily basis, the Contractor shall perform density testing across the mat being placed, prior to being compacted by equipment at 12" intervals. If the density values vary by more than 2.0% from the mean, the Contractor shall make adjustments to the screed until the inconsistencies are remedied. Failure to replace or repair defective placement equipment may result in a letter of suspension of work and notification of a quality control violation resulting in possible monetary penalties as governed by Section 106 - Quality

The Contractor shall cease paving operations whenever one of the following occurs:

- a. The quality level for density using all quality control tests for the current Lot is less than 60 PWL.
- b. The Coarse Aggregate Angularity or Fine Aggregate Angularity value falls below the requirements of Table 3: Aggregate Consensus Properties Criteria in Section 703.07 for the design traffic level.
- c. The Flat and Elongated Particles value exceeds 10% by ASTM D4791.
- d. There is any visible damage to the aggregate due to over-densification other than on variable depth shim courses.
- e. The Contractor fails to follow the approved QCP.

The Contractor shall notify the Resident in writing as to the reason for shutdown, as well as the corrective action, by the end of the work Day. Failure to do so will be treated as a second incident under 106.4.6 QCP Non-compliance. The Department will only allow the continuation of paving operations when it is satisfied the corrective action will result in an improvement in results. The Department may require the submittal of a passing verification sample to allow further production. The Department retains the exclusive right, with the exception of the first Day's production of a new JMF, to determine whether the resumption of production involves a significant change to the production process. If the Department so determines, then the current lot will be terminated, a pay factor established, and a new lot will begin.

The Contractor may utilize innovative equipment or techniques not addressed by the Contract documents to produce or monitor the production of the mix, subject to approval by the Department.

401.192 **Quality Control Method D** - Unless otherwise noted in Section 403 - Hot Mix Asphalt Pavement, the Contractor shall submit a modified QC Plan detailing, how the mix is to be placed, what equipment is to be used, and what HMA plant is to be used for Items covered under Method D. All mix designs (JMF) shall be approved and verified by MaineDOT prior to use. Certified QC personnel shall not be required unless otherwise noted in Section 403 - Hot Mix Asphalt Pavement. The Contractor shall certify the mix and the test results for each item by a Certificate of Compliance.

401.20 **Acceptance Method A, B & C** - These methods utilizes Quality Level Analysis and pay factor specifications. For Hot Mix Asphalt Pavement designated for acceptance under Quality Assurance provisions, the Department will sample once per subplot on a statistically random basis, test, and evaluate in accordance with the following Acceptance Properties (see Table on next page):

TABLE 7: ACCEPTANCE PROPERTIES

Properties	Point of Sampling	Test Method
Gradation	Paver Hopper	AASHTO T 30
PGAB Content	Paver Hopper	AASHTO T 308
% TMD (In-Place Density)	Mat behind all Rollers	AASHTO T 269
Voids at Ndesign	Paver Hopper	AASHTO T 312
VMA at Ndesign	Paver Hopper	AASHTO T 312
Fines to Effective Binder	Paver Hopper	AASHTO T 312
VFB	Paver Hopper	AASHTO T 312

The Department will obtain samples of Hot Mix Asphalt Pavement in conformance with AASHTO R 97, Sampling Asphalt Mixtures, and the MaineDOT Policies and Procedures for HMA Sampling and Testing. The Contractor shall transport the samples in containers provided by the Department to the designated MaineDOT Laboratory within 48 hours except when otherwise noted in the Project specific QCP or as directed by the Resident. Failure to deliver an acceptance sample to the designated acceptance laboratory will be considered the second incident under 106.4.6–QCP Non-Compliance.

Target values shall be as specified in the JMF. The Department will withhold reporting of the test results for the Acceptance sample until 7:00 AM, on the 2nd Working Day of receipt of the sample, or after receipt of the Contractors results of the Acceptance sample split. Upon conclusion of each lot, where there is a minimum of four sublots, results shall be examined for statistical outliers, as stated in Section 106.7.2 - Statistical Outliers. (See Table on next page.)

TABLE 8: ACCEPTANCE METHODS

Property	USL and LSL		
	Method A	Method B	Method C
Lot Size*	Entire production per item per Contract up to 6,000 ton	Entire production per item per Contract	Entire production per item per Contract up to 6,000 ton
Maximum Sublot Size – Mix	750 ton	Lot quantity divided by three	750 ton
Maximum Sublot Size – Density	Surface Layers – 250 ton Base / Intermediate Layers – 500 ton	Lot quantity divided by five	Surface Layers – 250 ton Base / Intermediate Layers – 500 ton
Minimum Number of Samples – Mix	Four	Three	Four
Minimum Number of Samples – Density	Five		
* Unless otherwise agreed upon at the Prepave Meeting			

If there is less than one-half of a subplot remaining at the end, then it shall be combined with the previous subplot. If there is more than one-half subplot remaining at the end, then it shall constitute the last subplot and shall be represented by test results. If it becomes apparent partway through a Lot that, due to an underrun, there will be insufficient mix quantity to obtain the minimum number of sublots needed, the Resident may adjust the size of the remaining sublots and select new sample locations based on the estimated quantity of material remaining in the Lot. Unanticipated over-runs of up to 1,500 ton shall be rolled into the last lot. Cases where the lot is terminated prior to reaching completion shall be handled in accordance with Section 106.7.3 - Early Termination of Lots. In cases where density incentive/disincentive provision apply, additional cores shall be taken to attain a minimum of three for the Lot.

Isolated Areas - During the course of inspection, should it appear that there is an isolated area that is not representative of the lot based on a lack of observed compactive effort, excessive segregation, a change in process or any other questionable practice, that area may be isolated and tested separately. An area so isolated that has a calculated pay factor below 0.80 for Method A and C or below 0.86 for Method B, based on three random tests shall be removed and replaced at the expense of the Contractor for the full lane width and a length not to be less than 150 ft.

Pavement Density - The Department will measure pavement density using core samples tested according to AASHTO T 166. The Contractor shall cut 6" diameter cores at no additional cost to the Department by the end of the Working Day following paving. Cores shall be cut such that the nearest edge at least 9" from any joint. Pre-testing of the cores will not be allowed. If the Contractor and the Department mutually determine that a core is damaged, the Contractor shall cut new core(s) at the same offset and within 3 ft of the initial sample. The Contractor and the Department will mutually determine if underlying material is adhered to the core and if so will mark the core at the point where sawing is needed. The Department will place the cores in a secure container and the Contractor shall transport the cores to the designated MaineDOT lab. The cores will be saw cut by the Department to remove underlying layers. No recuts are allowed at a test location after the core has been tested. Upon conclusion of each lot, density results shall be examined for statistical outliers as stated in Section 106.7.2.

On all sections of overlay with wearing courses designed to be 1" or less in thickness, there shall be no pay adjustment for density otherwise noted in Section 403 - Hot Mix Asphalt Pavement. For overlays designed to be 1" or less in thickness, density shall be obtained by the same rolling train and methods as used on mainline travelway surface courses with a pay adjustments for density, unless otherwise directed by the Department.

There shall be no pay adjustment for density on shoulders unless otherwise noted in Section 403 - Hot Mix Asphalt Pavement. Density for shoulders shall be

obtained by the same rolling train and methods as used on mainline travelway, unless otherwise directed by the Department. Efforts to obtain optimum compaction will not be waived by the Department unless it is apparent during construction that local conditions make densification to this point detrimental to the finished pavement surface course. (See Table on next page.)

TABLE 9: ACCEPTANCE LIMITS

Property	USL and LSL		
	Method A	Method B	Method C
Percent Passing 4.75 mm and larger sieves	Target +/-7%		
Percent Passing 2.36 mm to 1.18 mm sieves	Target +/-4%	Target +/-5%	Target +/-5%
Percent Passing 0.60 mm sieve	Target +/-3%	Target +/-4%	Target +/-4%
Percent Passing 0.30 mm to 0.075 mm sieve	Target +/-2%	Target +/-3%	Target +/-2%
PGAB Content	Target +/-0.4%	Target +/-0.5%	Target +/-0.4%
Voids at N _{design}	4.0% +/-1.5%	4.0% +/-2.0%	N/A
Fines to Effective Binder	0.9 +/-0.3	0.9 +/-0.3	N/A
VMA at N _{design}	LSL from Table 1	LSL from Table 1	N/A
VFB	Table 1 plus a 4% production tolerance for USL	Table 1 plus a 4% production tolerance for USL	N/A
% TMD (In-place Density)	95.0% +/- 2.5%		

The Contractor shall cease paving operations whenever one of the following occurs on a lot in progress (see Table on next page):

TABLE 10: CEASE PRODUCTION CONDITIONS

Property	Percent Within Limits (PWL)	
	Method A / Method B	Method C
Percent Passing NMAS sieve*	<60	<60
Percent Passing 2.36 mm sieve*		
Percent Passing 0.30 mm sieve*		
Percent Passing 0.075 mm sieve*		
PGAB Content		
Voids at N _{design}		N/A
Fines to Effective Binder*		
VMA at N _{design}		
VFB		
Percent TMD (In-place Density)		
* Paving operations shall not be required to cease if the mean test value is equal to the LSL or USL and s = 0.		

In cases where the Contractor is to cease paving operations based upon an Acceptance result or pay factor, the Contractor will submit a corrective action plan to the Department. The Department will only allow the continuation of paving operations when it is satisfied the corrective action will result in an improvement in results. The Department may require the submittal of a passing verification sample to allow further production.

The Department will sample, test, and evaluate Hot Mix Asphalt Pavement in accordance with Section 106 - Quality and Section 401.20 - Acceptance, of this Specification. The Department will use the following criteria for pay adjustment at the completion of the Lot using the pay adjustment factors under Section 106.7 - Quality Level Analysis:

Density - If the pay factor for Density falls below 0.80 for Method A or C or 0.86 for Method B, all of the cores will be randomly re-cut by Sublot. A new pay factor will be calculated that combines all initial and retest results. If the resulting pay factor is below 0.80 for Method A or C or below 0.86 for Method B, the entire Lot shall be removed and replaced with material meeting the specifications at no additional cost to the Department, except that the Department may, when it appears that there is a distinct pattern of defective material, isolate any defective material by investigating each mix sample subplot and require removal of defective mix sample sublots only, leaving any acceptable material in place if it is found to be free of defective material. Pay factors equal to or greater than the reject level will be paid accordingly.

Mix Properties - The Department will determine a pay factor (PF) using the applicable Acceptance Limits. If any single pay factor for PGAB Content, VMA at N_{design}, or Voids at N_{design} falls below 0.80 for Method A, then the composite pay factor for PGAB Content, VMA at N_{design}, and Voids at N_{design} shall be 0.55. If any

single pay factor for PGAB Content, VMA at N_{design} , or Voids at N_{design} falls below 0.86 for Method B, then the composite pay factor for PGAB Content, VMA at N_{design} , and Voids at N_{design} shall be 0.70. If the PGAB content falls below 0.80 for Method C, then the PGAB pay factor shall be 0.55.

The following variables will be used for pay adjustment:

- P = Pay Adjustment
- Q = Quantity represented by PF in ton
- P = Contract price per ton
- PF = Pay Factor

The Department will determine a pay adjustment using Table 11: Pay Adjustment Calculations as follows:

TABLE 11: PAY ADJUSTMENT CALCULATIONS

Acceptance Method	Mix Properties / Gradation	Density
Method A	$PA = (\text{Voids @ } N_d \text{ PF} - 1.0)(Q)(P) \times 0.20 + (\text{VMA at } N_{design} \text{ PF} - 1.0)(Q)(P) \times 0.20 + (\text{PGAB Content PF} - 1.0)(Q)(P) \times 0.10$	$PA = (\text{density PF} - 1.0)(Q)(P) \times 0.50$
Method B		
Method C	$PA = (\% \text{ Passing Nom. Max PF} - 1.0)(Q)(P) \times 0.05 + (\% \text{ passing 2.36 mm PF} - 1.0)(Q)(P) \times 0.05 + (\% \text{ passing 0.30 mm PF} - 1.0)(Q)(P) \times 0.05 + (\% \text{ passing 0.075 mm PF} - 1.0)(Q)(P) \times 0.10 + (\text{PGAB Content PF} - 1.0)(Q)(P) \times 0.25$	

In addition, for 9.5 mm NMAS mixtures the following pay adjustment shall also apply:

- The average percent passing for the 0.075 mm sieve shall be evaluated for each Lot. If the average is greater than 6.5%, a pay adjustment according to Table 12 below shall apply in addition to the other pay adjustments for the given method of testing.

TABLE 12: 0.075 MM SIEVE PAY ADJUSTMENT

Average Percent Passing 0.075 mm Sieve	Pay Adjustment
6.6% - 7.0%	-5%
> 7.0%	-10%

The Department shall notify the Contractor whenever the average of at least three samples in a given Lot is greater than 6.5%.

401.21 **Acceptance Method D** - Unless otherwise stated in the 403 special provision, one sample will be taken from the paver hopper or the truck body per 250 ton per pay item. The mix will be tested for gradation and PGAB content. Disputes will not be allowed. If the mix is within the tolerances listed in Table 13, the

Department will pay the Contract unit price. Contractor shall cut two 6" cores, which shall be tested for percent TMD per AASHTO T 269 unless otherwise noted in Section 403 - Hot Mix Asphalt Pavement. If the average for the two tests falls below 92.5% the disincentive shall apply. If the test results for each 250 ton increment are outside these limits, the following deductions shall apply to the HMA quantity represented by the test. (See Table on next page.)

TABLE 13: METHOD D ACCEPTANCE LIMITS AND PAY ADJUSTMENTS

Property	USL and LSL	Pay Adjustment
Percent Passing 4.75 mm and larger sieves	Target +/-7%	N/A
Percent Passing 2.36 mm sieve	Target +/-7%	-2.0%
Percent Passing 1.18 mm sieve	Target +/-5%	N/A
Percent Passing 0.60 mm sieve	Target +/-4%	N/A
Percent Passing 0.30 mm sieve	Target +/-3%	-1.0%
Percent Passing 0.075 mm sieve	Target +/-3%	-2.0%
PGAB Content	Target +/-0.5%	-5.0%
Percent TMD (In-place Density)	LSL of 92.5%	-10.0%

If test results do not meet the Table 13 requirements, deducts as shown shall be applied to the quantity of mix represented by the test.

401.22 **Method of Measurement** - The Department will measure Hot Mix Asphalt Pavement by the ton in accordance with Section 108.1 - Measurement of Quantities for Payment.

401.23 **Basis of Payment** - The Department will pay for the work, in place and accepted, in accordance with the applicable sections of this Section, for each type of HMA specified.

The Department will pay for the work specified in Section 401.12, for the HMA used, except that cleaning objectionable material from the pavement and furnishing and applying bituminous material to joints and contact surfaces is incidental. Payment for this work under the appropriate pay items shall be full compensation for all labor, equipment, materials, and incidentals necessary to meet all related Contract requirements, including design of the JMF, implementation of the QCP, obtaining core samples, transporting cores and samples, filling core holes, applying emulsified asphalt to joints, and providing testing facilities and equipment. The Department will make a pay adjustment for quality as specified in Section 401.20 - Acceptance Method A, B & C or 401.21 - Acceptance Method D.

401.24 **Process for Dispute Resolution (Methods A, B, & C only)** - At the time of Hot-Mix Asphalt sampling, the Department will obtain a split sample of each Acceptance test random sample for possible dispute resolution testing. The Contractor shall also obtain a split sample of the HMA at this same time. If the

Contractor wishes to retain the option of requesting dispute testing of the initial Acceptance sample, the Contractor will test their split of the Acceptance sample and shall report their results to the Resident, with a copy to Contractor.mainedot@maine.gov by 7:00 AM, on the 2nd Working Day from time of QA sampling, otherwise dispute resolution will not be initiated. The Department's dispute resolution split sample will be properly labeled and stored for a period of at least 2 weeks after it has been reported, or until the sample is tested. The properties eligible for dispute and the respective variances are shown in Table 14.

The Contractor may dispute the Department's Acceptance results and request that the dispute resolution split sample be tested by notifying the Department's Resident and QA Engineer in writing within 2 Working Days after the results of the Acceptance test are reported. The following shall be provided in the request:

- Acceptance sample reference number
- The specific test result(s) or property(ies) being disputed, and
- The complete, signed report of the Contractor's testing (In a lab certified by the NETTCP and MaineDOT) of their split of the Acceptance sample indicating that the variances in Table 14 for the specific test result(s) or property(ies) were exceeded.

TABLE 14: DISPUTE RESOLUTION VARIANCE LIMITS

Property	Disputable on Method A/B	Disputable on Method C	Variance Limits
PGAB Content	Yes	Yes	+/-0.4%
G_{mb}	Yes	No	+/-0.030
G_{mm}	Yes	No	+/-0.020
Voids at N_{design}	Only if G_{mb} or G_{mm} is not disputable	No	+/-0.8%
VMA at N_{design}	Only if G_{mb} or G_{mm} is not disputable	No	+/-0.8%
Percent Passing 4.75 mm and larger sieves	No	Yes	+/- 4.0%
Percent Passing 2.36 mm to 0.60 mm sieves	No	Yes	+/- 3.0%
Percent Passing 0.30 mm to 0.15 mm sieves	No	Yes	+/- 2.0 %
0.075 mm sieve	Only for 9.5 mm NMAS mixes	Yes	+/- 0.8%

The value of any disputed result or property reported for the initial Acceptance sample shall stand if the value reported for the dispute resolution sample is not

closer to the value the Contractor reported for their split sample than to the value reported for the initial Acceptance sample. If the value reported for the dispute resolution falls precisely half-way between the other two values the value reported for the dispute resolution will replace the original acceptance value. Otherwise, the value reported for the dispute resolution sample will replace the value reported for the initial Acceptance sample and will be used to re-calculate any other affected results or properties.

SECTION 402 - PAVEMENT SMOOTHNESS

- 402.00 **Smoothness Projects** - Projects to have their pavement smoothness analyzed in accordance with this Specification will be so noted in Special Provision 403 - Hot Mix Asphalt Pavement.
- 402.01 **Pavement Smoothness** - The final pavement surface shall be evaluated for smoothness using a Class I or Class II profiler as defined by ASTM E950 (94). Smoothness measurements will be expressed in terms of the International Roughness Index (IRI) as defined by the World Bank, in units of inches/mile.
- 402.02 **Lot Size** - Lot size for smoothness will be 3000 lane-feet. A subplot will consist of 50 lane-feet. Partial lots will be included in the previous lot if less than one-half the size of a normal lot. If equal to or greater than one-half the normal lot size, it will be tested as a separate lot.
- 402.03 **Acceptance Testing** - The Department will conduct Acceptance testing following completion of the surface course. Sections to be excluded from testing include the following:
- Bridge decks and joints (no smoothness measurements will be taken within 100 ft of bridge joints)
 - Acceleration and deceleration lanes
 - Shoulders and ramps
 - Side streets and roads
 - Within 100 ft of transverse joints at the beginning and end of the Project
 - Within 100 ft of railroad crossings
 - Urban areas with speed limits of 30 mph or lower

Each lot shall have 2 measurements made in each wheel path. The average of the 4 measurements will determine the smoothness for that lot. The smoothness measurements will be statistically evaluated for pay factors as described in

Subsection 106.7 - Quality Level Analysis, using the specification limits shown below.

TABLE 1: ACCEPTANCE LIMITS

Level	USL
I	50 in/mile
II	60 in/mile
III	70 in/mile

Computation of Smoothness Pay Adjustment:

$$PA = (PF-1.0)(Q)(P)$$

where:

Q = Quantity of surface course in the Lot (excluding shoulders, side streets, bridge decks, ramps, acceleration and deceleration lanes)

PF = smoothness pay factor for the Lot

P = Contract unit price for surface pavement

PA = pay adjustment

- 402.04 **Unacceptable Work** - In the event that any Lot is found to have a pay factor less than 0.80, the Contractor shall take whatever remedial action is required to correct the pavement surface in that Lot at no additional expense to the Department. Such remedial action may include but is not limited to removal and replacement of the unacceptable pavement. In the event remedial action is necessary, the Contractor shall submit a written plan to the Resident outlining the scope of the remedial work. The Resident must approve this plan before the remedial work can begin. Following remedial work, the Lot shall be retested, and will be subject to the specification limits listed above. The resulting pay factor, if within the acceptable range, will be used in the final pay adjustment. The Contractor shall pay the cost of retesting the pavement following corrective action.

Localized surface tolerance defects will be subject to the provisions outlined in Section 401.11 - Surface Tolerances.

Payment will be made under:

Pay Item		Pay Unit
402.10	Incentive/Disincentive - Pavement Smoothness	Lump Sum

SECTION 403 - HOT MIX ASPHALT PAVEMENT

- 403.01 **Description** - This work shall consist of constructing one or more courses of Hot Mix Asphalt Pavement on an approved base in accordance with these specifications, and in reasonably close conformity with the lines, grades,

thickness and typical cross sections shown on the plans or established. The HMA pavement shall be composed of a mixture of aggregate, filler if required, and asphalt material.

- 403.02 **General** - The materials and their use shall conform to the requirements of Section 401 - Hot Mix Asphalt Pavement.
- 403.03 **Construction** - The construction requirements shall be as specified in Section 401 - Hot Mix Asphalt Pavement.
- 403.04 **Method of Measurement** - Hot mix asphalt pavement will be measured as specified in Section 401.21 - Method of Measurement.
- 403.05 **Basis of Payment** - The accepted quantities of hot mix asphalt pavement will be paid for at the Contract unit price per ton for the mixtures, including hot mix asphalt material complete in place. Method A, Method B, Method C and Method D shall be used for acceptance as specified in Section 401 - Hot Mix Asphalt Pavements. (See Complementary Notes, Section 403 - Hot Mix Asphalt Pavement, for Method location).

Payment will be made under (Table continues on next page):

Pay Item		Pay Unit
403.102	Hot Mix Asphalt Pavement for Special Areas	Ton
403.206	Hot Mix Asphalt, 25 mm Nominal Maximum Size	Ton
403.207	Hot Mix Asphalt, 19.0 mm Nominal Maximum Size	Ton
403.2071	Hot Mix Asphalt , 19.0 mm Nominal Max Size (Polymer Modified)	Ton
403.2072	Asphalt Rich Hot Mix Asphalt, 19.0 mm Nominal Maximum Size (Asphalt Rich Base and Intermediate course)	Ton
403.208	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size	Ton
403.2081	Hot Mix Asphalt - 12.5 mm Nominal Max Size (Polymer Modified)	Ton
403.209	Hot Mix Asphalt, 9.5mm Nominal Maximum Size (sidewalks, drives, islands & incidentals)	Ton
403.210	Hot Mix Asphalt, 9.5 mm Nominal Maximum Size	Ton
403.2101	Hot Mix Asphalt, 9.5 mm Nominal Maximum Size (Polymer Modified)	Ton
403.2102	Asphalt Rich Hot Mix Asphalt, 9.5 mm Nominal Maximum Size (Asphalt Rich Intermediate course)	Ton
403.2104	Hot Mix Asphalt, 9.5 mm Nominal Maximum Size (Thin Lift Surface Treatment)	Ton
403.211	Hot Mix Asphalt, 9.5 mm Nominal Maximum Size (Shimming)	Ton
403.2111	Hot Mix Asphalt, 9.5 mm Nominal Maximum Size (Shimming, Polymer Modified)	Ton

403.212	Hot Mix Asphalt, 4.75 mm Nominal Maximum Size	Ton
403.213	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size (Base and Intermediate Base course)	Ton
403.2131	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size (Base and Intermediate Base course, Polymer Modified)	Ton
403.2132	Asphalt Rich Hot Mix Asphalt, 12.5 mm Nominal Maximum Size (Base and Intermediate Base course)	Ton
403.214	Hot Mix Asphalt, 4.75 Nominal Maximum Size ($\frac{5}{8}$ " Surface Treatment)	Ton

SECTIONS 404, 405, 406, 407, 408 – Vacant

SECTION 409 - BITUMINOUS TACK COAT

409.01 **Description** - This work consists of furnishing and applying one uniform application of liquid bituminous material on an approved surface in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established.

409.02 **Bituminous Material** - The type and grade of bituminous material will be specified in the Contract.

The bituminous material shall meet the applicable requirements of Section 702 - Bituminous Materials. The bituminous material may be conditionally accepted at the source.

409.04 **Weather Limitations** - Bituminous material shall not be applied on a wet or frozen surface, or when weather conditions are otherwise unfavorable to proper construction procedures.

Unless otherwise specified in the Contract, the use of rapid set emulsions shall be required after sunset or before sunrise, when the atmospheric temperature is below 50°F but above 40°F in a shaded area at the job site.

409.05 **Equipment** - The Contractor shall provide necessary equipment to properly and uniformly apply the bituminous material.

All distributors shall be equipped with accurate volume measuring devices, or a calibrated tank and measuring stick, thermometer for measuring temperatures of tank contents, power unit for the pump, capable of full circulation, and able to heat the contents to application temperatures. Approved fog type nozzles will be required.

Truck mounted distributors will be required for use on all roadway sections considered as traveled way, ramps, side roads and shoulders. Spray bars on truck mounted distributors shall be adjustable laterally and vertically.

Truck mounted distributors shall be designed, equipped, maintained and operated so that bituminous material at constant temperature may be applied uniformly on variable widths of surface up to 5 ft at readily determined and controlled rates from 0.01 to 0.5 gal/yd², with uniform pressure and with an allowable variation from any specified rate not to exceed 0.01 gal/yd².

In areas not accessible to a truck mounted distributors, or if Project conditions warrant, the Department may allow the use of trailer mounted pressurized tank distributors equipped with pressurized spray bars. Spray nozzles, tank pressure, and travel speed shall be adjusted to achieve proper application rate and coverage.

All liquid bituminous material bulk delivery vehicles, truck mounted distributors, or pressurized tank distributors shall be equipped with an acceptable sampling valve.

On bulk delivery vehicles the valve shall be located in an accessible area in the lower half of the front or rear bulkhead. The valve shall be similarly located on distributors except that it may be installed in a circulating line having a rising flow.

409.06 **Preparation of Surface** - before application of the bituminous tack coat the surface shall be thoroughly cleaned of all loose and objectionable material. Preparation of the surface shall be considered incidental to the Contract.

409.07 **Application of Bituminous Material** - Bituminous material shall be applied by a pressure distributor in a uniform, continuous spread over the area to be treated and within the temperature range specified in Section 702.05 - Application Temperatures. The rate of application and areas to be treated will be specified in the Contract.

When traffic is maintained, one-way passage of vehicles will be maintained on the untreated portion of the roadway. Bituminous tack coat shall not be placed on any surface where traffic will be forced to travel upon the uncovered tack coat. All tack coat shall be covered on the Day it is applied.

Care shall be taken so that the application of the bituminous tack coat at the junction of spreads is not in excess of the specified amount. Skipped areas and deficiencies shall be corrected as directed.

409.08 **Method of Measurement** - Unless otherwise specified, bituminous tack coat will be measured by the gallon. All quantity determinations will be made in accordance with Section 108 - Payment.

- 409.09 **Basis of Payment** - The accepted quantity of bituminous tack coat will be paid for at the Contract unit price per gallon for the designated type of material complete in place.

Payment will be made under:

Pay Item		Pay Unit
409.15	Bituminous Tack Coat, Applied	Gallon

SECTION 410 - BITUMINOUS SURFACE TREATMENT - Reserved

SECTION 411 - UNTREATED AGGREGATE SURFACE COURSE

- 411.01 **Description** - This work shall consist of constructing a surface course or leveling course of untreated aggregate or crushed stone on an approved base in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established.
- 411.02 **Aggregate** - Aggregates for untreated aggregate surface course shall conform to the requirements of Section 703.10 - Aggregate for Untreated Surface Course and Leveling Course Type A.
- Aggregates for crushed stone surface shall conform to the requirements of Section 703.12 - Aggregate for Crushed Stone Surface.
- 411.03 **Placing** - The surface course material shall be spread evenly in one layer upon the prepared base course to a depth that will insure the required depth after being compacted. The aggregate, when spread, shall be well graded with no pockets of fine or coarse material and shall be bladed and shaped with a power grader.
- 411.04 **Compaction** - Compacting shall be done with rollers, heavy construction equipment or any combination capable of satisfactorily compacting the course. The Contractor shall maintain the moisture content of the material to attain the required compaction.
- When the aggregate surface material lacks sufficient fines to obtain compaction, binder material of an approved quality shall be added. The binder material shall be uniformly incorporated into the surface material by means of harrowing or by other methods capable of obtaining satisfactory results. The amount added shall not increase the total fines in the mixture to exceed the limits specified.
- 411.05 **Surface Tolerance** - The entire surface shall be shaped and maintained to a tolerance of $\frac{3}{8}$ in above or $\frac{3}{8}$ in below the required cross sectional shape.

411.06 **Leveling Course** - When Aggregate Leveling Course for fine grading aggregate base and subbase course is called for, it shall be placed, measured and paid for under the Contract item for Untreated Aggregate Surface Course.

411.07 **Method of Measurement** - Untreated aggregate surface course will be measured by the cubic yard in place unless designated by pay item to be measured by truck measure. When measured in place, the width and thickness for measurement will be the width and thickness of aggregate surface as shown on the plans or as modified. The length will be along the centerline. All measurements will be in accordance with Section 108 - Payment. When designated by pay item to be measured by truck measure, the measurement will be in vehicles at the point of delivery as shown on delivery slips in accordance with Section 108.1.3f.

Aggregate surface course, designated by pay item to be measured in place and used for driveways and other locations difficult to accurately measure in place, may be measured in vehicles at 80% of the number of cubic yards accepted and used, at the point of delivery as shown by delivery slips in accordance with Section 108.1.3f. The quantity so measured shall not exceed 400 yd³ per Contract.

Aggregate for crushed stone, surface will be measured by the ton in accordance with Section 108 – Payment.

411.08 **Basis of Payment** - The accepted quantities of untreated aggregate surface course of the type specified will be paid for at the respective Contract price per cubic yard. Payment shall include purchasing material, stripping pits, excavating, crushing and screening when necessary, hauling, placing, compacting and other necessary processes which are required to furnish acceptable material under this item.

Water added or fines added or both added to the material to aid compaction and to prevent raveling will be at the Contractor's expense.

Payment will be made under:

Pay Item		Pay Unit
411.09	Untreated Aggregate Surface Course	Cubic Yard
411.10	Untreated Aggregate Surface Course, Truck Measure	Cubic Yard
411.12	Crushed Stone Surface	Ton

SECTIONS 412 to 418 - Vacant

SECTION 419 - SAWING AND SEALING JOINTS IN BITUMINOUS PAVEMENT - Reserved

SECTION 420 - PORTLAND CEMENT CONCRETE PAVEMENT - Reserved

SECTIONS 421, 422, 423 - Vacant

SECTION 424 - CRACK SEAL - Reserved

SECTION 425 - RECYCLED BITUMINOUS PAVEMENT - Reserved

SECTIONS 426 to 459 - Vacant

**SECTION 460 - HOT MIX ASPHALT PAVEMENT FOR SPECIAL AREAS -
Reserved**

SECTION 461 - LIGHT CAPITAL PAVEMENT - Reserved

SECTION 462 – MICROSURFACING – Reserved

DIVISION 500 - STRUCTURES

SECTION 501 - FOUNDATION PILES

501.01 **Description** - This work shall consist of furnishing and driving piles, of the types and dimensions specified on the Contract Plans. Piles shall conform to and be installed, as detailed in these specifications, to the lines, grades, locations, and required resistance(s) shown on the Plans or as authorized by the Resident. Work under this item shall also consist of any pile testing specified by the project Contract Plans and described in these specifications.

501.02 **Materials** - Materials shall meet the requirements of the following sections of Divisions 500 - Structures, and 700 - Materials:

Structural Concrete (Class A)	502.05
Reinforcing Steel	709.01
Welded Steel Wire Fabric	709.02
Steel Pipe Piles, Splices and Tips	711.01
H-Beam Piles, Splices and Tips	711.10

Steel casings shall conform to the material requirements of Section 711.01 - Steel Pipe Piles, Splices and Tips.

Mill test reports will be required for Steel Pipe Piles and H-Beam Piles. Notch toughness tests will not be required.

501.03 **Quality Control Plan** - The Contractor shall control the quality of the foundation piles through testing, inspection and practices which shall be described in the Quality Control Plan (QCP), sufficient to assure a product meeting the Contract requirements. The QCP shall meet the requirements of Section 106 - Quality and this specification. The Department will use criteria established in the approved QCP to accept the work provided in this Section.

No work under this item shall proceed until the QCP, or amendments to the QCP, is submitted to and approved by the Resident.

The QCP shall address all elements that affect the quality of the foundation piles including but not limited to, the following:

- A. Driving Equipment
- B. Wave Equation Analysis
- C. Static Load Testing Apparatus
- D. Driving Procedures
- E. Number of Pile Splices, Locations and Details
- F. Tolerances
- G. Pile and Driving Equipment Data Form

The Contractor's Schedule of Work shall allow time for the review of the QCP or amendments to the QCP, as noted in Section 106.4.1.B - Approval.

501.04 **Construction Requirements**

501.041 **Ordering Piles** - The Contractor shall order all pilings from an itemized list of order lengths that is submitted by the Contractor for review and approval by the Resident. When additional lengths of piles are necessary, the additional lengths will be ordered by the Contractor from a written list provided by the Resident.

501.042 **Equipment for Driving Piles**

Hammers - Piles shall be driven with approved power-actuated impact hammers powered with steam/air, diesel fuel, or hydraulics (hereinafter referred to as power hammers). Gravity drop hammers (hereinafter referred to as drop hammers), except as noted on the Plans, shall only be used to drive timber piles. When drop hammers are used to drive timber piles, the ram shall be between 2,000 and 3,500 lb and the height of drop shall not exceed 13 ft. In no case shall the ram weight be less than the combined weight of the drive head and pile. All drop hammers shall be equipped with hammer guides to assure concentric impact on the drive head.

Air/steam hammers - shall be operated and maintained within the manufacturer's specified ranges. The plant and equipment furnished for air/steam hammers shall have sufficient capacity to maintain, at the hammer under working conditions, the volume and pressure specified by the manufacturer. The plant and equipment shall be equipped with accurate pressure gauges that are easily accessible to the Resident. The weight of the striking parts of air and steam power hammers shall not be less than $\frac{1}{3}$ the weight of drive head and pile being driven, and in no case shall the striking parts weigh less than 2,750 lb.

Open-end (single acting) diesel hammers - shall be equipped with a device such as rings on the ram or a scale (jump stick) extending above the ram cylinder, to permit the Resident to visually determine hammer stroke at all times during pile driving operations. The Contractor shall provide the Resident with a chart from the hammer manufacturer equating stroke and blows per minute to energy imparted for the open-end diesel hammer to be used.

Closed-end (double acting) diesel hammers - shall be equipped with a bounce chamber pressure gauge, in good working order, mounted near ground level to be easily read by the Resident. The Contractor shall provide the Resident with a chart, calibrated within 90 days of use, of actual hammer performance, equating bounce chamber pressure to either equivalent energy or stroke for the closed-end diesel hammer to be used.

Double-acting hydraulic hammers - shall have a power plant with sufficient capacity to maintain the volume and pressure specified by the manufacturer, under working conditions. The power plant and equipment shall be equipped with digital readouts, easily accessible to the Resident, showing pertinent system criteria, including but not limited to energy imparted to the pile, to enable the Resident to visually determine whether or not the refusal criteria has been met. In addition, the Contractor shall provide the Resident with a chart, calibrated within 90 days of use, of actual hammer performance.

Approval of Pile Driving Equipment - All pile driving equipment shall be sized such that the specified piles can be driven to the required resistance, without damage, as indicated on the Plans. Approval of the pile driving equipment by the Department will be based on the wave equation analysis and a completed Pile and Driving Equipment Data Form, as shown on Figure 1 of this Section.

The wave equation analysis prepared by the Contractor shall include a proposed stopping criterion, where the number of blows per inch, for a number of 1" driving intervals, at a specified hammer-stroke and fuel setting, is clearly defined. The criteria that the Department will use to evaluate the driving equipment will be based on the approved wave equation analysis utilizing the information provided in the completed Pile and Driving Equipment Data Form.

For the driving system to be acceptable, the number of hammer blows at the required resistance indicated by the wave equation analysis shall be between 3 and 15 blows per inch, and the driving stresses shall not exceed 90% of the specified yield stress of the pile material. For timber piles, the compressive driving stress shall not exceed 3 times the base resistance of the wood in compression parallel to the grain. The stopping criteria used for pile driving operations shall be approved by the Department.

If the wave equation analyses show that the driving system is unacceptable, the Contractor shall modify or replace the proposed driving equipment in an amendment to the QCP, at its expense, until subsequent wave equation analyses indicate the piles can be driven to the required resistance, without damage or excessive blows.

Department review times of a revised wave equation analysis and Pile and Driving Equipment Data Form will be per Section 106.4.1.B.

During pile driving operations, the Contractor shall use the approved system. No variations in the driving system will be permitted without an amendment to the QCP and a revised wave equation analysis and Pile and Driving Equipment Data Form.

Acceptance of the pile driving equipment does not relieve the Contractor of the responsibility to properly install the piling. The hammer acceptance and driving criteria will be based on commonly accepted hammer efficiencies, component properties, and soil parameters. Local soil conditions and the actual driving system will affect the driving. If, in the opinion of the Resident, the accepted driving system fails to perform satisfactorily during actual driving, the Department reserves the right to revise the driving criteria.

Drive System Components and Accessories

Leads - Pile driver leads shall be constructed in such a manner as to afford freedom of movement of the hammer while maintaining alignment of the hammer and the pile to insure concentric impact for each blow.

Followers - Followers, when used, must be included in the QCP. In cases where a follower is permitted, the first pile in each group and every tenth pile driven thereafter shall be driven full length without a follower, to verify that adequate pile length is being attained to develop the required pile resistance. The follower and pile shall be held and maintained in equal and proper alignment during driving. The follower shall be of such material and dimensions to permit the piles to be driven to the length determined necessary from the driving of the full-length piles. The final position and alignment of the first two piles installed with followers in each substructure unit shall be verified in accordance with location tolerances.

Hammer Cushion - All power pile driving equipment shall be equipped with a suitable thickness of hammer cushion material to prevent damage to the hammer and pile and to insure uniform driving behavior. Hammer cushions shall be made of durable, manufactured materials, provided in accordance with the hammer manufacturer's guidelines except that all wood, wire rope, and asbestos hammer cushions are specifically disallowed and shall not be used. A striker plate as recommended by the hammer manufacturer shall be placed on the hammer cushion to insure uniform compression of the cushion material. The hammer cushion shall be inspected in the presence of the Resident when beginning pile driving at each pile group or after each 100 hours of pile driving, whichever is less. Any hammer cushion thickness measuring less than 75% of the original thickness shall be replaced by the Contractor before driving is permitted to continue.

Helmet - Piles driven with power hammers require an adequate drive head to distribute the hammer blow to the pile head. The helmet shall be axially aligned with the hammer and the pile. The

helmet shall be guided by the leads and not be free-swinging. The helmet shall fit around the pile head in such a manner as to prevent transfer of torsional forces during driving while maintaining proper alignment of hammer and pile.

For special types of piles, appropriate driving heads, mandrels, or other devices shall be provided in accordance with the manufacturer's recommendations so that the piles may be driven without damage.

- 501.043 ***Driving Procedures and Tolerances*** - The sequence of driving piles in any substructure unit shall be included in the QCP. The ground surface shall be brought to the bottom of the footing elevation before driving the piles. The Contractor shall furnish all assistance required to make any observations and measurements. Prior to placing any pile section in the leads, the Contractor shall make the pile section available for foot and inch marking by the Resident. When pile sections are placed in the leads prior to marking by the Resident, the Contractor shall mark the pile in foot and inch increments, or provide reasonable means of access to the pile for foot and inch marking. The order of placing individual piles in pile groups shall be either starting from the center of the group and proceeding outwards in both directions or starting at the outside row and proceeding progressively across the group.

When driving is interrupted before final penetration is reached, data for the bearing resistance of the pile shall not be taken until at least 12" of pile penetration is attained after driving has been resumed, or pile refusal has been attained.

The heads of all piles shall be plane and perpendicular to the longitudinal axis of the pile before the helmet is attached. Approval of the hammer relative to driving stress damage shall not relieve the Contractor of responsibility for piles damaged because of misalignment of the leads, failure of cushion materials, failure of splices, malfunction of the pile hammer, or improper construction methods. Piles damaged for such reasons shall be rejected and replaced at the Contractor's expense when the Resident determines that the damage impairs the strength of the pile.

Jetting - Jetting shall be done only with the permission of the Resident and must be addressed in the Contractor's Soil Erosion and Water Pollution Control Plan (SEWPCP). When water jets are used, the number of jets and the volume and pressure of the water at the nozzles shall be sufficient to erode freely the material adjacent to the piles. The plant shall have sufficient capacity to deliver at all times at least 100 lb per square inch pressure at two ¾" jet nozzles. Before the desired penetration is reached, the jets shall be withdrawn and the

piles shall be driven with the hammer to the required penetration or bearing capacity.

Vibratory Hammers - When approved, non-displacement piles may be initially driven with a power-actuated vibratory hammer powered with electricity or hydraulics (hereinafter referred to as vibratory hammers). Vibratory hammers shall not be used for precast concrete piles due to pile damage and bending stress considerations. Vibratory hammers shall not be used to set piles which develop resistance primarily from friction with the surrounding soils through the pile length.

Piles permitted to be initially driven using a vibratory hammer shall be subsequently driven to the required capacity in accordance with the approved stopping criteria and the QCP using a power hammer. Vibratory hammers, when permitted, may only be used to initially set a pile up to a distance of 20 ft above the expected tip elevation, at which point a power hammer shall be employed. At the discretion of the Resident piles may be initially set with a vibratory hammer to a distance of 10 feet above the expected tip elevation. Vibratory hammers will only be permitted to initially set production piles after the pile tip elevation is established by load testing and/or piles driven with an impact hammer and the ultimate pile resistance is verified. If the pile penetration rate is 12" or less per minute, the use of a vibratory hammer shall be discontinued and a power hammer employed. When a battered pile is initially set using a vibratory hammer, the hammer shall be mounted in a set of leads with gates and/or kept in alignment using a driving frame/template.

Preaugering - When necessary to clear obstructions or to obtain the specified pile penetration, as approved by the Resident, the Contractor may preauger. When specified in the Contract documents, the Contractor shall preauger holes at pile locations and to the depths shown on the Plans. Preaugered holes shall be of a size smaller than the diameter of the diagonal of the pile cross section. If subsurface obstructions, such as boulders or rock layers are encountered, the hole diameter may be increased to the least dimension needed for pile installation. Any void space remaining around any type pile after driving shall be completely filled with sand or other approved material. The use of spuds, which are driven and removed to make a hole for inserting a pile, shall not be permitted in lieu of preaugering.

Pre-excavation - When necessary to clear subsurface obstructions, such as boulders or rock layers, or to obtain the specified pile penetration, the Contractor may pre-excavate, with the approval of the Resident.

Heaved Piles - Piles that have heaved more than ¼" during the driving of other piles in a group shall be resealed to the required penetration or bearing capacity at the Contractor's expense.

Location and Alignment Tolerance - The Contractor will be responsible to hold the piles in place to allowable tolerances. Swinging leads, when used, shall be fitted with a pile gate at the bottom of the leads. The leads shall be adequately embedded in the ground or the pile constrained in a template to maintain alignment. At the discretion of the Resident a driving frame may be required. Piles shall be driven with a variation of not more than ¼" per foot from the vertical or from the batter shown on the Plans. For piles that cannot be inspected for axial alignment internally after installation, an alignment check shall be made before installing the last 5 ft of pile, or after installation is completed, provided the exposed portion of the piles is not less than 5 ft in length. The Resident may require that driving be stopped in order to check the pile alignment. Pulling laterally on piles to correct misalignment, or splicing a properly aligned section of a misaligned section shall not be permitted.

The cutoff elevation of piles for trestle bents and pile bent piers shall not be out of position by more than 2" from the dimensions shown on the Plans. The cutoff elevation of piles for integral abutments shall not be out of position from the dimensions shown on the Plans by more than 2" in any direction. The cutoff elevation of piles, other than for trestle bents and integral abutments, shall not be out of position by more than 6". Piles for integral abutments shall not be out of skew by more than 10 degrees. Actual embedment of the piles in the concrete shall be within 6" of that shown on the Plans. The as-driven centroid of load of any group at cutoff elevation shall be within 5% of the Plan location of the designated centroid of load. No pile shall be nearer than 4" from any edge of the pile cap. Any increase in size of the pile cap to meet this edge distance requirement shall be at the Contractor's expense.

- 501.044 **Special Requirements for Steel Pipe Piles and Steel Casings** - Pipe piles shall be driven closed ended, unless otherwise specified. When open-ended pipe piles are specified or when the ends are not completely closed ended when driven, the inside of the pile shall be thoroughly cleaned out, and the inside walls cleaned by jetting or other means approved by the Resident. The sediment control required for the cleaning operations shall be covered in the Contractor's SEWPCP.

Pipe piles shall be inspected and approved by the Resident immediately before concrete is placed in them. They shall be free from rupture and undue deformation and shall be free from water unless

the Resident determines that the concrete can be placed without damage to the pile and such that the discharged water will be contained. The Contractor shall provide lights and other equipment necessary to enable the Resident to inspect each pipe pile.

Portland cement concrete for filling the pipe piles shall be placed in one continuous operation to fill the pile completely without causing water contamination. An internal type vibrator shall be used in the top 25 ft. Pile heads shall be protected and cured in accordance with Section 502 - Structural Concrete.

The placing of concrete and the driving of piles shall be scheduled so that fresh and setting concrete will not be injured by the pile driving.

Concrete shall not be placed in pipe piles until pile driving has progressed beyond a radius of 15 ft from the pile to be concreted. If pile heave is detected for pipe piles that have been filled with concrete, the piles shall be redriven to the original position after the concrete has attained sufficient strength and a proper hammer-pile cushion system, is in place and is satisfactory to the Resident.

When a reinforcing steel cage is specified, it shall be placed inside the piles to allow for a minimum of 2" of concrete cover and the piles shall be filled with concrete to the elevation shown on the Plans.

Full-length pipe piles and steel casings shall be used wherever practicable; however, splicing may be permitted when approved by the Resident. The method of splicing shall be as follows:

- a. Steel pipe piles and steel casings shall be spliced by full penetration butt joint welds.
- b. When the pipe piles and steel casings are to be spliced while in a vertical position, splicing shall be accomplished utilizing single-bevel groove welds with the use of back-up rings. When the pipe piles and steel casings are to be spliced while in a horizontal position, splicing shall be accomplished utilizing single-vee groove welds with the use of back-up rings.
- c. Welded joints shall conform to the Standard Details [MF1.1].

501.045 **Defective Piles and Corrective Measures** - Pile driving activities shall not result in damage to, or deformation of, the piles. Any pile damaged due to internal defects, improper driving, or driven below cutoff elevation, shall be considered defective and shall be corrected by and at the expense of the Contractor, by a method approved by the Resident.

501.046 **Driven Pile Resistance, Pile Testing, and Acceptance** - Pile testing will be required as shown on the Plans. Pile testing will be required to

confirm that piles attain the required resistance and that the stresses in the piles do not exceed allowable limits during driving.

A dynamic load test consists of mounting instruments on the pile and accurately recording the output during driving using dynamic pile load test equipment meeting the requirements of ASTM D4945. The stresses in steel piles during driving shall not exceed 90% of the yield stress, as determined by wave equation analyses or dynamic pile load testing. Piles which have been overstressed, per wave equation or dynamic pile load testing, shall be replaced by the Contractor, at no additional cost to the Department.

A static load test consists of the application of a known load to the pile or group of piles and the accurate measurement of the resulting displacement. The Contractor shall furnish all labor and equipment for static load testing.

In the case of concrete filled steel pipe piles, no load shall be placed on the pile for at least 7 days after the concrete has been placed in the pile.

On completion of either static or dynamic load testing, any test or anchor piling, not a part of the finished structure, shall be removed or cut off at least 1 ft below either the bottom of the footing or the finished ground elevation, whichever is lower.

Driven Pile Capacity - Wave Equation - The piles shall be driven to the required resistance using the approved stopping criteria. The pile acceptance will be based on obtaining the blow count and hammer stroke from the approved stopping criteria at the required resistance. When the wave equation is used in conjunction with dynamic or static pile load testing, the stopping criteria shall be amended based on correlation with the testing method results, as determined by the Resident. Adequate pile penetration shall be considered to be obtained when the specified wave equation resistance criteria (approved stopping criteria) is achieved within 5 ft of the pile toe elevation, based on Contract lengths. Piles not achieving the specified required resistance within these limits shall be driven to penetration established by the Resident.

The wave equation resistance criteria will not be considered valid under any of the following conditions:

- a. The hammer or striking part does not have a free fall.
- b. The head of the pile becomes broomed or crushed.
- c. The penetration is not reasonably quick and uniform.
- d. There is an appreciable bounce after a blow.
- e. The hammer is operated outside the parameters recommended by the manufacturer.

Static Load Test - When a static load test is specified in the Contract documents, load tests shall be performed by procedures set forth in ASTM D1143 using the quick load test method except that the test shall be taken to plunging failure or the capacity of the loading system. Testing equipment and measuring systems shall conform to ASTM D1143, except that the loading system shall be capable of applying 150% of the nominal pile resistance or 2,000 kips, whichever is less, and that a load cell and spherical bearing plate shall be used.

The Contractor shall submit in the QCP, detailed plans, prepared by a licensed Professional Engineer, of the proposed loading apparatus. The apparatus shall be constructed to allow the various increments of the load to be placed gradually without causing vibration to the test pile. When the approved method requires the use of tension (anchor) piles, such tension piles shall be of the same type and diameter as the production piles and shall be driven in the location of permanent piles when feasible, except that timber or tapered piles installed in permanent locations shall not be used as tension piles.

The design load shall be defined as 50% of the failure load. The failure load for a pile shall be defined as follows:

For piles 24" or less in diameter or width, the failure load of a pile tested under axial compressive load is that load which produces a settlement at failure of the pile head equal to:

$$s_f = \Delta + (0.15 + 0.008b)$$

Where:

s_f = Settlement at failure in inches

b = Pile diameter or width in inches

Δ = Elastic deformation of total unsupported pile length in inches

For piles greater than 24" in diameter or width:

$$s_f = \Delta + b/30$$

The top elevation of the test pile shall be determined immediately after driving and again just before load testing to check for heave. Any pile that heaves more than ¼" shall be redriven or jacked to the original elevation before testing. Unless otherwise specified in the Contract, a minimum 3 day waiting period shall be observed between the driving of any anchor piles or the load test pile and the commencement of the load test.

Dynamic Pile Tests - When dynamic load tests are specified in the Contract, dynamic measurements will be taken by the Contractor using procedures set forth in ASTM D4945. Dynamic testing shall be completed during the driving of piles designated on the Plans, or as

designated by the Resident. Dynamic load tests will be performed for the full length of the test pile during initial drive. With the approval of the Resident, dynamic load tests may be performed for less than the full length of the test pile. The Contractor's representative performing the dynamic tests shall be an experienced pile testing engineer and have attained the dynamic pile load test Signatory Advanced level on the Foundation QA High Strain Dynamic Pile Testing Examination, or equivalent level of certification or training, or be a licensed Professional Engineer. The same Contractor's representative conducting the wave equation analysis shall perform the dynamic load tests. Each test shall also include a numerical evaluation of static axial pile resistance using field dynamic measurements obtained per ASTM D4945 (also known as signal matching). The Contractor's representative shall be experienced in the use of dynamic pile load test equipment and its purpose related to pile capacity determinations. Dynamic measurements shall be reported to the Resident and include items specified in Section 7 of ASTM D4945.

Before placement of the pile in the leads, the Contractor shall make the designated pile available for obtaining wave speed measurements and for predrilling the required instrument attachment holes. The Contractor shall mark the designated pile in foot and inch markings. The Contractor shall make provisions in ordered lengths of pile to account for an additional pile length, equal to three pile diameters or 5 ft, whichever is greater, for instrumentation attachment. Pre-driving wave speed measurements will not be required for steel piles. When wave speed measurements are made, the piling shall be in a horizontal position and not in contact with other piling. The Contractor will furnish the equipment, materials, and labor necessary for drilling holes in the piles for mounting the instruments. The instruments will be attached near the head of the pile with bolts placed through drilled holes on the steel piles or with wood screws for timber piles.

The Contractor shall provide the Contractor's dynamic testing technician with reasonable means of access to the pile for attaching instrumentation after the pile is placed in the leads. The Contractor shall furnish electric power for the dynamic test equipment. The power supply at the outlet shall be 10 amp, 115 volt, 55-60 cycle, A.C. only. Field generators used as the power source shall be equipped with functioning meters for monitoring voltage and frequency levels.

With the dynamic testing equipment attached, the Contractor shall drive the pile to the depth at which the dynamic test equipment indicates that the required nominal resistance has been achieved or to the minimum tip elevation, whichever results in the greatest depth, as called for on the Plans, or as directed otherwise by the Resident. The

stresses in the piles will be monitored during driving with the dynamic test equipment to ensure that the values determined do not exceed the allowable values specified in this Section. If necessary, the Contractor shall reduce the driving energy transmitted to the pile by using additional cushions or reducing the energy output of the hammer in order to maintain stresses at or below the allowable values. If non-axial driving is indicated by dynamic test equipment measurements, the Contractor shall immediately realign the driving system. At the completion of the dynamic pile test the pile testing engineer shall verbally communicate any amendments to the initial stopping criteria to the Resident. Numerical evaluations of static pile capacity using the field dynamic measurements and a driving criteria shall be supplied to the Resident within 24 hours of completing the testing. Piles will not be cut off until end of drive and restrike pile tests have been performed and numerical evaluations of pile resistance using signal matching, along with the final recommended driving criteria, are submitted and reviewed by the Department.

When directed to restrike by the Resident, the Contractor shall wait a minimum of 24 hours, or as otherwise specified on the Contract Plans, and after the instruments are reattached, restrike the dynamic load test pile. A cold hammer shall not be used for the restrike. The hammer shall be warmed up before restrike begins by applying at least 20 blows to another pile. The maximum amount of penetration required during restrike shall be 6", or the maximum total number of hammer blows required will be 50, whichever occurs first. After restriking, the pile testing engineer will provide a revised stopping criteria if necessary. After restriking the Resident will either accept the re-driven pile or specify additional pile penetration and testing. Numerical evaluations of static pile capacity using the field dynamic measurements and a driving criteria shall be supplied to the Resident within 24 hours of completing the restrike tests.

The Contractor shall supply the Resident with a written report of the test results of each dynamically tested pile, numerical evaluations of static axial pile resistance using dynamic field measurements (signal matching), and a driving criteria within 4 Working Days of the completion of testing. The Department will be allowed one additional Working Day to review the written dynamic pile testing report, the pile driving logs, and provide the Contractor with a determination of whether the piles can be cut for tolerance checks. At the direction of the Resident the final driving criteria may vary from that in the written report.

Hammer Performance - If at any time during pile driving operations or dynamic testing the performance or efficiency of the power hammer is

not in accordance with the Pile and Driving Equipment Data Form, the wave equation analyses, or the dynamic/static testing results, as determined by the Resident, the Contractor shall repair or replace the driving system. This may include, but not be limited to, rebuilding the hammer, or replacing the hammer with another hammer. All costs and time associated with replacing the driving system, including additional wave equation analyses and dynamic/static testing, as determined by the Department, shall be borne by the Contractor.

Required Pile Resistance - Piles shall be driven by the Contractor to the penetration depth shown on the Plans or to a greater depth if necessary to obtain the required pile resistance. For piles that end bear in soil the initial and final stopping criteria shall be carried out for a minimum of six consecutive inches. The required pile resistance shall be determined by the approved wave equation analysis or by the results of dynamic testing and numerical evaluations of static pile resistance using dynamic field measurements (signal matching).

Piles shall not be driven to the required nominal pile resistance with a vibratory hammer.

- 501.047 **Splicing Piles** - Full-length piles shall always be used wherever practicable. When full-length piles cannot be used, the number of splices, locations, and details shall be noted in the QCP. Piles fabricated from multiple pieces will be acceptable only if they comply with the following:

H-Beam Piles ^a		Pipe Piles and Steel Casings ^{a,b}	
Lengths	Maximum No. Field Splices	Lengths	Maximum No. Field Splices
Less than 20 ft	0	Less than 20 ft	0
Over 20 – 35 ft	1	Over 20 – 40 ft	1
Over 35 – 79 ft	2	Over 40 – 60 ft	2
Over 79 ft	1 per 40 ft	Over 60 – 80 ft	3
		Over 80 ft	1 per 20 ft
^a	Pile lengths less than 10 ft will not be spliced, except as the final (top) section of the pile.		
^b	Where pipe piles are used for pile bent piers, no splices will be allowed in the length of pile from the cutoff elevation to 2 ft below the channel bottom.		

When pre-planned splicing is approved, the pile piece of lesser length shall be placed at the tip of the pile (the first part of the pile that enters the ground).

When splicing is allowed, the work shall be done in accordance with the following:

- Welding shall be done in accordance with the requirements of the AWS D1.1 welding code.
- Qualify welders in accordance with the most recent edition of the AWS D1.5 Code.
- Submit a written Weld Procedure Specification (WPS) for each joint to be included as part of the QCP. The WPSs shall be provided to the Fabrication Engineer for review and approval prior to beginning welding. Provide copies of the approved WPSs to the welder, QC Inspector and Resident prior to beginning welding. Welding performed without an approved WPS and approved QCP will be considered Unacceptable Work.
- Provide a list of qualified welders with copies of their AWS certifications to the Fabrication Engineer for review prior to beginning welding. Welders shall have in their possession, at the time of welding, a valid certification for the process and position to be used in production from the AWS. The welder shall show the Resident their credentials upon request.
- The Contractor shall only use electrodes that are on the Department's Qualified Products List for Welding Electrodes or shall submit alternative electrodes for review and approval by the Fabrication Engineer. Electrodes used shall match those approved for use in the WPS.
- Welding shall not be done: when the temperature in the immediate vicinity of the weld is below 0°F; when the surfaces are damp or exposed to rain, snow, or high wind; or when the welders or welding operators are exposed to inclement conditions.
- The pile shall be preheated to and maintained at 150°F minimum, within 6" from the joint during welding.
- Power sources for welders shall have meters indicating amperage/voltage that have been calibrated within 1 year at the time of welding.
- The Contractor shall provide the Department with notice, a minimum of, 7 Days prior to the start of any welding.
- The Contractor shall provide a QC Inspector to perform QC for the welds in accordance with the AWS D1.1 welding code. The QC Inspector shall be an AWS Certified Welding Inspector

(CWI) in conformance with the requirements of AWS QC1, Standard for AWS Certifications of Welding Inspectors. The Contractor may submit, in lieu of a CWI, an alternative QC Inspector with documented training and experience in metals fabrication, inspection, and testing for approval by the Fabrication Engineer. The QC Inspector shall be someone other than the welder performing the welds to be inspected.

- The QC Inspector shall inspect all production stages of the welded splice to ensure that workmanship and materials meet the requirements of the AWS D1.1 welding code and the Contract. The QC Inspector shall submit a signed record of all weld inspection documentation to the Resident after welding is completed.

Record of weld inspection shall include, but not be limited to, the following:

- Name of QC Inspector
- Project WIN and Location
- Date
- Weather conditions
- Type, size, length, and location of welds.
- Confirmation of appropriate equipment and materials used, including proper handling of welding electrodes.
- Confirmation that welder has approved WPS onsite, and welding is performed in accordance with approved WPS.
- Confirmation that welder is qualified to perform work per approved WPS. Include name and certifications of qualified welder who performed the work.
- Confirm that 100% visual testing, in accordance with AWS D1.1 Table 8.1, has been conducted and any subsequent repairs are made prior to non-destructive testing (NDT).
- Document NDT testing including name of NDT technician, NDT personnel qualifications, type and extent of NDT testing performed, and include NDT testing reports provided by the NDT testing technician.

Piles shall not be driven until all pile welding has been inspected and accepted by the Department.

501.0471 ***Specific Requirements for Splicing H-Beam Piles -***
Damaged material shall be removed from the end of the

driven pile. Lifting holes shall be repaired or trimmed off. The ends of both pieces to be spliced shall be cut off square with the longitudinal axis of the pile and beveled per the approved WPS. All cutting shall be done with the use of a mechanical guide, except that minor trimming may be allowed, as approved by the Resident.

The Contractor shall use an approved mechanical splicer or a full penetration butt weld for the entire cross section of the pile. Mechanical splicers shall be installed per the manufacturer's recommendations, except that the flanges shall be welded using a complete joint penetration weld, per the AWS D1.1 welding code.

In addition to the 100% visual testing (VT) performed by the QC Inspector, the Contractor shall perform NDT on the first two welded splices of the same type/size. The welds shall be radiographically (RT) or ultrasonically (UT) tested for their full length for acceptance per Table 8.2 of AWS D1.1. If both RT/UT-tested splices are determined to be acceptable, no further NDT will be required. If either of the first two RT/UT-tested splices contain defects warranting rejection, RT/UT testing of splices shall continue until two consecutive splices are found to be acceptable.

Should the Department determine that the Quality Control of the Contractor is not producing welds with acceptable quality, then the Department may request the Contractor to perform additional NDT, such as RT or UT of any or all welds. Should the NDT testing identify defects warranting rejection, the welds shall be repaired and retested. The Contractor shall perform the NDT and weld repair work at no additional cost to the Department. If the NDT does not identify defects warranting rejection, then the Department will pay for the cost of the NDT testing. RT and UT defect indications will be evaluated according to the statically loaded criteria of AWS D1.1.

- 501.0472 ***Specific Requirements for Splicing Steel Pipe Piles and Steel Casings*** - Damaged material shall be removed from the end of the driven pile. Lifting holes shall be trimmed off. The ends of both pieces to be spliced shall be cut off square with the longitudinal axis of the pile and beveled per the approved WPS. All cutting shall be done with the use of a mechanical guide, except that minor trimming may be allowed, as approved by the Resident.

Splices shall be welded using an AWS D1.1 - Complete Joint Penetration butt weld with a backer ring.

In addition to the 100% VT performed by the QC Inspector, the Contractor shall perform NDT on the first two welded splices of the same type/size. The welds shall be RT or UT tested for their full length for acceptance per Table 8.2 of AWS D1.1. If both RT/UT-tested splices are determined to be acceptable, no further NDT will be required. If either of the first two RT/UT-tested splices contain defects warranting rejection, RT/UT testing of splices shall continue until two consecutive splices are found to be acceptable.

Should the Department determine that the Quality Control of the Contractor is not producing welds with acceptable quality, then the Department may request the Contractor to perform additional NDT, such as RT or UT of any or all welds. Should the NDT testing identify defects warranting rejection, the welds shall be repaired and retested. The Contractor shall perform the NDT and weld repair work at no additional cost to the Department. If the NDT does not identify defects warranting rejection, then the Department will pay for the cost of the NDT testing. RT and UT defect indications will be evaluated according to the statically loaded criteria of AWS D1.1.

501.048 ***Prefabricated Pile Tips*** - Welding of pile tips shall be done in accordance with the following:

- Welding shall be done in accordance with the requirements of the AWS D1.1 welding code.
- Qualify welders in accordance with the most recent edition of the AWS D1.5 Code.
- Submit a written WPS for each tip to be included as part of the QCP. The WPSs shall be provided to the Fabrication Engineer for review and approval prior to beginning welding. Provide copies of the approved the WPS to the welder and Resident prior to beginning welding. Welding performed without an approved WPS and approved QCP will be considered Unacceptable Work.
- Provide a list of qualified welders with copies of their AWS certifications to the Fabrication Engineer for review prior to beginning welding. Welders shall have in their possession, at the time of welding, a valid certification for the process and

position to be used in production from the AWS or other organization acceptable to the Resident. The welder shall show the Resident their credentials upon request.

- The Contractor shall only use electrodes that are on the Department's Qualified Products List for Welding Electrodes or shall submit alternative electrodes for review and approval by the Fabrication Engineer. Electrodes used shall match those approved for use in the WPS.
- Pile tips shall be approved by the Resident.

Welding shall not be done:

- When the temperature in the immediate vicinity of the weld is below 0°F;
- when the surfaces are damp or exposed to rain, snow, or high wind; or
- when the welders or welding operators are exposed to inclement conditions.

The pile shall be preheated to and maintained at 150°F minimum within 6" from the joint during welding.

Power sources for welders shall have meters indicating amperage/voltage that have been calibrated within 1 year at the time of welding.

Pile tips may be welded to the piles by the pile supplier upon approval by the Department. Approval is contingent upon submission of the following: A welding QC Plan; proof that the proposed welder(s) is certified per AWS D1.5; and an AWS D1.1 WPS, with base metal preheated to a minimum of 150°F. The Contractor shall provide notice a minimum of 14 Days prior to the start of any welding by the pile supplier. At a minimum, welds shall be 100% visually inspected by the pile supplier's QC representative.

The Contractor shall provide a QC Inspector to perform QC for the welds in accordance with the AWS D1.1 welding code. The QC Inspector shall be an CWI in conformance with the requirements of AWS QC1, Standard for AWS Certifications of Welding Inspectors. The Contractor may submit, in lieu of a CWI, an alternative QC Inspector with documented training and experience in metals fabrication, inspection, and testing for approval by the Fabrication Engineer. The QC Inspector shall be someone other than the welder performing the welds to be inspected.

The QC Inspector shall inspect all production stages of the welded splice to ensure that workmanship and materials meet the

requirements of the AWS D1.1 welding code and the Contract. The QC Inspector shall submit a signed record of all weld inspection documentation to the Resident after welding is completed.

Record of weld inspection shall include, but not be limited to, the following:

- Name of QC Inspector
- Project WIN and Location
- Date
- Weather conditions
- Type, size, length, and location of welds.
- Confirmation of appropriate equipment and materials used, including proper handling of welding electrodes.
- Confirmation that welder has approved WPS onsite, and welding is performed in accordance with approved WPS.
- Confirmation that welder is qualified to perform work per approved WPS. Include name and certifications of qualified welder who performed the work.
- Confirm that 100% VT, in accordance with AWS D1.1 Table 8.1, has been conducted and any subsequent repairs are made prior to NDT.
- Document NDT testing including name of NDT technician, NDT personnel qualifications, type and extent of NDT testing performed, and include NDT testing reports provided by the NDT testing technician.

The Contractor shall provide notice a minimum of 7 Days prior to the start of any field welding.

Piles shall not be driven until all pile welding has been inspected and accepted by the Department.

501.0481 ***Specific Requirements for Installing H-Beam Pile Tips*** - Damaged material shall be removed from the end of the driven pile, as applicable. Lifting holes shall be trimmed off. The end of the pile to which the tip is to be attached shall be cut off square with the longitudinal axis of the pile and prepared per the approved WPS. All cutting shall be done with the use of a mechanical guide, except that minor trimming may be allowed, as approved by the Resident.

Regarding weld size, prefabricated pile tips shall be attached to H-beam piles with 5/16" groove welds along each flange, or as recommended by the manufacturer of the pile tips, whichever weld size is larger.

The QC Inspector shall, at a minimum, perform 100% VT on each pile tip weld.

Should the Department determine that the Quality Control of the Contractor is not producing welds with acceptable quality, then the Department may request the Contractor to perform additional NDT, such as RT or UT of any or all welds. Should the NDT testing identify defects warranting rejection, the welds shall be repaired and retested. The Contractor shall perform the NDT and weld repair work at no additional cost to the Department. If the NDT does not identify defects warranting rejection, then the Department will pay for the cost of the NDT testing. RT and UT defect indications will be evaluated according to the statically loaded criteria of AWS D1.1.

501.0482 ***Specific Requirements for Installing Steel Pipe Pile Tips***

- Damaged material shall be removed from the end of the driven pile, as applicable. Lifting holes shall be trimmed off. The end of the pile to which the tip is to be attached shall be cut off square with the longitudinal axis of the pile and prepared per the approved WPS. All cutting shall be done with the use of a mechanical guide, except that minor trimming may be allowed, as approved by the Resident.

Unless otherwise shown on the Plans, steel pipe piles shall have pointed cast steel pile tips.

Regarding weld size, prefabricated pile tips shall be attached to steel pipe piles with a continuous 5/16" groove weld along the full perimeter of the pile, or as recommended by the manufacturer of the pile tips, whichever weld size is larger.

The QC Inspector shall, at a minimum, perform 100% VT on each pile tip weld.

Should the Department determine that the Quality Control of the Contractor is not producing welds with acceptable quality, then the Department may request the Contractor to perform additional NDT, such as RT or UT of any or all welds. Should the NDT testing identify defects warranting rejection, the welds shall be repaired and retested. The Contractor shall perform the NDT and weld repair work at no additional cost to the Department. If the NDT does not identify defects warranting rejection, then the Department will pay for the cost of the NDT testing. RT and UT defect

indications will be evaluated according to the statically loaded criteria of AWS D1.1.

501.05 **Method of Measurement**

- a. **Equipment Mobilization** - A lump sum price bid for mobilization shall include the cost of furnishing all labor, materials, and equipment necessary for the transporting, erecting, dismantling, and removing all pile driving equipment.
- b. **Piles Furnished** - The unit of measurement for furnishing H-piles, pipe piles and steel casings shall be the linear foot. Measurement will not include any pile tips. The quantity to be paid for will be the sum of the lengths in feet of the piles, of the types and lengths ordered in writing by the Resident. No allowance will be made for the length of piles, including test piles furnished by the Contractor, to replace piles that were previously accepted by the Resident, but are subsequently damaged prior to completion of the Contract. When additional lengths of piles are necessary, the additional length ordered in writing by the Resident will be included in the length of piling furnished. All piles must be cutoff at the cutoff elevation shown on the Plans.
- c. **Piles in Place** - Initiation of pile installation by use of a vibratory hammer, preaugering, jetting or other methods used for facilitating pile driving procedures will not be measured and payment shall be considered included in the unit price bid for the Piles, In Place, pay item.

The quantity of H-beam, pipe pile or casings to be paid for will be the actual number of linear feet of H-pile, steel pipe piles or casings driven and left in place in the completed and accepted work. Measurements will be made from the tip of the H-beam pile, steel pipe pile or casing to the cutoff elevation as shown on the Plans. Measurement will include the pile tips.

Unused pile cutoffs 20 ft or more in length, except those required to accommodate the Contractor's construction method, as discussed herein, will remain the property of the Department and will be stored at a bridge maintenance yard nearest the project. Hauling and unloading of piles will be done by the Contractor or by the Department, depending upon availability of services.[MF4.1]

When hauling and unloading is done by the Contractor, Payment will be made under the provisions of Section 109 - Changes. There will be no separate payment to load piles at the project site; loading will be considered an incidental cost to the item.

No separate measurement will be made for reinforcing steel, excavation, pre-excavation, drilling, cleaning of drilled holes, cleaning out of pipe

piles, drilling fluids, sealing materials, concrete, required casing, and other items required to complete the Work.

- d. **Pile Tips** - Pile Tips will be measured by the number of tips authorized and satisfactorily installed on the Pile.
- e. **Pile Splices** - Pile splices will be measured by the number of splices authorized and satisfactorily completed to drive the piles in excess of the ordered length furnished and approved by the Resident.
- f. **Static Load Tests** - Static load tests will be measured by the number of unit tests authorized and satisfactorily made.
- g. **Dynamic Load Tests** - Dynamic load tests will be measured by the number of dynamic pile tests authorized and satisfactorily made. One dynamic test includes all data collected on one pile during both the initial pile driving and a restrike done a minimum of 24 hours after the initial driving, and numerical evaluation of static axial pile resistance using dynamic field measurements (signal matching).

501.06 **Basis of Payment** - The accepted quantities of piles and casings will be paid for at the Contract Unit Price per linear foot, delivered, and complete, in place. Such payment will include full compensation for any necessary excavation or backfilling required after driving, to bring the foundation area to the correct elevation.

Pile cutoffs and concrete for pipe piles and casings will not be paid for separately but will be considered as incidental to related Pay Items. Damaged pile lengths removed for pile splicing will be considered incidental to related Pay Items.

Payment for all Work related to the following will not be made directly, but will be considered incidental to related Pay Items: Jetting; preaugering; pre-excavation; providing special driving tips or heavier sections for steel piles, or other work necessary to obtain the specified penetration and bearing resistance of the piles; reseating of piles; excavating and cleaning within steel pipe piles and steel casings; furnishing and placing reinforcing steel and steel templates in steel pipe piles; disposing of material resulting from cleaning out pipe piles; all excavation and backfilling involved in installing piles; installation and removal of temporary falsework and driving frames; and development of an approved QCP and amendments, as required.

Wave equation analyses and any subsequent wave equation analyses re-submittals, required to demonstrate the appropriateness of the driving system, will be considered incidental to the related Pay Items.

Payment for pile tips and pile splices will be paid for at the Contract Unit Price each.

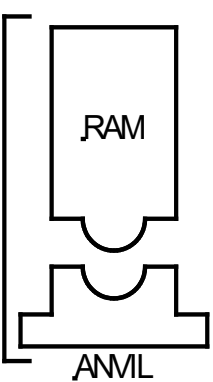
Payment for dynamic and static pile tests will be paid at the Contract Unit Price per pile tested. The price shall be full compensation for satisfactory completion

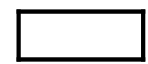
of all Work associated with performing and collecting measurements from initial dynamic tests, restrike tests, numerical evaluations of static pile resistance using dynamic measurements (signal matching), all sensors and wiring, monitoring equipment, setup time, reaction piles and frame, load cells, jacking equipment, survey tie-in, monitoring personnel, as applicable, and costs associated with the Contractor's down time during regular working hours while setting up equipment, performing tests and taking measurements.

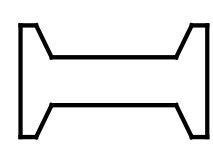
Payment will be made under:

Pay Item		Pay Unit
501.230	Static Loading Test	Each
501.231	Dynamic Loading Test	Each
501.36	Steel H-beam Piles 36 lb/ft, delivered	Linear Foot
501.361	Steel H-beam Piles 36 lb/ft, in place	Linear Foot
501.38	Steel H-beam Piles 42 lb/ft, delivered	Linear Foot
501.381	Steel H-beam Piles 42 lb/ft, in place	Linear Foot
501.40	Steel H-beam Piles 53 lb/ft, delivered	Linear Foot
501.401	Steel H-beam Piles 53 lb/ft, in place	Linear Foot
501.42	Steel H-beam Piles 57 lb/ft, delivered	Linear Foot
501.421	Steel H-beam Piles 57 lb/ft, in place	Linear Foot
501.44	Steel H-beam Piles 63 lb/ft, delivered	Linear Foot
501.441	Steel H-beam Piles 63 lb/ft, in place	Linear Foot
501.46	Steel H-beam Piles 73 lb/ft, delivered	Linear Foot
501.461	Steel H-beam Piles 73 lb/ft, in place	Linear Foot
501.48	Steel H-beam Piles 74 lb/ft, delivered	Linear Foot
501.481	Steel H-beam Piles 74 lb/ft, in place	Linear Foot
501.50	Steel H-beam Piles 89 lb/ft, delivered	Linear Foot
501.501	Steel H-beam Piles 89 lb/ft, in place	Linear Foot
501.52	Steel H-beam Piles 102 lb/ft, delivered	Linear Foot
501.521	Steel H-beam Piles 102 lb/ft, in place	Linear Foot
501.54	Steel H-beam Piles 117 lb/ft, delivered	Linear Foot
501.541	Steel H-beam Piles 117 lb/ft, in place	Linear Foot
501.70	Steel Pipe Piles, delivered	Linear Foot
501.701	Steel Pipe Piles, in place	Linear Foot
501.72	Steel Casings, delivered	Linear Foot
501.721	Steel Casings, in place	Linear Foot
501.90	Pile Tips	Each
501.91	Pile Splices	Each
501.92	Pile Driving Equipment Mobilization	Lump Sum

Project/Bridge: _____ Town: _____	
WIN: _____ Fed. Proj. No: _____ Bridge No: _____	
Contractor: _____ Pile Driving Sub: _____	

HAMMER COMPONENTS 	Manufacturer: _____ Model: _____ Hammer Type: _____ Serial No: _____ Max Energy: _____ (ft-lb) @ Stroke Length: _____ (ft) Ram Weight: _____ (lb) Modifications: _____ _____ _____

	HAMMER CUSHION Material: _____ Thickness: _____ (in) Area: _____ (in²) Modulus of Elasticity (E): _____ (psi) Coefficient of Restitution (e): _____

	DRIVE HEAD Helmet _____ Bonnet _____ Anvil Block _____ Pile Cap _____ Weight _____ (lb)

	PILE CUSHION Material: _____ Thickness: _____ (in) Modulus of Elasticity (E): _____ (psi) Coefficient of Restitution (e): _____

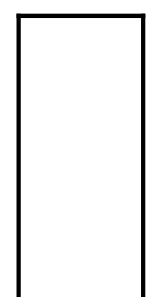
	PILE Pile Type: _____ Length (in Leads): _____ (ft) Weight/Length: _____ (lb/ft) Diameter: _____ (in) Wall Thickness: _____ (in) X-Section Area: _____ (in²) Maximum Factored Load: _____ (kips) Required Resistance: _____ (kips) Splice Description: _____ Pile Tip Description: _____ Submitted by: _____ Date: _____ Telephone #: _____ Fax #: _____

Figure 1- Pile and Driving Equipment Data Form. Form can be found on the Department Website

SECTION 502 - STRUCTURAL CONCRETE

502.01 **Description** - This work shall consist of furnishing and placing Portland Cement Concrete for structures and incidental construction in accordance with these Specifications and in conformity with the lines, grades, and dimensions shown on the Plans or established, or for placing concrete fill for foundations where called for on the Plans. For Method A Statistical Acceptance, or Method B Statistical Acceptance, the work shall conform to the Contractor's approved Quality Control (QC) Plan and Quality Assurance (QA) provisions, in accordance with these Specifications and the requirements of Section 106 - Quality. For Method C, the work shall conform to the Contractor's Quality Control Plan (QCP), the requirements of this specification and Section 106 - Quality.

502.02 **Classification** - The Portland Cement Concrete shall be the class indicated on the Plans.

502.03 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Portland Cement and Blended Hydraulic Cement	701.01
Water	701.02
Air Entraining Admixtures	701.03
Water Reducing Admixtures	701.04
High Range, Water Reducing, Admixture	701.0401
Set Retarding Admixtures	701.05
Accelerating, Chemical Admixtures	701.0501
Curing Materials	701.06
Water stops	701.07
Smooth Surfaced Asphalt Roll Roofing	701.08
Coal Ash and Natural Pozzolans	701.10
Calcium Nitrite Solution	701.11
Silica Fume	701.12
Slag Cement	701.13
Fine Aggregate for Concrete	703.01
Coarse Aggregate for Concrete	703.02
Alkali Silica Reactive Aggregates	703.0201
Combined Aggregate Grading for Concrete	703.03
Preformed Expansion Joint Filler	705.01
Bridge Drains	711.04

502.04 **Shipping and Storage** - All improperly stored or delivered cementitious materials will be rejected. All moisture contaminated cementitious materials will be rejected

Handling, shipping and stockpiling of aggregates shall be done in such a way as to minimize segregation and breakage.

Fine aggregate and each size of coarse aggregate shall be stored in separate stockpiles on prepared bases constructed of the same material as that to be stockpiled, with a minimum thickness of 1 ft. The ground under the prepared bases shall be reasonably graded to drain away from the stockpile and shall be free of brush or other harmful vegetation. The base shall be left in place, undisturbed for the duration of the use of the stockpile. Prepared bases can be salvaged for reuse provided this material is reprocessed. Wood, metal or other approved hard surfaces shall be considered acceptable alternates for the prepared bases described above.

502.041 **Testing Equipment** - The Contractor shall provide test equipment, curing boxes and materials as specified below for use by the Resident, or their representative, exclusively. The equipment shall be available and acceptable to the Resident 1 week prior to placing any concrete. All costs associated with providing and maintaining testing equipment and curing boxes shall be considered incidental to the Work and no additional payment will be made.

The Resident will maintain the test equipment in reasonable condition. However, the Contractor shall replace any equipment that becomes unusable due to normal wear and tear or which is stolen or damaged from other than the Resident's neglect or mistreatment. All such replacement costs shall be considered incidental to the work and no additional payment will be made.

- A. **Pressure Air Meter** - meeting requirements of AASHTO T 152 (Type B) and all accessory items required for use with the particular design of apparatus. This shall include one 9" mason trowel, one metal scoop 9" long x 5" wide, one tamping rod conforming to AASHTO T 119, one rubber mallet as described in AASHTO T 152, one strike off bar (flat straight bar of steel). The air meter shall be functional and shall bear a current calibration certificate issued by a recognized testing laboratory. Current shall mean within the calendar year.
- B. Two thermometers meeting the requirements of AASHTO T 309.
- C. "Contractors" rubber tired wheelbarrow.
- D. Two D-handle square end shovels 9½" wide.
- E. Two pair heavy duty, long cuff, rubber gloves.
- F. **Miscellaneous equipment** - 16 oz plastic squeeze bottle, 5 gal bucket, scrub brush, paper towels, folding rule, and rubber syringe.
- G. **Small rod** - one tamping rod conforming to AASHTO T 277.

H. *Curing boxes for concrete cylinders*

1. Furnish, install, operate and maintain a thermostatically controlled curing box for concrete test cylinders for the sole use of the Resident for the duration of the Contract.
2. The curing box shall be placed in a secure location, leveled and not moved without the permission of the Resident. Relocate the curing box to a new location, as directed, whenever considered necessary during the progress of the Work.
3. Furnish and maintain the electrical power and all utility connections necessary for the operation of the curing box. Monitor and maintain the internal temperature and water level of the box.
4. The Resident shall be provided with two locks, each with two keys, to be used with the two securing latches. A lock for the switch box, with two keys shall be furnished, as well.
5. The curing box shall be constructed with double walls separated by rigid foam insulation and shall have minimum internal dimensions of 42" long by 18" wide by 18" deep. Curing boxes less than the minimum stated dimensions may be permitted with the approval of the Resident provided they are adequate to handle the volume of cylinders anticipated. The top of the curing box shall be an insulated lid hinged at the back with at least two securing latches on the front, suitable for sealing and locking the curing box. A moisture-proof seal shall be provided between the lid and the body of the curing box. Handles shall be provided at the ends of the box for use in moving the box.
6. The curing box shall be constructed so that the required temperature and humidity within the box can be maintained using an immersible heating element (minimum of 1,000 Watts), when the heating element is immersed in water, approximately 4" in depth, at the bottom of the box. The heating element shall be located to provide free access for cleaning and for adequate circulation of the surrounding water. The cylinders shall be supported so that they will not come in direct contact with the pool of water and that there will be free circulation of air above the water and around the cylinders. A drain shall be provided at the base of the box

to allow draining of the water from the box. The electrical utility connection to the source of power shall be made in a lockable switch box that is securely attached to one end of the curing box.

7. All electrical connections from the curing box to the utility connection shall conform to the latest requirements of the NEC. When the curing box is outside and exposed to the weather, all wiring and fittings shall be of the weatherproof type. The curing box shall be effectively grounded.
8. An approved bimetallic thermometer shall be installed that will measure the internal temperature of the curing box.
9. The curing box shall be suitable for maintaining internal temperatures as specified in ASHTO T 23.

502.05 **Composition and Proportioning** - Concrete shall be composed of a homogeneous mixture of Portland Cement or Portland Cement with coal ash, natural pozzolan, silica fume, or slag cement, fine aggregate, coarse aggregate, water and admixtures proportioned according to these Specifications and shall conform to the requirements of Table 1. All material shall be approved by the Department prior to use.

TABLE 1 (See Notes on next page)

Concrete CLASS	Compressive Strength (PSI)	Permeability as indicated by Surface Resistivity (KOhm-cm)	Entrained Air (%)		Notes
			LSL	USL	
LP	5,000	17	5.0	8.0	1,2,3
A	4,000	14	5.0	8.0	1,2,3
Fill	3,000	N/A	5.0	8.0	2,3
S	3,000	N/A	N/A	N/A	2,3
Note #1	Permeability testing for all concrete mixes will be done at 56 Days. Concrete expected to be exposed to deicing salts prior to the test date shall be sealed with a protective coating, in accordance with Standard Specification Section 515 - Protective Coating for Concrete Surfaces, at no additional cost to the Department.				
Note #2	Compressive strength testing for all concrete mixes will be done at 56 Days.				

Note #3 Coarse aggregate for concrete shall meet the requirements of Section 703.02 for Class “A” or “AA” or, with Department approval, SP1 or SP2 (refer to Standard Specification Section 518 - Structural Concrete Repair).

Each concrete mix design shall be submitted by the Contractor to the Department for approval. No concrete shall be placed on a Project until the concrete mix design is approved by the Department. Approval by the Department will be contingent upon the ability of the mix design proportions to meet concrete strength and permeability requirements and other factors that affect durability.

For the first time use of a concrete batch plant or a change in pozzolan source or type, the Department may require trial batching. When required, the Contractor shall conduct a trial batch at the concrete plant utilizing transit mixers. The Contractor shall submit four clearly identified 4" diameter x 8" high cylinders to the Department, at least 15 Days prior to the first placement, for permeability testing. Full documentation shall be submitted with the cylinders and must include actual batch weights and all concrete test properties. The cylinders shall be submitted between the ages of 2 and 7 Days.

The mix design submitted by the Contractor shall include the following information:

- A. Description of individual coarse aggregate stockpiles, original source, bulk specific gravity, absorption, gradation, and alkali silica reactivity test results. A combined coarse aggregate blended gradation shall be provided, including the percentage of each coarse aggregate used.
- B. Description of fine aggregate, original source, bulk specific gravity, absorption, colorimetric, gradation, Fineness Modulus (F.M.), alkali-silica reactivity and sand equivalent test.
- C. Description and original source and amount of cement and pozzolanic material.
- D. Target water-cementitious material ratio (w/cm).
- E. Target water content by volume.
- F. Target strength.
- G. Target air content, slump and concrete temperature.
- H. Target concrete unit weight.
- I. Type, manufacturer, and dosages of chemical admixtures.
- J. Target KOhm-cm Value

When pozzolans are used as Portland Cement replacement. Concrete mix designs shall follow Table 1A below.

TABLE 1A

Pozzolan or Cementitious Material	Replacement Specification Limit
	USL
Coal Ash (Class C)	50%
Coal Ash (Class F)	30%
Slag Cement	50%
Silica Fume	15%
Natural Pozzolan, Metakaolin (Class N)	20%
Natural Pozzolan, Calcined Clay or Shale (Class N)	35%
Total Coal Ash and Silica Fume (when applicable)	35%
Total pozzolan/cementitious material replacement	50%

Cast-in-place concrete shall contain no more than 635 lb/cy of cement and not more than 660 lb/cy of cementitious material. Pozzolans are included as cementitious material.

Class S concrete shall contain a minimum of 650 lb/cy of cementitious material.

All concrete mixes must be designed in accordance with the criteria of this Section. The design proportions with the fine aggregates designated as a percent of the total aggregate must be stated in terms of aggregates in a saturated, surface dry condition and the batch weights will be adjusted by the Contractor for the actual moisture of the aggregate at the time of use.

Self-consolidating concrete (SCC) may be used for Class A, LP or P mixes when approved by the Resident. SCC shall meet the requirements for strength, entrained air and permeability for the respective concrete Class. SCC shall be tested for slump flow in accordance with ASTM C1611; the visual stability index (VSI) shall be 0 or 1.

No change in the source, proportions or character of the mix ingredients may be made without notice to the Department and no new mix ingredients shall be used until the Department has approved such ingredients and new mix proportions, if they change. The Contractor shall notify the Resident of any changes to the coarse aggregate blend prior to supplying concrete to the Project.

502.06 **Batching** - Measuring and batching of materials for Structural Concrete shall be performed at an approved batching plant. The plant shall meet the requirements of AASHTO M 157. Batching plants will be inspected annually for approval by either the Department or by the National Ready Mixed Concrete Association.

The Contractor shall provide a Certificate of Compliance for each truckload of concrete to the Department at the time of the load placement. The Certificate of Compliance shall be a form acceptable to the Department and shall include:

- Contract Name and Number
- Bridge Name
- Manufacturing Plant (Batching Facility)
- Name of Contractor (Contractor)
- Date
- Time Batched/Time Discharged
- Truck Number
- Quantity (Quantity Batched this Load)
- Type of Concrete by Class and Department Mix Design Number
- Cement Brand or Type, and Shipment Certification Number
- Temperature of Concrete at Discharge

Target Weights per cubic yard and Actual Batched Weights for:

1. Cement
2. Pozzolanic Additives, including Coal Ash, natural pozzolans, Slag Cement, and Silica Fume
3. Coarse Concrete Aggregate
4. Fine Concrete Aggregate
5. Water (including free moisture in aggregates, batch water held out at the plant and water added at the Project)
6. Admixtures- Brand Names and Quantities (fluid ounces/cubic yard)

502.07 ***Mixing and Delivery***

- A. All transit mixers used in the production and delivery of Structural Concrete shall be inspected annually by the Department. Delivery and discharge of the concrete from the mixer shall be completed within a maximum of 90 minutes from the time the cement is added to the aggregate, except that in hot weather when the concrete mix temperature exceeds 70°F, or under other conditions contributing to quick stiffening of the concrete, delivery and discharge from the mixer shall be completed within 60 minutes. When approved by the Resident, the use of a retarding admixture (Type D) may be used for increasing the 60 minutes discharge time to 90 minutes, provided concrete temperatures are kept below 80°F and conditions contributing to quick stiffening of the concrete are not present. An approved hydration stabilizing admixture may be used to increase the discharge time. Justification for the need for a hydration stabilizing admixture shall be provided in the QC Plan. When a hydration stabilizing admixture is used, the manufacturer, dosage rate and discharge time, from the time cement is added to the aggregate, shall be documented in the approved QC Plan. The proposed discharge time(s) shall be based on the manufacturer's written recommendations, the anticipated concrete temperatures and anticipated ambient conditions at the time of placement(s). Discharge time(s) shall be adjusted when conditions change or are not as anticipated as outlined in the approved

QC Plan. The discharge time(s) approved by the Department shall be subject to change at any time, and discharge of concrete into the permanent work shall cease immediately if the concrete is determined to have attained Accelerated Hydration Gain. Accelerated Hydration Gain being the condition where the fresh concrete has hydrated to the point where the workability and finishability is detrimental to the quality of the final product. Determination of when concrete has attained Accelerated Hydration Gain shall be made by the Contractor's Quality Control Technician(s) and shall be based on parameters proposed by the Contractor in the QC Plan, such as, but not limited to, loss of slump, plasticity, or workability, an increase in concrete temperature, or a change in the percentage of entrained air.

B. Concrete, which has been rejected for any reason, shall be removed immediately from the job site and disposed of properly.

C. Concrete temperature, prior to discharge, shall not exceed 85°F.

502.08 **Cold Weather Concrete** - Concrete shall not be placed against frozen surfaces.

All frost, ice, and snow shall be removed from all material that will be in contact with fresh concrete.

Unless authorized by the Resident, the mixing and placing of concrete shall be discontinued when the atmospheric temperature is below 40°F in the shade and dropping and shall not be resumed until the atmospheric temperature is as high as 35°F in the shade and rising. If authorization is granted for the mixing and placing of concrete under atmospheric conditions different from those specified above, the water shall be heated to a temperature not exceeding 180°F. When either the aggregate or water is heated to above 120°F, they are to be combined first in the mixer before the cement is added. If the atmospheric temperature is below 25°F, the aggregate shall also be heated. Materials containing frost or lumps of frozen material shall not be used. Stockpiled aggregates may be heated using dry heat or steam. Aggregates shall not be heated directly by gas or oil flame or on sheet metal over a fire. When aggregates are heated in bins, steam coil or water coil heating or other methods that will not be detrimental to the aggregates may be used. The heating apparatus shall be capable of heating the mass uniformly and preventing the occurrence of spots of overheated material. The minimum temperature of the mixed concrete shall be in accordance with Table 2, when it is placed in the forms. Salt, other chlorides or other unapproved chemicals shall not be added to the concrete for any reason whatsoever.

TABLE 2 COLD WEATHER TEMPERATURE TABLE
MINIMUM FORM DIMENSION SIZE

<12"	12 to 36"	36 to 72"	>72"
60°F	55°F	45°F	40°F
MINIMUM CONCRETE TEMPERATURE AS PLACED			

When permitted by the Resident, footings may be protected by completely submerging them by admitting water inside the cofferdam. Until submersion takes place, the temperature of the concrete and its surface shall be controlled as specified above. Submersion shall proceed slowly and the temperature of the air or water shall be maintained sufficient to prevent ice from forming within the cofferdam for a period of 7 Days after the placing of the concrete.

When depositing concrete under water, there shall be no ice inside the cofferdam.

Permission given to place concrete under the conditions mentioned above and as described in the Contractor's QCP shall not relieve the Contractor of its responsibility for obtaining satisfactory results. The Contractor shall be wholly responsible for the protection of concrete during cold weather operations and any concrete injured by frost action or overheating shall be removed and replaced at the Contractor's expense.

502.09 **Forms and False work**

- A. **Construction of Forms** - All forms shall be well built, substantial and unyielding, securely braced, strutted and tied to prevent motion and distortion while concrete is being placed in them. The forms shall be strong enough to safely support the weight of the concrete and all superimposed loads (such as runways, concrete buggy loads, workers, scaffolding, etc.) placed upon them.

Forms shall be built to conform to the dimensions, location, contours and details shown on the Plans. The faces of forms against which the concrete is to be placed shall be dressed smooth and uniform and shall be free from winds, twists, buckles and other irregularities.

Stay-in-place forms of any type will not be permitted for any part of slab structures, unless otherwise indicated on the Plans.

The placing of concrete in excavated pits and trenches without forms will not be permitted.

All corners within the forms shall be fitted with chamfer strips mitered at their intersections, except that chamfer strips will not be required as follows:

- (1) on corners of slab blocking of interior steel beams and the inside of exterior steel beams;
- (2) on corners constructed transversely at the underside of the slab of superstructures which consist of a concrete slab on steel beams;
- (3) on footings not exposed to view; and
- (4) on all structures when more than 2 ft below the final finished grade line.

Chamfer strips shall have a width across the diagonal face between $\frac{1}{2}$ and $\frac{3}{4}$ ". The size to be adopted for a given portion of the work shall depend upon the general dimensions. Except where special size chamfer strips are shown on the Plans, the size of chamfer strips shall be uniform on individual Projects. Provision shall be made for the chamfering of the top edges of abutment bridge seats and wing walls, tops of piers and retaining walls, tops of through girders, roadway curbs, etc., by nailing chamfer strips inside the forms. Unless otherwise provided, all chamfer strips shall produce plain flat surfaces on the concrete.

The forms for beams, girders and spandrel arches shall be so constructed as to permit the sides to be removed without disturbing the supports.

All foreign matter within the forms shall be removed before depositing concrete in them.

In all cases where metal or composite anchorages or ties within or through the face forms are required to hold the forms in their correct position, such anchorages or ties shall be of ample strength and shall be so constructed that the metal/composite work can be removed to a depth of not less than 1" from the face and back surfaces of the concrete without damaging such surfaces.

Elevations will be taken on the top flanges of structural beams and girders for determining the depth of blocking necessary for the construction of the forms for the concrete slab, after the following conditions have been satisfied:

1. The satisfactory erection of the superstructure structural beams or girders, including any required flooring beams, stringers and intermediate diaphragms, unless an alternative plan is submitted by the Contractor and approved by the Department.
2. All bolt tightening operations must be complete.
3. No foreign loads supported by the beams or girders are present.

The Contractor shall submit working drawings for approval of the proposed forms and false work supporting the overhanging portion of the superstructure slab in accordance with Section 105.7. The working drawings shall show the size and location of the supporting members, the proposed loads and the weight of concrete forms to be carried by the members.

In the construction of forms and false work for the portion of superstructure slabs overhanging the exterior members of beam and girder spans, forms and supporting devices resulting in point loadings on the exterior members shall not be used. Loads resulting from supporting devices shall be distributed directly to the flanges by means of brackets or braces. No welding will be permitted to attach form supports of any type

to the superstructure, unless approved by the Fabrication Engineer. Where shear connector studs are available, welding to the studs will be permitted.

All forms shall be inspected and approved by the Department before the placing of any concrete within them.

- B. **Surface Treatment of Forms** - The inside surfaces of forms shall be uniformly coated with form oil or other approved surface treatment. Form surfaces shall be treated before placing the reinforcing steel.
- C. **Construction of False Work** - All false work used for supporting reinforced concrete superstructures shall be comprised of members having ample structural sections to resist all loads imposed upon them, with deformations less than: $(\text{Span Length}) / 360$.

When the vertical members of false work consist of piles or when framed or other false work is supported upon piles, the piles shall be driven to secure a safe load resistance.

When false work is supported upon mud sills, the foundation pressures resulting from the imposed loads upon the mud sills (false work, forms, fresh concrete, scaffolding, etc.) shall not exceed the capacity of the on-site soils.

All false work systems shall be designed to support all vertical loading and any differential settlement forces, all horizontal and longitudinal forces, and shall account for any temporary unbalanced loading due to the placement sequence of the concrete. Sufficient redundancy shall be designed into false work systems so that the failure of any member shall not cause a collapse. False work systems adjacent to and/or over traveled ways shall additionally be designed to resist any vibration forces due to traffic and shall incorporate sufficient protection against impact by errant vehicles.

False work shall be so constructed that the forms will have a camber, the amount of which will depend upon the deflection anticipated in the design. Forms supported upon false work shall be provided with a satisfactory means for their adjustment in the event of settlement or deformation of the false work due to overloading or other causes. Provisions shall be made for the gradual lowering of false work and rendering the supported structure self-supporting.

All false work system computations, plans, and working drawings shall be designed and sealed by the Contractor's Professional Engineer, who must be licensed in accordance with the laws of the State of Maine. Prior to concrete placement, the Contractor's Professional Engineer responsible for the design of the false work system shall, after false work inspection, provide a sealed certification that the system was erected in conformance

with the Professional Engineer's plans and design details. This Professional Engineer may be directly employed, or otherwise retained, by the Contractor.

No concrete shall be placed until the sealed design computations, plans and working drawings package and the sealed certification of erection of the false work have been submitted to the Resident. The Department shall have no obligation to review or comment on any design, construction, maintenance or removal of false work. No review or comment by the Department, or any lack of review or comment by the Department, shall relieve the Contractor of its responsibility to properly design, construct, maintain in good condition, and remove false work in accordance with the Contract, or shall shift any responsibility to the Department. The Contractor shall be responsible for all damages resulting from the failure of false work.

The torsional effect of the false work on permanent structural members, which results from supporting cantilevered concrete sections, shall be analyzed by the Department. If the Department finds that the torsional stresses imposed on any permanent structural member, due to the false work, is unacceptable, the Contractor shall redesign the false work in order to reduce the stresses to an acceptable level, at no additional cost to the Department.

D. *Removal of Forms and False work*

1. Location, weather conditions, cementitious materials used and the character of the structure involved shall be considered in determining the time for the removal of forms and false work. Forms and false work shall not be removed until concrete cylinders cured with the structure establish that the concrete has developed a minimum of 80% of design strength. The Contractor shall cast and break enough cylinders to ensure that all concrete, associated with the forms and Falsework to be removed, has reached the minimum required strength; the test results from these cylinder breaks shall be furnished to the Resident before removal of the forms and false work.

When approved by the Resident, the vertical forms of footings, walls, columns and sides of beams and slabs may be removed 48 hours after completion of placement of concrete, exclusive of the time the ambient air temperature is below 45°F and provided the following conditions are met:

- Immediately after, or as otherwise allowed by the Resident, the forms are removed, defects in the concrete surface shall be repaired in accordance with Section 502.12 and the repaired area thoroughly dampened with water.

- The surfaces of exposed concrete shall be cured for the remainder of the 7 Day curing period by the application of a curing compound listed on the Department's Qualified Products List.
 - The curing compound shall be applied continuously by approved mechanical pressure spraying or distributing equipment at a rate necessary to obtain an even, continuous membrane, meeting the manufacturer's recommendations but at a rate of not less than 1 gal per 200 ft² of surface.
 - At a minimum, two coats shall be applied using a pressurized sprayer, with the second coat being applied within 30 minutes and at right angles to the first. Hand-pump sprayers, rollers or brushes shall not be used.
2. Forms and false work, including blocks and bracing, shall not be removed without the consent of the Resident. The Resident's consent shall not relieve the Contractor of its responsibility for the safety of the Work. In no case shall any portion of wood forms be left in the concrete. As the forms are removed, all Projecting metal or composite devices that have been used for holding the forms in place shall be removed in accordance with Section 502.09(A). The holes shall be filled as required in Section 502.12.

502.10 **Placing Concrete**

- A. **General** - Concrete shall not be placed until forms and reinforcing steel have been checked and approved by the Resident. The forms shall be clean of all debris. The method and sequence of placing the concrete shall be approved before any concrete is placed.

All concrete shall be placed before it shows signs of accelerated hydration gain and, in any case, as specified in Section 502.07. Concrete shall be placed in horizontal layers in such a manner as to avoid separation and segregation. Enough workers for the proper handling, tamping and operation of vibrators shall be provided to compact each layer before the succeeding layer is placed and to prevent the formation of cold joints between layers. Concrete shall not be placed against any surface coated with curing compound unless the curing compound has been removed. Care shall be taken to prevent mortar from spattering on structural steel, reinforcing steel and forms. Any concrete or mortar that becomes dried on the structural steel, reinforcing steel or forms shall be thoroughly cleaned off before the final covering with concrete. Following the placing of the concrete, all exposed surfaces shall be thoroughly cleaned as required, with care not to injure any surfaces.

Concrete shall not come in direct contact with seawater during placing and for a period of 72 hours thereafter, except as follows:

1. Concrete seals that are located entirely below low tide.
2. Concrete footings constructed in the dry and located entirely below low tide or final ground elevation.
3. Concrete Fill placed under water.

Concrete in any section of a structure shall be placed in approximately horizontal layers of such thickness that the entire surface shall be covered by a succeeding layer before the underlying layer has taken its initial set. Layers shall not exceed 18" in thickness and be compacted to become an integral part of the layer below. Should the placement be unavoidably delayed long enough to allow the underlying layer to take initial set or produce a so-called "cold joint", the following steps shall be taken:

- An incomplete horizontal layer shall be bulk-headed off to produce a vertical joint.
- Horizontal joints shall be treated as required in Section 502.10(F).

The concrete in superstructures shall be placed monolithically except when construction joints are shown on the Plans or are authorized in accordance with approved details submitted by the Contractor. If the concrete in the stems of T-beams is to be placed independent of the slab section, the construction joint shall be located at the underside of the slab and the bond between stem and slab shall be a mechanical one. The bond shall be produced by embedding 2" by 4" wooden blocks having a length approximately 4" less than the width of the stem and placed horizontally at right angles to the centerline of the beam in the top surface of the concrete immediately following the completion of the concrete placement. To provide for the uniform spacing of the blocks and their ready removal when the concrete has taken a set sufficient to hold its form, the blocks shall be firmly nailed upon a board at a spacing of 1 ft center-to-center. The blocks shall be thoroughly oiled to facilitate their ready removal from the concrete.

In arch spans, the order of construction or sequence of the work, as shown on the Plans, shall be followed in the placing of concrete.

In no case shall the work on any section or layer be stopped or temporarily discontinued within 18" below the top of any face, unless the Plans provide for a coping having a thickness less than 18", in which case, at the option of the Resident, the construction joint may be made at the underside of the coping. Concrete in columns shall be placed in one continuous operation, unless otherwise directed.

If SCC has been approved for use, it shall be placed from a single discharge point to build hydraulic head and allow the SCC to progressively

flow forward until the form is filled. The discharge point shall be moved as the SCC reaches the full height being cast, while maintaining a hydraulic head as the cast progresses. If subsequent loads of SCC are placed on top of a previous layer, a minimal amount of internal vibrating must be introduced to ensure the top layer blends with the previous layer.

Fresh concrete threatened with rain damage shall be protected by approved means. Sufficient material for covering the work expected to be done in 1 Day shall be on hand at all times for emergency use. The covering shall be supported above the surface of the concrete.

Concrete Fill shall be placed at least to the pay limits shown on the Plans. Forms may be omitted at the Contractor's option. Vibration of concrete will not be required. The Contractor has the option of placing Concrete Fill under water or in the dry.

- B. **Chutes, Troughs, Pipes and Buckets** - Sectional drop chutes or short chutes, troughs, pipes and buckets, when used as aids in placing concrete, shall be arranged and used in such a manner that the ingredients of the concrete do not become separated or segregated. Wood and aluminum chutes, troughs, pipes or buckets shall not be used.

Dropping the concrete from a distance of greater than 6 ft, unless confined by closed chutes or pipe, will not be permitted. The concrete shall be deposited at, or as near as possible to, its final position.

- C. **Vibrating** - Mechanical, high frequency internal vibrators shall be used, operating within the concrete, for compacting the concrete in all structures and precast and cast-in-place piles, except for concrete placed under water. The vibrators shall have a frequency of between 5,000 and 12,000 vibrations per minute and shall be visibly capable of properly consolidating the designed mixture. For each type of vibrator used, a spare vibrator shall be available on the Project at all times during the placing of concrete.

Sufficient vibrators shall be used to consolidate the incoming concrete within 5 minutes after placing. Vibrators shall neither be held against forms or reinforcing steel, nor shall they be used for flowing the concrete or spreading it into place. Over-vibrating shall not be allowed.

- D. **Dewatering Forms** - All forms shall be dewatered before concrete is placed in them. Pumping will not be permitted from the inside of forms while concrete is being placed. Moving water shall not be permitted to be exposed to fresh concrete.
- E. **Depositing Concrete under Water** - No concrete shall be deposited under water except for cofferdam seals. Pumping will not be allowed within the cofferdam while concrete is being placed.

The concrete shall be placed carefully in a compact mass in its final position by means of a tremie or by other approved means and shall not be disturbed after being deposited. Bottom dump buckets will not be permitted. Particular care must be exercised to maintain still water at the point of deposit. Concrete shall not be placed in running water. The method of depositing concrete shall be so regulated as to produce approximate horizontal surfaces. Each seal shall be placed in one continuous operation.

When a tremie is used, it shall consist of a tube not less than 10" in diameter. The means of supporting the tremie shall be such as to permit free movement of the discharge end over the entire seal and to permit its being lowered rapidly, when necessary to choke off or retard flow. The tremie shall be filled by a method that will prevent washing of the concrete. The discharge end shall be completely submerged in concrete at all times and the tremie tube shall be kept full to the bottom of the hopper. The flow shall be regulated by raising or lowering the tremie.

When the horizontal area of the tremie seal is large, several tremie hoppers shall be provided and positioned strategically to allow placement of concrete near the point where it is needed, to avoid moving concrete horizontally through the water. The number of tremie hoppers and the work plan shall be approved by the Resident.

All laitance or other unsatisfactory material shall be removed from the surface of the seal before placing additional concrete. The surface shall be cleaned by scraping, chipping or other means that will not injure the concrete.

The placing and dewatering of seal concrete within cofferdams shall be in accordance with Section 511 - Cofferdams.

- F. **Construction Joints** - Construction joints shall be located where shown on the Plans or permitted by the Resident. When the concrete is in seawater, no horizontal construction joint will be permitted between extreme low tide and extreme high tide elevations, except for concrete cores for stone masonry.

At horizontal construction joints, temporary gage strips, having a minimum thickness of 1½", shall be placed horizontally inside the forms along all exposed faces, to give the joints straight lines. The joint shall be so constructed that the surface of the concrete will not be less than ¼" above the bottom of the gage strip. Before placing fresh concrete, the temporary gage strip shall be removed, the surfaces of construction joints shall be thoroughly cleaned, drenched with water until saturated and kept saturated until the new concrete is placed. Immediately prior to placing new concrete, the forms shall be drawn tight against the concrete already in place. Concrete in substructures shall be placed in such a manner that

all horizontal joints will be horizontal and, if possible, in locations such that they will not be exposed to view in the finished structure.

Where vertical construction joints are necessary, reinforcing bars shall extend across the joint in such a manner as to make the structure monolithic. Construction joints through paneled wing walls or other large surfaces which are to be treated architecturally will not be allowed except as shown on the Plans. All vertical construction joints in abutments and retaining walls shall contain water stops as shown on the Plans. The water stops shall be one continuous piece at each location.

All horizontal construction joints in abutments and retaining walls shall be constructed using a joint cover, as shown on the Plans.

Construction joints in the wearing surface shall be located where called for on the Plans. No other construction joints will be allowed.

All joints shall be formed in the manner detailed on the Plans. The forms shall not be treated with oil or any other bond breaking material that will adhere to the concrete.

Sealing slots shall be provided at all joints in the wearing surface that are located directly over a slab construction joint.

Construction joints in the wearing surface not receiving a sealing slot shall be brushed with a neat cement paste immediately prior to making the adjacent concrete placement.

After the concrete has been cured, sealing slots, when required, shall be sandblasted, or high-pressure (minimum of 4,000 psi) water cleaned, to remove all laitance and foreign material on the surfaces of the slots. The bottom of the sealing slots shall receive an approved bond breaker. The joint shall then be filled within $\frac{1}{8}$ " of the surface with an elastomeric concrete product listed on the Department's Qualified Products List, in accordance with the manufacturer's recommendations.

- G. ***Bonding of Cast-In-Place Concrete Slabs*** - Concrete wearing surface slabs placed on cast-in-place superstructure slabs, concrete wearing surface slabs placed on precast concrete superstructure elements, structural concrete slabs placed on precast concrete superstructure elements, or concrete leveling slabs placed on precast concrete superstructure elements shall be permanently bonded. Precast concrete superstructure elements include, but are not limited to, deck slabs, voided slabs, box beams, bulb tee girders and Northeast Extreme Tee (NEXT) beams.

The structure supporting the cast-in-place slab shall be cleaned to remove all laitance, dust, dirt, debris, oil, grease, bituminous material, paint, and other foreign matter. When the supporting structure is composed of cast-in-place concrete, the Contractor shall scabble the

entire surface of the structure and then sandblast, or high-pressure (minimum of 4,000 psi, typical) water clean, the entire supporting structure. When the supporting structure is comprised of precast elements, the Contractor shall sandblast, or high-pressure water clean, the entire surface of the supporting surface elements. The final cleaning of the supporting structure shall be performed within the 24 hour period preceding the placement of the cast-in-place slab. All debris resulting from the cleaning operation shall be thoroughly removed using compressed dry air from the cleaned surfaces and adjacent areas. Air lines shall be equipped with effective oil traps. Prepared areas of the supporting structure that have not received the cast-in-place slab within 36 hours of being cleaned shall be recleaned. No surface preparation of a new supporting structure shall begin before completion of the specified curing period.

After cleaning of the structure supporting the cast-in-place slab has been satisfactorily completed, the supporting structure and all porous surfaces to be in contact with the new slab shall be thoroughly saturated with water for a minimum of 12 hours prior to placement of the slab. Remove all standing water immediately prior to placement with oil-free compressed air and protect the supporting structure from drying, so that the concrete remains in a saturated surface dry condition.

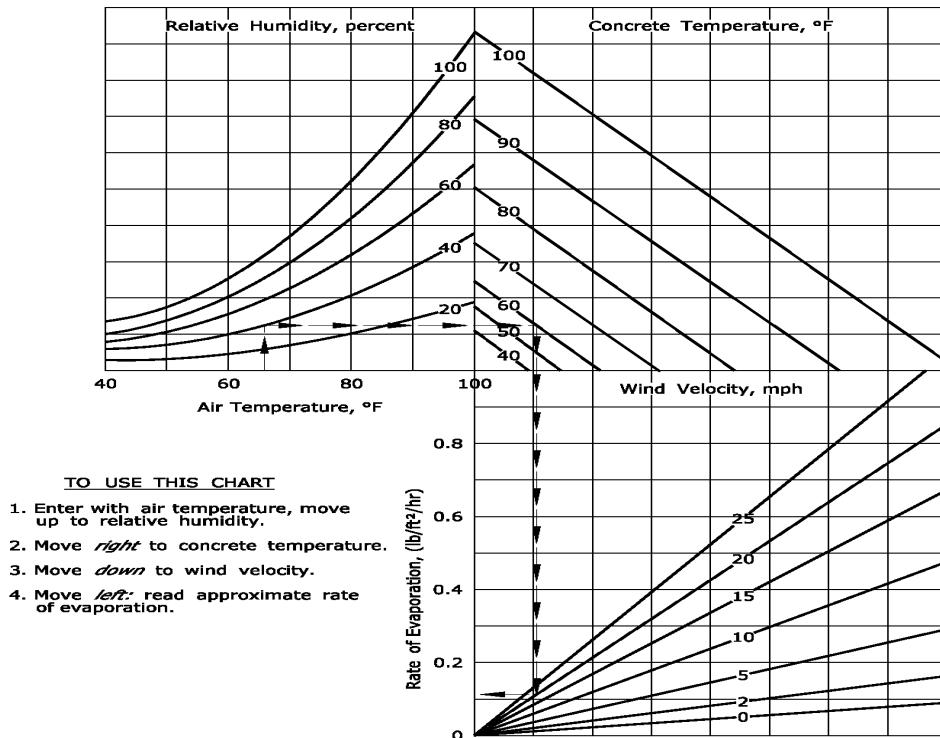
The following is further required when placing concrete wearing surface slabs: In addition to the cleaning prescribed above for the supporting structure, the faces of curb and barrier walls, or other median devices, up to a height of 1" above the top elevation of the wearing surface, shall be cleaned to remove all curing compound, laitance, dust, dirt, debris, oil, grease, bituminous material, paint and all other foreign matter. The cleaning shall be performed by dry sand blasting or high-pressure water cleaning.

Bonding grout for wearing surface slabs. All horizontal surfaces in contact with the wearing surface shall receive a coating of bonding grout. The vertical faces in contact with the wearing surface shall be broomed up to the elevation of the top of the wearing surface with bonding grout. Stiff bristled street brooms shall be used to brush the grout onto the surface. The coating shall not exceed $\frac{1}{8}$ " in thickness. The rate of progress in applying grout shall be limited so that the grout does not become dry before it is covered with new concrete. During delays in the surfacing operations, should the surface of the grout indicate an extensive amount of drying, the grout shall be removed by methods approved by the Resident and the area shall be re-grouted. The bonding grout shall have Portland Cement and fine aggregate proportioned 3 to 1, respectively, by volume. The grout mix design shall be included in the QCP. The fine aggregate shall be the same source as used in the concrete. The cement

and fine aggregate shall be measured separately in appropriately sized containers. The fine aggregate shall be deposited in an approved mechanical mortar mixer before adding cement. Water shall be added in sufficient quantity to allow flow of the grout without segregation of the grout ingredients. No water shall be added to the bonding grout after initial mixing. The grout shall not be allowed to separate before placement. The cement to water contact time of the grout shall not exceed 30 minutes before it is placed. Any grout that has dried or become unworkable before application, as determined by the Resident, shall not be incorporated into the work. The use of retarding admixtures for increasing the discharge time limits will be allowed. The Resident may approve the batching of bonding grout at an approved commercial concrete batch plant. In this case, mixing and delivery shall be in transit truck mixers.

- H. ***Concrete Slab Surface Evaporation Limitations*** - No placement of structural concrete slab structures, including, but not limited to, concrete deck slabs, wearing surfaces, simple slab spans, and slabs on precast superstructures, shall be commenced if the combination of ambient air temperature, relative humidity, wind speed, and plastic concrete temperature result in a surface moisture evaporation rate theoretically equal to, or greater than, 0.1 lb/ft²/hr of exposed surface (Refer to the Rate of Evaporation from Concrete Surface Chart). If the surface moisture evaporation rate rises to 0.15 lb/ft²/hr of exposed surface, the Contractor shall implement the remedial action described in the approved QCP. The temperature of the concrete shall not exceed 75°F at the time the concrete is placed in its final position. The maximum temperature of the surface on which concrete will be placed shall be 90°F. The Contractor shall provide all equipment and perform all measurements and calculations in the presence of the Resident to determine the rate of evaporation, the cost of which shall be incidental to related items. (See Chart on next page.)

**RATE OF EVAPORATION FROM CONCRETE
SURFACE CHART**



- 502.11 **Expansion and Contraction Joints** - Expansion and Contraction joints shall be located and constructed as shown on the Plans. Water stops shall be one continuous piece at each location. Joint cover, as shown on the Plans, shall be applied to all joints where water stops cannot physically be installed, as determined by the Resident.
- 502.12 **Repairing Defects and Filling Form Tie Holes in Concrete Surfaces** - After the forms are removed, all surface defects and holes left by the form ties shall be repaired.

All fins and irregular Projections shall be removed from the following: Surfaces which are visible in the completed work; surfaces to be waterproofed; and the portion of vertical surfaces of substructure units which is below the final ground surface to a depth of 12", not including underwater surfaces.

In patching surface defects, all coarse or fractured material shall be chipped away until a dense uniform surface, exposing solid coarse aggregate, is obtained. Feathered edges shall be saw cut away to form faces having a minimum depth of 1" perpendicular to the surface. All surfaces of the cavity shall be saturated thoroughly with water, after which a thin layer of neat cement paste shall be applied. The cavity shall then be filled with thick, reasonably stiff mortar, not more than 30 minutes old, composed of material of the same type and quality and of the same proportions as that used in the concrete being repaired. The

surface of this mortar shall be floated before initial set takes place and shall be neat in appearance. The patch shall be water cured for a period of 5 Days.

The holes left by form ties shall be filled with a mortar similar to that described above, but with the addition of a non-shrink additive.

If the removal of defective concrete materially impairs the soundness or strength of the structure, as determined by the Resident, the affected unit shall be removed and replaced by the Contractor at its expense.

The holes left by form ties, on the portions of substructure concrete that are to be permanently covered in the finished work, may be filled with an acceptable grade of plastic roofing cement. Holes in the bottom of slabs caused by supporting hangers need not be filled.

502.13 **Finishing Concrete Surfaces** - Neat cement paste, dry cement powder or the use of mortar for topping or plastering of concrete surfaces will not be permitted. Use of evaporation retardants, finishing aids, or water, to finish any concrete surfaces shall not be allowed.

- A. **Float Finish** - A float finish for horizontal surfaces shall be achieved by placing an excess of concrete in the form and removing or striking off the excess with a template or screed, forcing the coarse aggregate below the surface. Creation of concave surfaces shall be avoided. After the concrete has been struck off, the surface shall be thoroughly floated to the finished grade with a suitable floating tool. Aluminum and steel floats are not allowed.

Float finish, unless otherwise required, shall be given to all horizontal surfaces except those intended to carry vehicular traffic and those of sidewalks.

- B. **Structural Concrete Slab Structures** - Structural concrete slab structures include, but are not limited to, structural concrete deck slabs, wearing surfaces, slabs on precast superstructures, top and bottom slabs of box culverts, approach slabs, rigid frame structures and simple slab spans, as applicable. Screed rails shall be set entirely above the finished surface of the concrete and shall be supported in a manner approved by the Resident. Additional shear studs may be welded to the top flange to be used for screed rail support in locations that do not conflict with the location of the designed shear stud locations.

Screed rail supports set in the concrete shall be so designed that they may be removed to at least 2" below the surface of the concrete. Voids created by removal of the upper part of the screed rail supports shall be filled with mortar having the same proportions of sand and cement as that of the slab. The mortar shall contain an approved additive in sufficient proportions to produce non-shrink or slightly expansive characteristics. Screed rail supports for slab structures with integral concrete wearing

surfaces or bonded concrete wearing surfaces shall be removed immediately following screeding operations and repaired prior to final finishing.

The rate of placing concrete shall be limited to that which can be finished without undue delay and shall not be placed more than 10 ft ahead of strike-off.

The Contractor shall furnish a minimum of two work bridges behind the finishing operation, supported on the screed rails, each of which shall be capable of spanning the entire width of the deck and supporting at least a 500 lb load without deflection to the concrete surface. These work bridges shall be used by the Contractor for touch-up and curing cover application and shall be available for inspection purposes. When the overall length of the structure is 60 ft, or less, only one work bridge will be required.

An approved bridge deck finishing machine complying with the following requirements shall be used, except as otherwise specified, for finishing structural concrete slab structures. The finishing machine shall have the necessary adjustments, built in by the manufacturer, to produce the required cross section, line and grade. The supporting frame shall span the section being cast in a transverse direction without intermediate support. The finishing machine shall be self-propelled and capable of forward and reverse movement under positive control. Provisions shall be made for raising all screeds to clear the screeded surface for traveling in reverse. The screed device shall be provided with positive control of the vertical position.

The finishing machine shall be self-propelled with one, or more, oscillating screeds or one, or more, rotating cylinder screeds. An oscillating screed shall oscillate in a direction parallel to the centerline of the structure and travel in a transverse direction. A rotating cylinder screed shall rotate in a transverse direction while also traveling in the same direction. Either type of screed shall be operated transversely in overlapping strips in the longitudinal direction not to exceed 6". One, or more, powered augers shall be operated in advance of the screed(s) and a drag (pan type) float shall follow the screed(s). For concrete placements less than 6" in depth, vibratory pan(s) having a minimum of 3,000 vibrations/minute shall be operated between the oscillating screed(s) or rotating cylinder screed(s) and the power auger(s). For concrete placed more than 3½" in depth, hand-operated spud vibrators shall be used in addition to the machine vibratory pan(s).

The transversely operated rotating cylinder(s) of the bridge deck finishing machine shall be rotated such that the direction of the rotation of the cylinder(s) at the surface of the concrete is in accordance with the manufacturer's recommendations.

Concrete immediately in front of the power auger(s) of a bridge deck finishing machine shall be placed or cut to a depth that is close to the center of the rotating auger(s). The advance auger(s) shall strike off the concrete to approximately ¼" above the final grade. The concrete shall then be consolidated with the vibrating pan(s) and then finished to final grade.

If the drag float does not seal the surface of the concrete, an additional float finish shall be applied immediately following strike-off.

A small handheld pan vibrator shall be required at edges and adjacent to joint bulkheads. In lieu of the handheld pan vibrator equipment, the Resident may approve small spud vibrator(s).

Lightweight, vibrating, screeds may be used for bonded concrete wearing surfaces, leveling slabs and full or partial depth cast-in-place deck slabs meeting the following criteria:

1. Where concrete placements are specified to be less than or equal to 16 ft in width.
2. Where concrete placements encompass the entire area of a bridge deck that meets the following dimensions: The total bridge length is equal to or less than 100 ft AND the total bridge width is equal to or less than 36 ft.

Use of lightweight, vibrating, screeds for concrete wearing surfaces, leveling slabs and full or partial depth cast-in-place deck slabs not meeting the criteria listed above may be allowed with the written permission of the Department.

Lightweight, vibrating, screeds shall have the following features:

1. Be portable and easily moved, relocated, or adjusted.
2. The power unit shall be operable without disturbing the screeded concrete.
3. Be self-propelled or mechanically propelled with controls that will allow a uniform rate of travel and by which the rate of travel can be increased, decreased or stopped.
4. Have controlled, uniform, variable frequency vibration, end to end.
5. Be fully adjustable for flats, crowns, or valleys.
6. The screed length shall be adjustable to accommodate the available work area.

When a lightweight vibrating screed is utilized, the concrete shall be placed or cut to no more than ½" above the finished grade in front of the front screed. The screed shall be operated such that at least 3 ft of concrete is in position in front of the screed.

Supporting slabs for bituminous wearing surfaces shall be finished in accordance with the recommendations of the waterproofing membrane manufacturer.

On all concrete wearing surfaces, a 1 ft wide margin shall be finished adjacent to curbs and permanent barriers with a magnesium float.

Immediately after screeding and floating, the surface of the concrete shall be tested for trueness, by the Contractor, with a 10 ft straightedge and all irregularities corrected at once in order to provide a final surface within the tolerance required in Table 3. The surface shall be checked both transversely and longitudinally.

The straightedges shall be furnished and maintained by the Contractor. They shall be fitted with a handle and all parts shall be made of aluminum or other lightweight metal. The straightedges shall be made available for use by the Resident when requested.

In the event of a delay during a concrete placement, all concrete that cannot receive the final curing cover shall be covered with wet burlap.

No vehicles will be allowed, either directly or indirectly, on reinforcing steel before concrete placement.

- C. ***Curb and Sidewalk Finish on Bridges*** - Curbs and sidewalks shall receive a float finish. Sidewalks shall, additionally, receive a light broom finish, perpendicular to the sidewalk.

When a concrete curb is monolithic with a sidewalk, a 6" wide smooth margin shall be made along the top of the curb with a magnesium float.

Unless shown on the Plans, the sidewalk area shall not be divided into sections by transverse grooves.

At all transverse construction and expansion joints, except where steel expansion dams are used, the edges of the joints, on the surface of the sidewalk, shall be finished with a sidewalk edging tool, 2" in width, with a ¼" radius lip. Finishing shall be completed within 15 minutes of concrete placement.

- D. ***Form Surface Finish*** - The character of the materials used and the care with which forms are constructed and concrete placed shall be considered in determining the amount of rubbing required. If concrete surfaces are obtained that are satisfactory to the Resident, then the Contractor may be relieved, in part, from the requirement of rubbing.

- 1. ***Ordinary Finish*** - An Ordinary Finish is defined as the finish left on a surface after the removal of the forms, the filling of all holes and the repairing of all defects. The surface shall be true and even, free from stone pockets and depressions or Projections and of uniform texture.

All formed concrete surfaces shall be given an ordinary finish unless otherwise specified.

Repaired areas that do not meet the above requirements or areas that cannot be satisfactorily repaired to meet the requirements for ordinary finish shall be given a rubbed finish. When a rubbed finish is required on any part of a surface, the entire surface shall be given a rubbed finish.

2. ***Rubbed Finish*** - After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be thoroughly saturated with water. Sufficient time shall have elapsed before wetting down to allow the mortar used in ordinary finish to become thoroughly set. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone, using a small amount of mortar on its face. The mortar shall be composed of cement and fine sand mixed in proportions as used in the concrete being finished. Rubbing shall be continued until all form marks, Projections and irregularities have been removed, all voids filled and a uniform surface has been obtained. A thin layer of paste produced by this rubbing shall be left on the surfaces.

After all concrete above the surface being treated has been cast, the final finish shall be obtained by a second rubbing with a fine carborundum stone using only water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform color. The paste produced by this second rubbing shall be carefully spread with a moist whitewash brush to form a very thin uniform coating upon the surface of the concrete.

After the final rubbing is completed and the surface has dried, it shall be rubbed lightly with clean, dry, burlap to remove excess loose powder and shall be left free from all unsound patches, paste, powder and objectionable marks. This finish shall result in a surface of smooth texture and uniform color.

No surface finishing shall be done in freezing weather or when the concrete contains frost. In cold weather, the preliminary rubbing necessary to remove the inert sand and cement materials and the surface irregularities may be done without the application of water to the concrete surfaces.

The following portions of concrete roadway grade separation structures shall be given a rubbed finish unless otherwise indicated in the Contract:

- a. ***Retaining walls and the breast and wing walls of abutments*** - face surfaces to 12" below the finished ground line.

- b. **Piers** - All vertical surfaces and the underside of overhanging portions of caps, except that for overpass structures, the piers beyond the outside limits of the roadway pavement, the vertical surfaces on the back which are not visible from the roadway or sidewalk will not require a rubbed finish.

If, in the opinion of the Resident, the general appearance of a concrete structure, due to the excellence of workmanship, cannot be improved by a rubbed finish, this requirement may be waived.

- E. **Surface Finish** - After the concrete has cured the surface shall be tested with a 10 ft straightedge or a lightweight profiler.

The straightedge shall be furnished and maintained by the Contractor. It shall be fitted with a handle and all parts shall be made of aluminum or other lightweight metal. The straightedges shall be made available for use by the Resident when requested.

Areas found to not comply with the tolerance of Table 3 shall be brought into conformity by methods proposed by the Contractor and approved by the Resident at no additional cost to the Department.

TABLE 3 - SURFACE TOLERANCE LIMITS

Type of Surface	Maximum deviation of surface in inches below a 10 ft straightedge*
Concrete Wearing Surfaces, Curbs, Sidewalks, and Barriers	$\frac{1}{8}$ "
Concrete Slab Surfaces to be Covered by Membrane Waterproofing or Concrete Wearing Surfaces	$\frac{1}{4}$ "
Concrete Slab Surfaces with Integral Concrete Wearing Surface	$\frac{1}{4}$ "
Concrete Slab Surfaces to be Covered by Earth or Gravel	$\frac{3}{8}$ "
Concrete Surface of Box Culvert Bottom Slabs	$\frac{3}{8}$ "
Concrete Surface of Abutments, Piers, Pier Shafts, Footings, and Walls	$\frac{3}{8}$ "
* Allowance shall be made for crown, camber and vertical curve.	

- F. **Saw Cut Grooving of Concrete Wearing Surfaces** - A saw cut grooved finish shall be applied to concrete wearing surfaces. This work shall be performed using a multi-bladed diamond wet saw using circular saw blades. The Resident may allow the use of a single blade, circular saw tool, where it is determined that such equipment is necessary to complete

the work, as required. The equipment the Contractor proposes to use will be subject to the approval of the Resident, prior to use.

Saw cutting may begin only after the specified curing period has elapsed. Cut all grooves in a rectangular shape conforming to the following dimensions:

- Width: $\frac{1}{8}'' \pm \frac{1}{32}''$
- Depth: $\frac{1}{4}'' \pm \frac{1}{16}''$

Unless otherwise specified in the Contract, terminate grooves 4 to 12" away from curbs, parapets, drainage structures, bridge joints, medians and exposed edges of the structural concrete slab.

During the grooving operations, the Resident will verify, at random, that the minimum grooved depth is being achieved. If the Resident determines that the minimum groove depth is not being achieved, then the Contractor shall stop grooving operations and make all adjustments necessary, as well as any repairs, as required by the Resident.

The Contractor shall supply the Resident with two accurate, easily readable, gauges with which to verify groove depth. Deliver the gauges and applicable manufacturer's instructions for use no later than 7 Days prior to the anticipated start of grooving operations.

Slurry, or debris, generated by the grooving operation will not be allowed to accumulate or harden and shall be prevented from flowing into drains, onto the roadway slopes or water bodies below or adjacent to the bridge. Residue shall be continuously removed. The slurry and debris shall be disposed of properly by the Contractor.

Only rubber tired vehicles are allowed on the bridge deck after saw cut grooving.

Saw cutting concrete produces silica fume dust. Include Saw Cut Grooving of Concrete Wearing Surfaces in the Health and Safety Plan.

Saw cut grooves shall be longitudinal. Cut longitudinal grooves parallel to the bridge centerline, or working line, using continuous passes. On curved alignments, grooves shall be parallel to the centerline of construction or working line. Spacing of longitudinal grooves shall be 1½". Spacing does not need to be varied.

- 502.14 **Curing Concrete** - All concrete surfaces shall be kept wet with clean, fresh, water for a curing period of at least 7 Days after concrete placing, with the exception of vertical surfaces, as provided for in Section 502.09(D) - Removal of Forms and False work, and sidewalks, as provided for in this section. For concrete wearing surfaces and all concrete containing coal ash and slag cement, the temperature of the concrete shall be kept above 50°F for the entire 7 Day

period. All other concrete and its surfaces shall be kept above 50°F for the first 4 Days of the curing period and above 32°F for the remainder of the period.

In the 24 hours following the end of the curing period, the temperature of the concrete shall be decreased on a gradual basis, not to exceed a total change of 40°F for moderate sections, such as abutments and pier bents, and 30°F for mass sections, such as massive piers.

All slabs and wearing surfaces shall be water cured and continuously wet for the entire curing period by covering with one of the following systems:

- A. 2 layers of wet burlap,
- B. 2 layers of wet cotton mats,
- C. 1 layer of wet burlap and either a polyethylene sheet or a polyethylene coated burlap blanket,
- D. 1 layer of wet cotton mats and either a polyethylene sheet or a polyethylene coated burlap blanket.

Except as otherwise specified, curing protection for slabs and wearing surfaces shall be applied within 15 minutes after the concrete is screeded and before the surface of the concrete has lost its surface “wetness” or “sheen” appearance. The burlap or the cotton mats shall be pre-soaked, prior to being applied. Polyethylene sheets shall not be placed directly on the concrete, but may be placed over the fabric cover to prevent drying.

The covering of concrete wearing surfaces, decks, curbs, and sidewalks shall be kept continuously wet for the entire curing period using a continuous wetting system and shall be located to ensure a completely wet concrete surface for the entire curing period.

All other surfaces, if not protected by forms, shall be kept thoroughly wet either by sprinkling or using wet burlap, cotton mats or other suitable fabric until the end of the curing period, except as provided for in Section 502.09(D) - Removal of Forms and False work. Polyethylene sheets shall not be placed directly on the concrete, but may be placed over the fabric cover to prevent drying.

502.15 ***Loading Structures and Opening to Traffic*** - No superstructure concentrated loads such as structural steel beams, girders and trusses shall be placed upon finished concrete substructures until the concrete has reached its design strength.

No load or work will be permitted on concrete superstructure slabs or rigid frame structures until concrete cylinders cured with the slab establish that design strength has been reached. However, after a shorter period, the Resident may permit handwork for form construction and setting stone bridge curb. No curbing or other materials shall be stored on the bridge during the 7 Day curing period, except that if handwork is permitted, curb stones may be stored in a line near their final location until ready to be set.

Neither traffic nor fill material shall be allowed on superstructures of concrete bridges or culverts until concrete cylinders cured with the slab establish that design strength has been reached, dependent upon conditions as specified in Section 502.09 and with the approval of the Resident.

No traffic will be allowed on the cured concrete of a concrete wearing surface until 24 hours after the completion of the application of protective coating for concrete surfaces.

Concrete approach slabs at the end of structures may be opened to traffic or backfilled if buried, when the design strength has been reached.

Foundations for light bases, traffic signals and overhead signs must reach design strength prior to loading.

- 502.16 **Bridge Drains and Incidental Drainage** - All drains shall be accurately placed at the locations shown on the Plans, or authorized, and adequate means provided for securely holding them in the required positions during the placing of concrete.

Bridge drains shall be galvanized in accordance with Section 711.04 - Bridge Drains. The Contractor shall furnish an insulator between surfaces of galvanized and weathering steels when erecting the bridge drain support assembly. Epoxy-coated washers shall be used when the support assembly attaches to weathering steel beam webs.

Drains or weep holes through abutments and retaining walls shall be pipe of the size and shape shown on the Plans and shall be of Schedule 40 PVC pipe.

For providing drainage for any moisture that may collect between the deck slab and the hot mix asphalt roadway surface, approved 1" inside diameter plastic tube drains shall be installed at the low points of the slab surface, adjacent to the end dam or dams. The exact location will be determined in the field by the Resident and the discharge from them shall be such as to clear the bridge seats and any other portion of the structure in their proximity. The tops of the drains shall be depressed $\frac{3}{8}$ " below the surface of the slab and the outlets shall Project 2" below the underside of the slab. Care shall be exercised such that the drains are open after the installation of the membrane waterproofing, when it is installed.

- 502.17 **Quality Control** - The Contractor shall control the quality of the concrete through testing, inspection, and practices which shall be described in the QCP, sufficient to assure a product meeting the Contract requirements. The QCP shall meet the requirements of Section 106 - Quality, and this specification. No work under this item shall proceed until the QCP is submitted to and approved by the Department. Failure to comply with the approved QCP will result in work suspension and pay reductions as outlined in Section 106.4.6. The Quality Control Plan Value shall be the total bid value for all cast-in-place items covered by the QCP, using the P value listed in Special Provision 502. If no P value is

listed, a value of \$350, or bid value per cubic yard, whichever is less, shall be used.

502.1701 **Quality Control, Method A and B** - The QCP shall address all elements that affect the quality of the structural concrete including, but not limited to, the following:

- A. Mix Design(s)
- B. Aggregate Production
- C. Quality of Components
- D. Stockpile Management
- E. Proportioning, including Added Water
- F. Mix and Transportation, including Time from Batching to Completion of Delivery, as well as manufacturer, product name, proposed dosage(s) and discharge time(s) if a hydration stabilizing admixture is used.
- G. Initial and as-Delivered Mix Properties, including Temperature, Air Content, Consistency and Water/Cementitious Material Ratio
- H. Process QC Testing, including monitoring for attainment of Accelerated Hydration Gain when a hydration stabilizing admixture is used.
- I. Placement and Consolidation
- J. Permeability
- K. Compressive Strength
- L. Finishing and Curing
- M. Hot and Cold Weather Concreting Procedures, including curing and form removal

The QCP shall include the names and specific qualifications of the individuals meeting these requirements and qualifications:

- A. QCP Administrator meeting one of the following qualifications:
 - 1. Professional Engineer licensed in the State of Maine with 1 year of concrete experience acceptable to the Department.
 - 2. Engineer Intern certified by the State of Maine with 2 years of concrete experience acceptable to the Department.
 - 3. An individual with 3 years concrete experience acceptable to the Department and with a Bachelor of Science Degree in Civil Engineering or a related Civil Engineering Technology discipline.

4. Certified Quality Assurance Technologist, certified by the NorthEast Transportation Training and Certification Program (NETTCP).
- B. **Process Control Technician(s) (PCT)** - shall utilize test results and other quality control practices to assure the quality of aggregates and other mix components and control proportioning to meet the mix design(s). The QCP shall detail the frequency of sampling and testing, corrective actions to be taken, and documentation. The PCT shall periodically inspect all equipment utilized in proportioning and mixing to assure it is operating properly and that proportioning and mixing conforms to the mix design(s) and other Contract requirements. The QCP shall detail how these duties and responsibilities are to be accomplished and documented and whether more than one PCT is required. The QCP shall include the criteria utilized by the PCT to correct or reject unsatisfactory materials. The PCT shall be a MCTCB certified Concrete Plant Technician or a NETTCP certified Concrete Technician.
 - C. **Quality Control Technician(s) (QCT)** - shall perform quality control tests and inspection at the job site to assure that materials meet the requirements of the mix design(s) and specifications. The QCP shall detail frequency of sampling and testing, inspection procedures, corrective actions to be taken, and documentation. The QCP shall detail how these duties and responsibilities are to be accomplished and documented, and whether more than one QCT is required. The QCP shall include the criteria utilized by the QCT to reject unsatisfactory materials. The QCT shall be an ACI certified Concrete Field Testing Technician - Grade I or a NETTCP certified Concrete Technician.
 - D. The Plan shall detail the coordination of the activities of the QCP Administrator, the PCT and the QCT.

The Contractor shall maintain records of all QC tests and calculations. All QC test data shall be signed by the person who performed the test. The representative gradation test results shall be reported to the Department before the placement they represent. This initial representative gradation test shall be sampled a maximum of 30 Days prior to the production Day. The Contractor or supplier shall retain split samples of the most recent QC gradations for possible testing by the Department. In addition, the Department will sample the aggregates at the plant monthly to determine compliance with 703.03 - Combined Aggregate Grading for Concrete. The Combined Aggregate

Grading will be calculated by mathematically blending the individual aggregate gradations using the batch percentages from the approved mix design. If the Department's gradation tests determine that the aggregate does not meet the specified gradation limits, the current procedure mentioned in MaineDOT PCC Policies and Procedures Manual shall be followed. The compressive strength test results shall be reported to the Department by 10:00 a.m. of the 1st Working Day following the test. The Contractor shall record all onsite QC test data and calculations at the time of the placement and present this information, on a form acceptable to the Department, to the Department by 10:00 a.m. of the 1st Working Day following the concrete placement. Batch tickets shall be representative of that Day's total moisture in aggregate value, QC test data for total moisture in aggregate shall be provided to the Department by 10:00 a.m. of the 1st Working Day following the concrete placement. All Method A and B QC testing shall meet the minimum requirements found in Table 4.

TABLE 4 - METHOD A & B MINIMUM QUALITY CONTROL TESTING REQUIREMENTS *

TEST	TEST METHOD	SAMPLING LOCATION	FREQUENCY
Gradation	AASHTO T 27 & T 11	Stockpile	One representative set per proposed grading before production. One set every 100 cy (Min. 1 set per month)
Organic Impurities	AASHTO T 21	Stockpile	Once per fine aggregate per year **
% Absorption	AASHTO T 84 & T 85	Stockpile	Once per aggregate per year
Specific Gravity	AASHTO T 84 & T 85	Stockpile	Once per aggregate per year
Total Moisture in Aggregate	AASHTO T 255	Stockpile	One set per Day's production
Free Water and Aggregate Weight	N/A		One per Day's production
% Entrained Air	AASHTO T 152	On Project	On first two loads and every third load thereafter provided consistent results are achieved
Compressive Strength	AASHTO T 22	On Project	One set per subplot
Compressive Strength	AASHTO T 22	On Project	One set per subplot
* Additional QC testing will be required any time a process change occurs during a placement, including changes in type or dosage of admixture. Additional testing shall include, but is not limited to, entrained air testing. ** If the color produced is a laboratory designation Plate III, then the fine aggregate shall be tested once per month.			

502.1702 **Quality Control, Method C** - The Contractor shall submit a QCP listing the mix design(s) to be used, the name and location of the production facility, a brief description of the placement and curing process and the name and qualifications of any QCT to be used. When a hydration stabilizing admixture is proposed for use, the manufacturer, product name, dosage rate and discharge time, from the time cement is added to the aggregate, shall be included, as well as procedures for monitoring attainment of Accelerated Hydration Gain. A QCT will be required. The Contractor shall provide a Certificate of Compliance for

each truckload of concrete to the Department at the time of the load placement.

502.1703 **Acceptance Methods A and B** - The Department will determine the acceptability of the concrete through a quality assurance program.

The Department will take Acceptance samples a minimum of once per subplot on a statistically random basis. Samples will be taken at the discharge point, with pumped concrete sampling taken at the discharge end of the pump line. Acceptance tests will include compressive strength, air content and permeability.

Lot Size - A lot size shall consist of the total quantity represented by each class of concrete in the Contract. A lot shall consist of a minimum of 3 and a maximum of 10 sublots. If a lot is comprised of more than 10 sublots, sized in accordance with Table 5, then this quantity shall be divided equally into 2, or more, lots, such that there is a minimum of 3 and a maximum of 10 sublots per lot. If there is insufficient quantity in a lot to meet the recommended minimum subplot size, then the lot shall be divided into 3 equal sublots.

Sublot Size, General - The size of each subplot shall be determined in accordance with Table 5. The Resident may vary subplot sizes based on placement sizes and sequence.

Sublot Size, Unit Price Items - Sublot sizes will initially be determined from estimated quantities. When the actual final quantity of concrete is determined: If there is less than one-half the estimated subplot quantity in the remaining quantity, then this quantity shall be combined with the previous subplot, and no further Acceptance testing will be performed; if there is more than one-half the estimated subplot quantity in the remaining quantity, then this quantity shall constitute the last subplot and shall be represented by Acceptance test results. If it becomes apparent part way through a lot that, due to an underrun in quantity, there will be an insufficient quantity of concrete to comprise three sublots, then the Resident may adjust the sizes of the remaining sublots and select new sample locations based on the revised estimated quantity of concrete remaining in the lot.

Sublot Size, Lump Sum Items - Each lot shall be divided into sublots of equal size, based on the estimated quantity of concrete.

TABLE 5

Quantity (CY)	Recommended Sublot Size (CY)
0-500	50
501-1000	75
1001-2000	100
2001 or greater	250

Determination of the concrete cover over reinforcing steel for structural concrete shall be made prior to concrete being placed in the forms. Bar supports, chairs, slab bolsters, and side form spacers shall meet the requirements of the Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice, Chapter 3 Section 3.2.5 Class 1, Section 3.2.6 Class 1A, or Section 3.4, All-Plastic Bar Supports. All supports shall meet the requirements for type and spacing as stated in the CRSI Manual of Standard Practice, Chapter 3. Concrete will not be placed until the placing of the reinforcing steel and supports have been approved by the Resident. If the Contractor fails to secure Department approval prior to placement, the Contractor's failure shall be cause for removal and replacement at the Contractor's expense. The Contractor shall notify the Resident, at least 48 hours prior to the placement, when the reinforcing steel will be ready for checking. Sufficient time must be allowed for the checking process and any needed repairs.

Compressive strength tests will be completed by the Department in accordance with AASHTO T 22 and T 23 at ≥ 56 Days, except that no slump will be taken. Three 4" x 8" cylinders will be cast per subplot placed. The average of two concrete cylinders per subplot will constitute a test result and this average will be used to determine the compressive strength for pay adjustment computations.

Testing for Entrained Air in concrete, at the rate of one test per subplot, shall be in accordance with AASHTO T 152.

Surface Resistivity specimens will be tested by the Department in accordance with AASHTO T 358 at an age ≥ 56 Days. Three 4" x 8" cylinders will be cast per subplot placed. The average of three concrete specimens per subplot will constitute a test result and this average will be used to determine the permeability for pay adjustment computations.

Surface Tolerance, Alignment and Trueness, Plumb and Batter, Finish - The Resident will measure the properties of surface tolerance, alignment and trueness, plumb and batter and finish to ensure they conform to the following criteria. If the concrete fails to meet any of these requirements and the Contractor fails to repair or mitigate the identified defects, to the satisfaction of the Resident, then there shall be no positive Quality Assurance Acceptance incentive payments on the respective lots.

- A. **Surface Tolerance Surface** - tolerance of exposed horizontal and sloping portions of the substructure, superstructure slabs, wearing surface, sidewalks, barriers and wingwalls will be measured with a 10 ft straightedge. Surface tolerance

limits are given in Table 3, Section 502.13(E). The Contractor shall furnish the 10 ft straightedge.

- B. **Alignment and Trueness** - Alignment and trueness will be measured longitudinally along any vertical surface of any portion of the structure and shall not exceed a deviation of ¼" in 3 ft for structures up to 30 ft in length. Structures more than 30 ft in length will be subject to a maximum tolerance of 2".
- C. **Plumb and Batter** - Columns and other vertical surfaces that will remain exposed will be measured to determine actual batter and degree of verticality. Measurements will be taken after every placement. Vertical faces of columns will be measured at a minimum of two faces at right angles to each other. Other vertical surfaces will be measured once every 15 ft along the face of longitudinal walls. All measurements will be made on a per placement basis and will be subject to a tolerance of ¼" in 10 ft.
- D. **Finish** - Surface finish of concrete surfaces will be evaluated and repaired in accordance with Sections 502.09, 502.12, and 502.13, for each placement.

Rejection by Resident - For material represented by an Acceptance test with test results failing to meet the criteria specified in Table 1, the Department will, at its sole discretion:

- A. Require the Contractor to remove and replace the entire affected placement with concrete meeting the Contract requirements at no additional expense to the Department, or
- B. Accept the material, at a reduced payment as determined by the appropriate Quality Level Analysis specification formula.

502.1704 **Acceptance Method A** - A lot size shall consist of the total quantity represented by each class of concrete in the Contract. A lot shall consist of a minimum of 3 and a maximum of 10 sublots.

502.1705 **Acceptance Method B** - A lot size shall consist of the total quantity represented by each class of concrete in the Contract. A lot shall consist of a minimum of 3 sublots.

502.1706 **Acceptance Method C** - The Department will determine the acceptability of the concrete through Acceptance testing. Acceptance tests will include compressive strength, air content and permeability. Method C concrete not meeting the requirements listed in Table 1 shall be removed and replaced at no cost to the Department. At the Department's sole discretion, material not meeting requirements may be left in place and paid for at a reduced price as described in Section 502.195.

502.1707 **Resolution of Disputed Acceptance Test Results** - The Contractor shall work cooperatively with the Resident in maintaining Control Charts, as outlined in Subsection 106.4.3, in order to identify potential issues with any test results and take appropriate actions to address these issues before they become disputed issues. In cases where the Department may determine that removal of the affected placement is warranted or that the material is marginally acceptable and may remain in place and paid for at a reduced rate, in accordance with Section 502.1703 - Acceptance Methods A and B, this Subsection provides recourse for the Contractor to contest the Department's Acceptance test results as follows, at no additional cost to the Department:

- A. **Compressive Strength** - There may be cases where the Department's test results indicate that concrete must be removed and replaced, or that the material is marginally acceptable and may remain in place and paid for at a reduced rate. In these cases, and providing that the Contractor's QC test results from a NETTCP certified laboratory for the same load are more than 500 psi higher than that of the Department's test results, the following procedure concerning compressive strength may be undertaken by the Contractor and witnessed by the Department, within 64 Days of the placement date:
 - 1. Drilled core specimens shall be retrieved from the concrete in question in accordance with the requirements of ASTM C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. The core strength acceptance and evaluation criteria included in ACI 318 shall not apply.
 - 2. Three drilled core specimens shall be taken from each subplot in question, from randomly selected locations to be representative of the entire volume of the subplot. The Resident and the Contractor's representative shall agree on the sample locations prior to drilling. The specimens shall have a minimum diameter of 4" and a minimum length of 8".
 - 3. The concrete cores shall be taken directly from the Project to the nearest Department laboratory for processing for testing. The cores shall be protected from drying during transport. The Contractor shall make arrangements with the appropriate Department laboratory for testing prior to beginning the coring process.

4. Core test results will be evaluated by the Department. The test results of the three cored cylinders shall be averaged and then divided by a factor of 0.85. The resulting compressive strength shall be used by the Department in the final determination of the acceptability of the material in question and shall replace the contested test result in computing pay adjustments for the Lot in question. If coring is not done within the 36 Day time limit (or 64 Day time limit, as applicable), the Department will not allow dispute testing of the subplot.
5. If the Department concludes that the strength of the structural element in question is adequate as a result of the above procedure, then the concrete shall remain in place and payment will be adjusted using the test results from the above procedure. If the Department concludes that the strength of the structural element in question is unsatisfactory as a result of the above procedure, the original acceptance test result will remain in the lot and the Department will direct the Contractor to take appropriate actions, as determined by the Department, and at no additional cost to the Department.

B. **Permeability** - In cases where the Department's test results indicate that the material is subject to removal and replacement according to Section 502.192, the following procedure concerning permeability may be undertaken by the Contractor and witnessed by the Department, within 4 Calendar Days of the receipt of the results:

1. Drilled core specimens shall be retrieved from the concrete in question in accordance with the requirements of ASTM C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. Specimens shall have a diameter of 4" and a minimum length of 8".
2. Three drilled core specimens shall be taken from a location that would be from the same load as the original Department specimen for each subplot in question.
3. The concrete cores shall be taken directly from the Project to the nearest Department laboratory for processing for testing. The cores shall be protected from drying during transport. The Contractor shall make arrangements with the appropriate Department

laboratory for testing prior to beginning the coring process.

4. The cored cylinders will be tested by the Department in accordance with AASHTO T 358. The resulting permeability value shall be used by the Department in the final determination of the acceptability of the material in question and shall replace the contested test result in computing pay adjustments for the Lot in question.
5. If the Department concludes that the permeability of the placement in question is adequate as a result of the above procedure, then the concrete shall remain in place and payment will be adjusted using the test results from the above procedure. If the Department concludes that the permeability of the affected placement in question is unsatisfactory as a result of the above procedure, the original acceptance test result will remain in the lot and the Department will direct the Contractor to take appropriate actions, as determined by the Department, and at no additional cost to the Department.

- C. **Entrained Air** - In order to dispute the Department's test results, the Contractor must test material from the same sample as the Department. If the difference between the Department's and the Contractor's air tests is equal to or greater than 0.6%, then the material shall be retested by both parties. If the difference between the retests is equal to or greater than 0.6%, the concrete placement will be suspended immediately. Both air meters will be checked for accuracy by either comparison to a third calibrated air meter or by use of an air meter calibration vessel. If either air meter is found to be out of calibration it shall be replaced immediately. Once it is demonstrated that the QC and Acceptance air meters agree within 0.6%, the concrete placement may resume.

502.18 **Method of Measurement**

- A. Structural concrete satisfactorily placed and accepted will be measured by the cubic yard, in accordance with the dimensions shown on the Plans or authorized changes in the Plans, or as one lump sum unit, as indicated in the Schedule of Items.

Structural Concrete for any irregular shapes may be measured by the cubic yard as determined from the theoretical yield of the design mix or in the case of transit mixed concrete, by delivery ticket, as directed by the Resident.

B. The limits to be used in determining the quantities of the aforementioned structural concrete items for arriving at a lump sum price will be as follows:

1. ***Structural Concrete Superstructure Slabs Structural Concrete Roadway and Sidewalk Slabs on Steel Bridges, Structural Concrete Roadway and Sidewalk Slabs on Concrete Bridges and Structural Concrete Superstructure T-beam Type*** - The limits will be the entire concrete superstructure, outside to outside, both transversely and longitudinally, exclusive of concrete curbs, sidewalks, permanent concrete barrier and concrete transition barriers.
2. ***Structural Concrete Wearing Surfaces*** - The limits will be the entire concrete wearing surface bounded transversely by the roadway curbs and longitudinally by the extreme ends.
3. ***Structural Concrete Box Culverts*** - The limits will be the entire structure, meaning the bottom floor slab, abutments, wings, superstructure floor slab and headwalls or curbs.
4. ***Structural Concrete, Approach Slabs*** - The limit will be the entire approach slab or slabs, as shown on the Plans.
5. ***Structural Concrete, Abutments and Retaining Walls, Structural Concrete, Abutments and Retaining Walls (placed under water), Structural Concrete Piers, and Structural Concrete Piers (placed under water)*** - The limits will be the entire concrete substructure unit or units, from the bottom of the footing to the top of the unit, and outside to outside, both transversely and longitudinally, except for the portion to be placed under water, as indicated on the Plans, which will be the limits of the concrete unit or units, outside to outside, transversely, longitudinally, and vertically.
6. ***Structural Concrete Rigid Frame Structures*** - The limits will be the entire concrete structure, meaning the frame walls and top slab. Included within the limits for payment, unless otherwise shown on the Plans, are bottom slab, wing walls and headwalls.
7. ***Structural Concrete Culvert End walls*** - The limit will be the entire concrete end wall or end walls, as shown on the Plans.
8. ***Structural Concrete Curb and Sidewalks*** - The limit will be the entire concrete curb or sidewalk, as shown on the Plans.
9. ***Concrete Fill*** - Will be measured for payment by the number of cubic yards of concrete, in place, to the vertical pay limits shown on the Plans. If the Contractor elects to omit forms,

then any excavation or concrete placed beyond the pay limits indicated on the Plans shall not be paid for, but shall be at the Contractor's expense.

- C. No deduction will be made for the volume of concrete displaced by structural steel, reinforcing steel, pile heads, expansion joint material, drains, chamfers on corners, inset panels of 1½" or less in depth, pipes, weep holes and authorized openings for utilities of ¼ yd³ or less in volume, when any of these items occur in structural concrete which is to be paid for on a cubic yard basis.
- D. When the bottom of foundations for concrete structures is required to be at a definite elevation within rock excavation, as shown on the Plans or otherwise designated, the quantity to be measured will be the number of cubic yards of concrete actually and satisfactorily placed above a plane at 1 ft below the above specified plan elevation and within the neat lines of the structure as shown on the Plans or on authorized changes in the Plans. If the ledge rock is excavated below the plane at 1 ft below the plan elevation, without authorization, then this space shall be replaced with concrete of the same composition as required for the structure foundation but will not be measured for payment.
- E. For the purposes of making pay adjustments under Quality Level Analysis Method A or Method B, quantities of lots and sublots shall be determined as outlined under Section 502.1703 - Acceptance Methods A and B, and under Section 502.19 - Basis of Payment.
- F. Saw cut grooving of concrete wearing surfaces, complete and accepted, will be measured for payment as one lump sum.

502.19 ***Basis of Payment*** - The accepted work done under structural concrete, of the classes and for the types of work required, will be paid for at the Contract unit price per cubic yard, or at the Contract lump sum price, for the respective Contract items involved. Payment for both the unit price and the lump sum price items will be full compensation for furnishing and installing bridge drains, pier nose armor, water stops, expansion joint filler, PVC or plastic tube drains, asphalt roll roofing (roofing felt), asphalt for painting or covering various type of joints, all required sandblasting, high-pressure water cleaning, bonding, curing and joint sealing and all incidentals necessary to complete the work satisfactorily. No direct payment will be made for concrete admixtures.

No price adjustments will be made to the lump sum bid for the respective items that are bid lump sum, except when quantity changes are directed by the Department. It will be the responsibility of the Contractor to verify the estimated quantities prior to submitting bid documents.

Saw cut grooving of concrete wearing surfaces will be paid for at the Contract Lump Sum Price, which shall be payment for furnishing all materials, labor, and

equipment, including depth gauges and all incidentals, to satisfactorily complete the work. (Also see 535.24 and 535.25 for related changes.)

Payment for structural concrete culvert connection shall include drilling and grouting the dowels into the existing headwall and excavation. Reinforcing will be paid for under Pay Item 503.12 - Reinforcing Steel, Fabricated and Delivered and Pay Item 503.13 - Reinforcing Steel, Placing.

Reinforcing steel, railings, stone curbing and any material that may be required for bridge lighting systems, will be measured and paid for separately as provided in the appropriate sections.

Implementation of the QCP and costs associated with acceptance test sampling shall be incidental to related items.

All costs associated with obtaining, testing and evaluating drilled core specimens for dispute resolution will not be paid for directly, but will be considered incidental to related items.

Pay adjustments will be made only for cast-in-place concrete. Pay adjustments shall be computed on the actual final quantity for unit price items. Pay adjustments shall be computed on the estimated quantity for lump sum items, except when precast deck panels are used, or when quantity changes are directed by the Department. When precast deck panels are used, the precast deck panel quantity, as computed from the Working Drawings, shall be deducted from the estimated lump sum quantity to determine the new estimated quantity that will be used to compute pay adjustments. When Department-directed quantity changes are made, this quantity shall be added to, or subtracted from, the estimated lump sum quantity to determine the new estimated quantity that will be used to compute pay adjustments. When precast deck panels are used and Department-directed quantity changes are made under the same lump sum item, the combined quantity change shall be added to, or subtracted from, the estimated lump sum quantity to determine the new estimated lump sum quantity that will be used to compute pay adjustments. Pay adjustments will be made according to the formula in Section 502.194. P, the unit value for pay adjustment purposes, is specified in Special Provision Section 502 - Structural Concrete (QC/QA Acceptance Methods). P values, as specified in Special Provision Section 502, reflect the price per cubic yard for all pay adjustment purposes.

502.191 ***Pay Adjustment for Compressive Strength, Methods A and B*** - Pay factors (PF) for pay adjustments for compressive strength will be determined using the Quality Level Analysis as specified in Section 106.

502.192 ***Pay Adjustment for Permeability, Methods A and B*** - Pay factors (PF) for pay adjustments for Permeability will be determined using the Quality Level Analysis as specified in Section 106.

Values less than 10 KOhm-cms for Class A concrete or 11 KOhm-cms for Class LP concrete shall be subject to rejection and replacement, at no additional cost to the Department.

- 502.193 **Pay Adjustment for Air Content, Methods A and B** - Pay factors (PF) for pay adjustments for air content will be determined using the Quality Level Analysis as specified in Section 106.
- 502.194 **Pay Adjustments for Compressive Strength, Permeability and Air Content, Methods A and B** - The Composite Pay Factor (CPF) for each lot of concrete shall be computed as follows:
- $CPF = [(Compressive\ Strength\ PF - 1)(0.20)] + [(Air\ Content\ PF - 1)(0.40)]$
 - $+ [(Permeability\ PF - 1)(0.40)]$
 - The pay adjustment for each lot of concrete shall be computed as follows:
 - $Lot\ Pay\ Adjustment = P \times CPF \times Lot\ Size$
 - There will be no positive pay adjustments for Method B Concrete.
- 502.195 **Pay Adjustment Method C** - When the Department determines that Method C concrete which does not meet the specified limits may remain in place, payment will be reduced in accordance with Table 6. The quantity to which the pay reduction shall apply will be determined by the Resident. (See Table on next page.)

TABLE 6: METHOD C PAY REDUCTIONS*

Class LP	Class A	Class S	Class Fill
Compressive Strength {Strength Range in PSI and Pay Reduction per CY}			
4,750 to 4,999 (\$25)	3,900 to 3,999 (\$60)	2,900 to 2,999 (\$10)	2,900 to 2,999 (\$10)
4,500 to 4,749 (\$40)	3,800 to 3,899 (\$80)	2,800 to 2,899 (\$20)	2,800 to 2,899 (\$20)
4,250 to 4,499 (\$55)	3,700 to 3,799 (\$100)	2,700 to 2,799 (\$30)	2,700 to 2,799 (\$30)
4,000 to 4,249 (\$70)	3,600 to 3,699 (\$120)	2,600 to 2,699 (\$40)	2,600 to 2,699 (\$40)
< 4,000 (Removal)	< 3,600 (Removal)	2,500 to 2,599 (\$50)	2,500 to 2,599 (\$50)
		< 2,500 (Removal)	< 2,500 (Removal)
Surface Resistivity {Permeability in KOhm-cms and Pay Reduction per CY}			
15-16 (\$50)	13 (\$25)	N/A	N/A
13-14 (\$75)	12 (\$50)	N/A	N/A
12 (\$100)	11 (\$75)	N/A	N/A
11 (\$125)	10 (\$100)	N/A	N/A
< 11 (Removal)	< 10 (Removal)	N/A	N/A
Entrained Air {Air Range in Percent and Pay Reduction per CY}			
< 3.5 (Removal)	< 3.5 (Removal)	N/A	< 3.5 (Removal)
3.5 to 3.9 (\$100)	3.5 to 3.9 (\$100)	N/A	3.5 to 3.9 (\$20)
4.0 to 4.4 (\$75)	4.0 to 4.4 (\$75)	N/A	4.0 to 4.4 (\$15)
4.5 to 4.9 (\$50)	4.5 to 4.9 (\$50)	N/A	4.5 to 4.9 (\$10)
5.0 to 8.0 Acceptable	5.0 to 8.0 Acceptable	N/A	5.0 to 8.0 Acceptable
8.1 to 8.5 (\$25)	8.1 to 8.5 (\$25)	N/A	8.1 to 8.5 (\$10)
8.6 to 9.0 (\$50)	8.6 to 9.0 (\$50)	N/A	8.6 to 9.0 (\$15)
9.1 to 9.5 (\$75)	9.1 to 9.5 (\$75)	N/A	9.1 to 9.5 (\$20)
> 9.5 (Removal)	> 9.5 (Removal)	N/A	> 9.5 (Removal)
* All Ranges Are Inclusive			

Payment will be made under (Table continues on next page):

Pay Item		Pay Unit
502.21	Structural Concrete, Abutments and Retaining Walls	Cubic Yard
502.219	Structural Concrete, Abutments and Retaining Walls	Lump Sum
502.22	Structural Concrete, Abutments and Retaining Walls (placed under water)	Cubic Yard
502.229	Structural Concrete, Abutments and Retaining Walls (placed under water)	Lump Sum
502.23	Structural Concrete Piers	Cubic Yard
502.239	Structural Concrete Piers	Lump Sum
502.24	Structural Concrete Piers (placed under water)	Cubic Yard
502.249	Structural Concrete Piers (placed under water)	Lump Sum
502.25	Structural Concrete Superstructure Slab	Lump Sum
502.26	Structural Concrete Roadway and Sidewalk Slab on Steel Bridges	Lump Sum

502.261	Structural Concrete Roadway and Sidewalk Slab on Concrete Bridges	Lump Sum
502.27	Structural Concrete Superstructure T-beam Type	Lump Sum
502.28	Structural Concrete Rigid Frame Structures	Cubic Yard
502.289	Structural Concrete Rigid Frame Structures	Lump Sum
502.29	Structural Concrete Wearing Surface on Bridges	Lump Sum
502.291	Saw Cut Grooving	Lump Sum
502.30	Structural Concrete Box Culvert	Lump Sum
502.31	Structural Concrete Approach Slab	Lump Sum
502.32	Structural Concrete Culvert End wall	Cubic Yard
502.33	Structural Concrete Culvert End wall	Lump Sum
502.40	Structural Concrete Box Culvert	Cubic Yard
502.41	Structural Concrete Superstructure Slab	Cubic Yard
502.42	Structural Concrete Roadway and Sidewalk Slab on Steel Bridges	Cubic Yard
502.43	Structural Concrete Superstructure T-beam Type	Cubic Yard
502.44	Structural Concrete Wearing Surface on Bridges	Cubic Yard
502.45	Structural Concrete Approach Slab	Cubic Yard
502.46	Structural Concrete Culvert Connection	Cubic Yard
502.49	Structural Concrete Curbs and Sidewalks	Lump Sum
502.565	Concrete Fill	Cubic Yard

SECTION 503 - REINFORCING STEEL

503.01 **Description** - This work shall consist of furnishing and placing reinforcing steel bars (plain, galvanized, stainless, epoxy-coated, zinc and epoxy dual-coated, or low-carbon chromium), welded wire fabric and mechanical/welded reinforcing steel splices in accordance with these specifications and other applicable Contract Documents.

503.02 **Materials** - Materials shall meet the requirements of the following Sections of Division 700 - Materials:

Reinforcing Steel	709.01
Welded Steel Wire Fabric	709.02

503.03 **Schedule of Material** - When the Department does not furnish reinforcing steel schedules, the Contractor shall submit order lists, bending diagrams and bar layout drawings to the Resident for approval. The reinforcing steel shall not be ordered until these lists and drawings are approved. Approval shall not relieve the Contractor of full responsibility for the satisfactory completion of this item. When the Department allows the use of precast concrete deck panels, or any other significant changes that affect the quantity of reinforcing steel, the Contractor shall be responsible for revising the reinforcing steel schedule; the revised schedule shall be submitted to the Resident for approval.

503.04 **Protection of Material** - Reinforcement, either plain, galvanized, stainless, epoxy-coated, zinc and epoxy dual-coated, or low-carbon chromium, shall be stored on skids or other supports a minimum of 12" above the ground surface and protected at all times from damage and surface contamination. The storage supports shall be constructed of wood or other material that will not damage the surface of the reinforcement or epoxy coating. Bundles of bars shall be stored on supports in a single layer. Each bundle shall be placed on the supports out of contact with adjacent bundles. Coated and uncoated steel reinforcing bars should be stored separately.

Do not use carbon steel tools, chains, slings, etc. when fabricating or handling stainless steel reinforcing bars- use only nylon or polypropylene slings. Prior to shipping, ensure that all chains and steel bands will not come into direct contact with stainless steel reinforcing bars. Place wood or other soft materials (e.g., thick cardboard) under the tie-downs. Alternatively, use nylon or polypropylene straps to secure stainless steel reinforcing bars. When bundles of plain reinforcement steel and stainless steel reinforcing bars must be shipped one on top of the other, the stainless steel reinforcing bars should be loaded on top. Use wooden spacers to separate the two materials.

If it is expected that epoxy-coated or zinc and epoxy dual-coated bars will be required to be stored outdoors for a period in excess of 2 months, then they shall be protected from ultraviolet radiation.

503.05 **Fabrication** - Bending of reinforcing bars and tolerances for bending of reinforcing bars shall be in conformance with the latest edition of the "Manual of Standard Practice of the Concrete Reinforcing Steel Institute" and the "Detailing Manual of the American Concrete Institute." Unless otherwise specifically authorized, bars shall be bent cold.

503.051 **Epoxy Coating** - Reinforcing steel, specified on the design drawings to be epoxy coated or zinc and epoxy dual-coated, shall meet the requirements of AASHTO M 284 (ASTM A775), Epoxy-Coated Steel Reinforcing Bars, or ASTM A1055, Zinc and Epoxy Dual-Coated Steel Reinforcing Bars as applicable and the following requirements:

- a. The Contractor shall furnish a written certification that, at the point of application of the coating and at the reinforcing steel fabrication shop, the coating, the coated bars, and the handling and packaging of the coated bars, meet all the requirements specified in Section 5.2.1 and Section 15.1 of AASHTO M 284 (ASTM A775), or 5.3.2 and 15.1 of ASTM A1055 as applicable, and Section 503.053 of these specifications.
- b. Patching material as specified in Section 5.4 of AASHTO M 284 (ASTM A775) shall be supplied for both shop and field patching of epoxy-coated and dual-coated reinforcing steel.

The patching material shall be supplied as required, but at not less than the following rates:

- #3 to #5 bars: 1 quart/15,000 ft of bar, or fraction thereof
 - #6 to #9 bars: 1 quart/8,000 ft of bar, or fraction thereof
 - #10 and up: 1 quart/6,000 ft of bar, or fraction thereof
- c. All testing shall be as specified in AASHTO M 284 (ASTM A775) or ASTM A1055 as applicable, except that the frequency of testing for adhesion of the coating shall be two bars of each size out of all bars coated with each individual batch or lot of epoxy resin, or two bars of each size out of all bars coated in an 8 hour period, whichever is greater.
- d. If a reinforcing bar fabrication shop uses previously stockpiled bars to supply the requirements of this Contract, the fabrication shop shall furnish copies of all certificates required to be furnished by the coating applicator under a., above. The certificates furnished shall be directly traceable to the actual bars used through batch numbers, order numbers or similar information. If such certification is not available, the Department reserves the right to perform the tests specified under AASHTO M 284 (ASTM A775) or ASTM A1055 as applicable, at the expense of the Contractor. For bars supplied from stock, the fabrication shop shall supply all patching material specified under b., above.
- e. The Contractor shall notify the Resident at least 1 week prior to the start of any coating application, so that the Resident, or their designated representative, may be present at the beginning of the application of the coating.

503.052 **Patching of Epoxy Coating** - Patching required at the point of application of the epoxy coating shall be done in conformance with the requirements of AASHTO M 284 (ASTM A775). All patching related guidelines in ASTM A775 or A1055, Section X1, Guidelines for Job-Site Practices, shall be considered mandatory.

At the reinforcing steel fabrication shop and at the job site, all nicks, cuts, scratches, cracks, abrasions, sheared ends etc., visible to the naked eye, shall be repaired using patching material supplied as specified under Section 503.051 b. To the greatest extent possible, repairs to each Day's production at the fabrication shop and each Day's placement at the job site shall be done before the end of each Working Day. If damaged areas do become rusted or contaminated with foreign matter, then these areas shall be cleaned by

sandblasting, or an equally effective method, such that all visible rust and/or foreign matter is removed prior to patching.

- 503.053 **Zinc Coating** - Reinforcing steel, specified on the design drawings to be zinc-coated (galvanized) shall meet the requirements of ASTM A767, Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement. Bars shall have a Class 1 coating per ASTM A767 and shall be galvanized after fabrication. Bending of galvanized bars in the field shall not be allowed unless approved by the Resident. Damage to the zinc coating as a result of field-bending shall be repaired in accordance with Section 9 of ASTM A767.

The Contractor shall furnish a written certification from the galvanizer that the material was manufactured and tested in accordance with ASTM A767, together with the report of the test results, at the time of shipment.

- 503.054 **Packaging and Handling of Epoxy-Coated and Zinc-Coated (Galvanized) Bars** - All handling of epoxy-coated, dual-coated, and galvanized reinforcing bars by mechanical means shall be done by equipment having padded contact areas, or by the use of nylon webbing slings. The use of chains or wire rope slings shall not be allowed, even when used with padding. All bundles of coated bars shall be lifted with a strong-back, spreader bar, multiple supports or a platform bridge to prevent bar-to-bar abrasion from sags in the bundles. Support points during lifting or transporting of bundled coated bars shall be spaced at a maximum of 15 ft.

Bundled bars shall be strapped together with non-metallic or padded straps in a manner to prevent bar-to-bar abrasion due to relative movement between bars.

Bars loaded for transport shall be loaded and strapped down in a manner that will prevent damage from motion and vibration, to the greatest extent possible. Bundles of bent bars shall be transported strapped to wooden platforms or shall be crated. All individual bundles and layers of bundles shall be separated, and supported by dunnage.

Individual bars shall be handled in a manner that prevents damage to the coating due to abrasion or impact, and at no time shall any bar be moved by dragging over any surface, including other reinforcing bars. Sufficient personnel shall be assigned to assure that there is compliance with the above.

All packaging and handling related guidelines in ASTM A775, A1055, or A767, Section X1, Guidelines for Job-Site Practices, shall be considered mandatory where not already covered by this specification.

503.06 **Placing and Fastening** - All steel reinforcement shall be accurately placed in the positions shown on the Plans and shall be firmly held there during the placing and setting of the concrete. Immediately before placing concrete, steel reinforcement shall be free from all foreign material, which could decrease the bond between the steel and concrete. Such foreign material shall include, but not be limited to, dirt, loose mill scale, excessive rust, paint, oil, bitumen and dried concrete mortar.

Bars shall be fastened together at all intersections except where spacing is less than 1 ft in either direction, in which case, fastening at alternate intersections of each bar with other bars will be permitted, providing this will hold all the bars securely in position. This fastening may be done using tightly twisted wire or by welding, when permitted by the Fabrication Engineer. All welding shall be done in accordance with this specification. Welders must be qualified by passing qualification tests for the process and position to be used in accordance with AWS D1.4 Structural Welding Code – Reinforcing Steel. Welding shall only be done when performed in accordance with a welding procedure approved by the Fabrication Engineer. Weld area preheat shall comply with AWS D1.4. Weld areas shall be free of cracks, undercut or other deficiencies injurious to the reinforcing steel. Welds are not permitted within two bar diameters of a bend, if the bend radius is less than 16 bar diameters. Welds must comply with testing and sampling requirements in the Fabrication and Mechanical Properties sections of AASHTO M 54 (ASTM A184). Welds shall be able to withstand a static load of 150 lb applied perpendicular to the reinforcing grid. Tension specimens must meet the material requirements of the type bar used when tested with a welded joint approximately at the center of the specimen. Frequency of testing shall be for every 75,000 square feet, or fraction thereof, of reinforcing grid fastened by welding. No welding for fastening or supporting reinforcing steel in areas of high tensile stresses will be permitted. Welding on epoxy-coated or dual-coated reinforcing steel will not be permitted under any condition.

In general, no welding will be permitted on the main reinforcing steel of superstructures.

Proper distances from the forms shall be maintained by means of chairs, stays, blocks, ties, hangers or other approved means. Chairs used for this purpose shall be plastic, plastic coated, epoxy coated or plastic tipped. Where stainless steel reinforcement is specified, the plastic tipped chairs shall be made of stainless steel conforming to the requirements of ASTM A493, Type 316 or 316L. Blocks used for this purpose shall be precast Portland Cement mortar blocks of approved shape and dimensions. Blocks shall not be used in cases where the blocks will be visible in the finished product. Layers of bars may be separated by precast Portland Cement mortar blocks or other approved devices. The use of pebbles, pieces of broken stone or brick, metal pipe or wooden blocks shall not be permitted. The placing of reinforcement as concrete placement progresses, without definite and secure means of holding the steel in its correct position,

shall not be permitted except in the case of welded steel wire fabric or reinforcing bar grids.

Epoxy-coated, dual-coated, or galvanized reinforcing bars supported on formwork shall rest on coated wire bar supports, or on bar supports made of dielectric material or other acceptable materials. Wire bar supports shall be coated with dielectric material for a minimum distance of 2" from the point of contact with the reinforcing bars. Reinforcing bars used as support bars shall be epoxy-coated or zinc-coated as applicable. In walls, spreader bars shall be epoxy-coated or zinc-coated as applicable.

Tie wire for epoxy-coated, zinc and epoxy dual-coated, galvanized, stainless, or low-carbon chromium reinforcing steel shall be soft annealed wire that has been nylon, epoxy or plastic coated. Tie wire for stainless steel reinforcement may also be uncoated stainless steel conforming to the requirements of ASTM A493, Type 316 or 316L. 16 gauge (or heavier) black-annealed ferrous metal wire may also be used for low-carbon chromium or plain reinforcement.

When formwork for casting concrete is made of uncoated steel or stainless steel, the use of galvanized steel reinforcing bars shall require an electrical isolation of the formwork from the galvanized reinforcement. The Contractor is referred to Section X2 of ASTM A767, Guidelines for Use of Galvanized Reinforcing Bars with Non-Galvanized Steel Formwork, for more information.

Field bending or cutting of epoxy-coated or dual-coated reinforcing bars will not be allowed, unless otherwise indicated on the Plans or permitted by the Resident. When field bending or cutting is allowed, all damaged coating areas shall be repaired in accordance with the patching requirements, Section 503.052. All placing and fastening related guidelines in ASTM A775 or A1055, Section X1, Guidelines for Job-Site Practices, shall be considered mandatory where not already covered by this specification.

Bars in bridge seats shall be placed so as to clear anchor bolts.

When specified on the Plans, reinforcing steel shall be anchored into drilled holes.

The anchoring material shall be one of the products listed on the Maine Department of Transportation's Qualified Products List, Epoxy and Resin Based Adhesive Bonding Systems. Installation shall be in accordance with the manufacturer's published recommendations.

At each anchor location, existing reinforcing shall be located to avoid drilling through existing bars. Where interferences are found to exist, location adjustments will be determined by the Resident.

Minimum embedment lengths of reinforcing bars shall comply with the manufacturer's published recommendations for the anchoring material selected. These embedment lengths shall be verified by the Resident before installation of the reinforcing bars. The reinforcing steel lengths indicated on the

Plans may be reduced, at the Contractor's option, to the determined minimum embedment lengths.

Reinforcement shall be inspected and approved by the Resident before any concrete is placed.

- 503.07 **Splicing** - Reinforcing bars shall be spliced in accordance with the requirements of this section, and in the locations shown on the Plans. No modifications of, or additions to, the splice arrangements shown on the Plans shall be made without the Resident's prior approval. Any additional splices authorized shall be staggered as much as possible. All splices shall be made in a manner that will ensure that not less than 75% of the clear concrete cover and not less than 75% of the minimum clear distance to other bars will be maintained, as compared to the cover and clear distance requirements for the unspliced bar.

Lapped splices shall be made by placing the bars in contact and wiring them together. Splice laps shall be made in accordance with the following table, unless otherwise noted on the Plans:

US CUSTOMARY UNITS									
Minimum Lap Splice Length (inches)									
Bar Type	Bar Size								
	#3	#4	#5	#6	#7	#8	#9	#10	#11
Plain or Galvanized	16	20	24	29	38	47	59	72	85
Epoxy or Dual Coated	17	24	36	43	56	71	88	107	128
Stainless	19	24	30	36	47	59	73	89	107
Low-carbon Chromium	24	32	39	47	63	78	97	119	142

The minimum lap splice lengths in the table above are based on the parameters below. When any of these parameters are altered, appropriate minimum lap splice lengths will be as shown on the Plans.

- Normal weight concrete
- Minimum 28 Day concrete compressive strength from 4,000 psi to 10,000 psi
- Class B tension lap splice
- Minimum center-to-center spacing between bars of 6"
- Minimum clear cover of 2"
- Nominal reinforcing steel yield strengths
 - Low-carbon Chromium = 100 ksi
 - Stainless = 75 ksi
 - All others = 60 ksi
- Reinforcement with yield strengths greater than 75 ksi shall have beam transverse reinforcement and column ties provided over the required lap splice length in accordance with the current edition of the AASHTO LRFD Bridge Design Specifications

When lap splices are placed horizontally in an element where the concrete depth below the splice will be 12", or more, the indicated lap splice lengths shall be multiplied by a factor of 1.3.

Mechanical couplers may be used for splicing reinforcing bars, provided they are approved by the Resident and conform to the following requirements:

- a. **Tension Couplers** - Couplers shall be able to develop 1.25 times the theoretical yield strength of the spliced bar in tension. Bolted and wedge-lock type couplers will not be allowed.
- b. **Compression Couplers** - Couplers shall be capable of maintaining the spliced bars in alignment prior to and during concrete placement. For reinforcing bars designed to act in compression, the individual bar ends shall be within 1½° of being "square" to the final 12" of the bar. Additionally, abutting bar ends shall be in contact, and the angle of the gap between abutting bar ends shall be 3°, or less.
- c. **Mechanical Couplers** - Any mechanical couplers using a threaded splicer and dowel in combination, requiring a lapped splice with the reinforcing bars, shall have a minimum lap splice length as required by this Section.

Welded splices may be made by the "Thermit" process or, with the approval of the Resident, by the shielded metal arc welding process or the self-shielded flux-core arc welding process. The latter two processes shall be used in strict conformance with the requirements of the latest edition of AWS D1.4 "Structural Welding Code - Welding Reinforcing Steel" and any applicable provisions of Section 504 - Structural Steel. The Contractor shall submit complete details of their proposed method of making welded splices for the Resident's approval at least 10 Days prior to use.

503.08 **Lapping** - Sections of welded steel wire fabric shall be securely fastened to adjoining sections and overlapped. All laps for wire sizes D4 through D20 shall be 14".

Reinforcing bar grids shall be spliced as required for the individual bars, per the table in Section 503.07 - Splicing.

503.09 **Substitution** - Substitution of different size bars shall not be permitted except with the written authorization of the Resident.

503.10 **Method of Measurement** - Reinforcing steel bars, either plain, galvanized, stainless, epoxy-coated, zinc and epoxy dual-coated, or low-carbon chromium, shall be measured by the computed number of pounds or by the lump sum, of steel reinforcement authorized, as indicated in the Contract. Welded steel wire fabric shall be measured by the computed number of pounds or by the lump sum of fabric authorized, as indicated in the Contract. Splices made using mechanical devices or by welding, as shown on the Plans or required by the specifications, will be measured as the number of splices of each kind satisfactorily made and accepted.

Weights will be computed in accordance with the following:

- For steel bars, either plain, galvanized, stainless, epoxy-coated, zinc and epoxy dual-coated, or low-carbon chromium, weights will be computed in accordance with the following table:

US CUSTOMARY UNITS

Pounds per Foot									
Bar Size	#3	#4	#5	#6	#7	#8	#9	#10	#11
Weight	0.376	0.668	1.043	1.502	2.044	2.67	3.4	4.303	5.313

For welded steel wire fabric, weights will be computed in accordance with the following table:

US CUSTOMARY UNITS

Size in inches	6 by 6	3 by 6	4 by 4	6 by 6
Gauge	W1.4 by W1.4	W1.4 by W1.4	W1.4 by W1.4	W2.9 by W2.9
Weight (lb/100 ft ²)	21	30	31	42

- For other sizes of fabric, the commercially recognized weights will be used.
- No addition to, or deduction from, the theoretical weight per foot of the uncoated bars will be made because of additional requirements for blast cleaning and epoxy, zinc, or dual-coating of the bars.
- Lapped splices and splices made using mechanical devices or by welding, that are authorized at the Contractor's request, will not be measured for payment.

503.11 **Basis of Payment** - The accepted quantity of reinforcing steel, either plain, stainless or low carbon chromium, will be paid for at the Contract unit price per pound or by the lump sum, for each item involved, complete, and accepted.

The accepted quantity of epoxy-coated, galvanized or zinc and epoxy dual-coated reinforcing steel will be paid for at the Contract unit price per pound or by the lump sum, for each item involved, complete and accepted, and all additional expenses that may be incurred by the Contractor or their suppliers as a result of the requirements in these specifications will be considered incidental to, and included in, the Contract unit price per pound or lump sum price.

When reinforcing steel schedules are required, they shall be considered incidental to the related Contract items. Payment for work associated with revisions to the reinforcing steel schedule, required when the Department allows the use of precast concrete deck panels, or any other significant changes that affect the quantity of reinforcing steel, shall be considered incidental to related Contract items.

The accepted quantity of welded steel wire fabric will be paid for at the Contract unit price per pound or by the lump sum, in place, complete and accepted.

The accepted quantity of mechanical and/or welded splices will be paid for at the Contract unit price each, complete and accepted, for each type specified.

Payment will not be made for any materials used to hold reinforcement in place or for extra weight due to substitutions and splices made for the Contractor's convenience.

When reinforcing steel is specified to be anchored into drilled holes, no additional payment will be made for drilling and anchoring reinforcing steel or cutting of reinforcing steel to embedment lengths.

Payment for additional material samples, as required for testing by the Department, shall be considered incidental to related Contract items.

Payment will be made under (Table continues on next page):

Pay Item		Pay Unit
503.12	Reinforcing Steel, Fabricated and Delivered	Pound
503.121	Reinforcing Steel, Fabricated and Delivered	Lump Sum
503.13	Reinforcing Steel, Placing	Pound
503.131	Reinforcing Steel, Placing	Lump Sum
503.14	Epoxy-Coated Reinforcing Steel, Fabricated and Delivered	Pound
503.141	Epoxy-Coated Reinforcing Steel, Fabricated and Delivered	Lump Sum
503.15	Epoxy-Coated Reinforcing Steel, Placing	Pound
503.151	Epoxy-Coated Reinforcing Steel, Placing	Lump Sum
503.16	Welded Steel Wire Fabric, Complete in place	Pound
503.161	Welded Steel Wire Fabric, Complete in place	Lump Sum
503.17	Mechanical/Welded Splice	Each
503.19	Low-Carbon Chromium Reinforcement, Fabricated and Delivered	Pound
503.191	Low-Carbon Chromium Reinforcement, Fabricated and Delivered	Lump Sum
503.20	Low-Carbon Chromium Reinforcement, Placing	Pound
503.201	Low-Carbon Chromium Reinforcement, Placing	Lump Sum
503.22	Zinc-Coated (Galvanized) Reinforcing Steel, Fabricated and Delivered	Pound
503.221	Zinc-Coated (Galvanized) Reinforcing Steel, Fabricated and Delivered	Lump Sum
503.23	Zinc-Coated (Galvanized) Reinforcing Steel, Placing	Pound
503.231	Zinc-Coated (Galvanized) Reinforcing Steel, Placing	Lump Sum
503.26	Stainless Steel Reinforcement, Fabricated and Delivered	Pound

503.261	Stainless Steel Reinforcement, Fabricated and Delivered	Lump Sum
503.27	Stainless Steel Reinforcement, Placing	Pound
503.271	Stainless Steel Reinforcement, Placing	Lump Sum
503.28	Zinc and Epoxy Dual-Coated Reinforcing Steel, Fabricated and Delivered	Pound
503.281	Zinc and Epoxy Dual-Coated Reinforcing Steel, Fabricated and Delivered	Lump Sum
503.29	Zinc and Epoxy Dual-Coated Reinforcing Steel, Placing	Pound
503.291	Zinc and Epoxy Dual-Coated Reinforcing Steel, Placing	Lump Sum

SECTION 504 - STRUCTURAL STEEL

GENERAL REQUIREMENTS

- 504.01 **Description** - This work shall consist of detailing, fabricating and erecting structural steel bridges, ancillary bridge products and other steel structures. Materials, workmanship, inspection and documentation not specifically addressed by this Specification shall be done be in accordance with the applicable sections of the AASHTO/AWS D 1.5 Bridge Welding Code including Commentary (the D 1.5 Code), the AASHTO Guide Specification For Highway Bridge Fabrication with HPS 70W (HPS 485W) STEEL (the Fab Guide) and other Standards and Specifications referenced herein. The edition governing the work shall be the edition in effect on the date that the Contract was awarded.

All requirements in this Specification are the responsibility of the Contractor unless noted otherwise.

- 504.02 **Materials** - Materials shall meet the requirements of the following sections of Division 700 - Materials:

Structural Steel	713.01
Heavy-Hex Structural Bolts, Washers, Nuts and DTI's	713.02
Pre-formed Pads	713.03
Bronze or Copper-Alloy Bearing and Expansion Plates	713.04
Cold-Finished Carbon Steel Shafting	713.05
Castings	713.06

Note: The Department maintains a list of pre-approved welding consumables that the Contractor may use without furnishing Certificates of Conformance from the electrode/consumable manufacturer. This list is available on the Department's Qualified Products List of Electrodes for Field Welding.

- 504.03 **Drawings** - Prepare shop detail, erection and other necessary drawings in accordance with Section 105.7 – Working Drawings. Show nondestructive examination symbols on the Shop Drawings. Include a fastener assembly table showing the number, size, length location and number of all bolts. Procedure Qualification Records (PQR) and Weld Procedure Specifications (WSP) are part of the shop drawing submittal. Weld Procedure Specifications that have been previously reviewed by the Department and are in conformance with the D1.5 Code need not be re-submitted. The drawings will be reviewed in accordance with the applicable requirements of Section 105.7 of the Standard Specifications, the AASHTO/NSBA Shop Detail Drawing Review/Approval Guidelines, G1.1 and this Specification. Review times will be in accordance with Section 105.7.2 of the Standard Specifications.
- 504.04 **Facility Requirements** - Fabricate structural steel in a facility holding a current AISC certification as follows (see Table on next page):

Type of Product	Type of Certification Required ^{1,2,3,4}
Simple Bridges: • Unspliced Rolled Sections • Structural Steel Repair Items (excluding replacement girders)	AISC Certified Bridge Fabricator – Simple (SBR)
Intermediate Bridges: Examples: 1. Rolled beams w/ field or shop splice(s), straight or with radius >500 ft. 2. Welded plate girder with constant web depth, with or without splices, straight or with radius >500 ft. 3. Welded plate girder with variable depth webs, straight or with radius >1,000 ft. 4. Trusses 200 ft or less in length, either entirely or substantially preassembled at the certified facility and shipped in no more than three subassemblies.	AISC Certified Bridge Fabricator – Intermediate (IBR)
Advanced Bridges: Examples: 1. Structures that include the use of High Performance Steel (HPS) 2. Tub or trapezoidal box girders 3. Closed box girders 4. Large or non-preassembled trusses 5. Arches 6. Bascule bridges 7. Cable-supported bridges 8. Movable bridges 9. Bridges with tight curve radii	AISC Certified Bridge Fabricator – Advanced (ABR)
Ancillary Products (as defined in Section 713.01) and Support Structures (as defined in Section 504.58)	AISC Certified Bridge Fabricators – Simple (SBR) or AISC Bridge and Highway Component Manufacturer (CPT)
¹ Application of protective coatings requires a Complex Coating Endorsement “CCEP” endorsement or AMPP QP3 Certification. ² Fracture Critical fabrication requires a Fracture Control “F” Endorsement “FCE”. ³ All materials fabricated in a non-certified shop will be rejected. ⁴ Work shall not be Subcontracted to a non-certified facility, except that machining operations (i.e., cutting, drilling, milling) may be performed in non-certified facilities, with written approval by the Fabrication Engineer.	

504.05 **Notice of Beginning Work** - Provide the Fabrication Engineer with a minimum of 2 weeks notice for in-state work and 3 weeks notice for out-of-state work prior to beginning production. Provide the Fabrication Engineer with a copy of the production schedule. If the production schedule changes, notify the Fabrication Engineer no less than 3 Working Days prior to the initial start-up date. If work is suspended on a Project, the Fabrication Engineer will require 72 hours' notice prior to the resumption of work. Any work done without the Quality Assurance Inspector (QAI) present will be subject to rejection.

504.06 **Fabrication Inspection Quality Control (QC)** - is the responsibility of the Contractor and shall be performed as required by the D1.5 code. Inspect all aspects of the work and supervise all nondestructive testing (NDT). Record measurements and test results in a clear and legible manner. Reject materials and workmanship that do not meet Contract requirements. The Contractor may perform NDT in addition to the minimum required. Provide a copy of all measurements and testing to the QAI.

Quality Assurance (QA) - is the prerogative of the Department. The QAI will ensure that the QC Department is performing properly, verify documentation, periodically inspect workmanship and witness NDT. The QAI will schedule testing deemed necessary by the Fabrication Engineer in addition to the minimum testing requirements in a manner that minimizes interference with the production schedule.

504.061 Fabrication Inspection Personnel

- A. QC Inspector shall be qualified in accordance with the D1.5 code, as follows:
 - (1) The Inspector shall be an AWS Certified Welding Inspector (CWI) qualified and certified in conformance with the provisions of AWS QC1, Specification for AWS Certification of Welding Inspectors, or
 - (2) The Inspector shall be qualified by the Canadian Welding Bureau (CWB) to the Level II or Level III requirements of the Canadian Standard Association (CSA) standard W178.2, Certification of welding inspectors, or
 - (3) Upon written request to the Fabrication Engineer, the Contractor may request approval to use an Inspector who, by training and experience in metals fabrication, inspection and testing, is found to be equivalent to either (1) or (2).
- B. NDT Technician/Inspector shall be qualified in accordance with the D1.5 code, as follows:
 - (1) Personnel performing NDT, other than visual examination, shall be certified in conformance with the

American Society for Nondestructive Testing's (ASNT) Recommended Practice No. SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.

Individuals who perform NDT shall be certified as:

- a. NDT Level II, or
- b. NDT Level I working under the direct supervision of an individual qualified for NDT Level II or NDT Level III.
- c. NDT Level III and qualified per ASNT SNT-TC-1A as a Level II for NDT performed.

504.07 **Inspector's Authority** - The QAI has the authority to reject material or workmanship that does not meet the Contract requirements. The acceptance of material or workmanship by the QAI will not prevent subsequent rejection if the work or material is found unacceptable.

504.08 **Rejections** - Correct or replace rejected material and/or workmanship. Generate a non-conformance report (NCR). Provide a copy to the QAI and forward a copy to the Fabrication Engineer for review and comments. Structural Defects: Repair structural defects only with the approval of the Fabrication Engineer. Submit a nonconformance report (NCR) to the Fabrication Engineer with a proposed repair procedure. Do not perform structural repairs without an NCR that has been reviewed by the Fabrication Engineer. Give the QAI adequate notice prior to beginning structural repairs.

In the event that an item fabricated under this Specification does not meet the Contract requirements but is deemed suitable for use by the Department, said item may be accepted in accordance with Section 100 of the Standard Specifications (see 106.8) - Non-Conforming Work.

504.09 **Facilities for Fabrication Inspection** - Provide a private office at the fabrication plant for QA personnel. The office shall be in close proximity to the work. The office shall be climate controlled to maintain the temperature between 68°F and 75°F and have the exit(s) closed by a door(s) equipped with a lock and two keys which shall be furnished to the QAI (s).

The QAIs' office shall meet the following minimum requirements (see Table on next page):

Description	Quantity
Office area (minimum ft ²)	100
Drafting Table Surface (ft ²)	35
Drafting stools-each	1
Office Desk	1
Ergonomic Swivel Chairs	1 per inspector
Folding Chairs	2
High-speed internet connection (ports) or wireless	1 per inspector
Fluorescent Lighting of 100 foot-candles minimum for all work areas	2
110 Volt 60 Cycle Electric Wall Outlets	3
Wall Closet	1
Waste Basket with trash bags	1
Water Cooler	1
Broom	1
Dustpan	1
Cleaning Materials-floor, surfaces, windows -	duration of the Project
Folding Chairs	2
High-speed internet connection (ports) or wireless	1 per inspector

- The Contractor is responsible for disposing of trash and supplying commercially bottled water for the water cooler.
- The QAI will have the option to reject any furniture or supplies provided to the Inspector's Office based on general condition.
- Provide parking spaces for QA personnel in close proximity to the QAIs' Office. Maintain the pathway between the parking area and the QAIs' office so that it is free of obstacles, debris, snow and ice.
- The facilities and all furnishings shall remain the property of the Contractor upon completion of the work. Payment for the facilities, heating, lighting, telephone installation, internet connection, basic monthly telephone and internet charges and all furnishings shall be incidental to the Contract.
- Failure to comply with the above requirements will be considered denial of access to work for the purpose of inspection. The Department will reject all work done when access for inspection is denied.

504.10 **Mill Test Reports** - Provide legible Certified Mill Test Reports (CMTRs) for all steel and iron material. Provide the CMTRs prior to fabrication. If the Contractor begins fabrication, including cutting material, before the QAI has verified the CMTRs and mill markings, the material will be rejected.

Furnish Certified Mill Test Reports for fasteners. The supplier shall perform a Rotational Capacity Test (RCT) for both plain and galvanized bolts in accordance

with AASHTO M 164M/M 164 (ASTM A325) for each combination of bolts, nuts and washers supplied. Each combination shall be assigned a unique Rotational Capacity (R-C) lot number.

- 504.11 **Material Identification and Control** - Mark steel plates and shapes as specified in AASHTO M 160 (ASTM A6). Only use material from stock if it can be positively identified, properly documented and the direction of rolling can be determined.

Store material and fabricated items off the ground. Protect the material and fabricated items from dirt, grease, other foreign materials and significant corrosion.

Store fasteners in a protected environment. Provide four fastener assemblies for each lot, length and combination to the Fabrication Engineer for testing. A fastener assembly consists of a bolt, washer, nut and direct tension indicator (when required). Provide the fastener samples to the Fabrication Engineer immediately upon delivery to the fabrication shop or job site.

Provide Certificates of Conformance for welding consumables that are not on the Department's pre-approved electrode list.

- 504.12 **Protective Coatings** - If paint is specified, apply the coating in accordance with Section 506 of the Standard Specifications or Special Provision 506 as applicable.

When galvanizing is specified, clean the steel in accordance with SSPC-SP 6 prior to galvanizing. Galvanize in accordance with AASHTO M 111 (ASTM A123). Galvanize fasteners in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695, Class 50, Type I. Galvanized nuts shall be lubricated with a water-soluble lubricant containing a dye that contrasts with the color of the galvanizing.

- 504.13 **Unpainted Steel** - Clean all surfaces to a minimum SSPC-SP 6, Commercial Blast Cleaning. Steel may be abrasive-blast cleaned prior to fabrication. Clean steel that is abrasive cleaned prior to fabrication in accordance with SSPC-SP 6 shall be cleaned in accordance with SSPC-SP 1 Solvent Cleaning after fabrication is complete. Disassemble bolted field splices and solvent clean all faying surfaces in accordance with SSPC-SP 1 Solvent Cleaning after drilling or reaming is complete. Inspect the splices prior to re-assembly.

HIGHWAY BRIDGE FABRICATION

- 504.14 **Materials for Bridges** - The grade of steel is designated on the Plans. Do not substitute material without the approval of the Fabrication Engineer.

- 504.15 **Handling Material** - Handle material in a manner that prevents nicks, gouges or other damage from chains, wire ropes or other handling devices during all phases of fabrication.

- 504.16 **Plates for Fabricated Members** - Cut plates subject to calculated stress, including splice plates, so that the direction of rolling is parallel to the primary stresses. The direction of primary stresses for web and field splice material is parallel to the flanges unless otherwise shown. Transfer heat numbers to each primary member used in fabrication. Primary members include flanges, webs, splice plates, bearing stiffeners, connection plates and diaphragm material on curved bridges.
- 504.17 **Correcting Materials** - Correct material by a method that does not damage the material. If heating of the steel is required, submit a written procedure to the Fabrication Engineer for review. Do not use external force in conjunction with heating unless authorized in the procedure. Following corrective work, inspect the steel with nondestructive testing methods acceptable to the Fabrication Engineer. The presence of cracks or fractures will be cause for rejection of the material.
- 504.18 **Base Metal Repairs** - Make base metal repairs in accordance with the D1.5 Code. Submit an NCR to the Fabrication Engineer for review if the repair area exceeds the allowable limits for base metal repairs as specified in the D1.5 Code. Notify the QAI prior to beginning the repairs.
- 504.19 **Thermal Cutting** - Thermal cut steel using automatic equipment or a mechanical guide. Adjust the rate of travel of the cutting equipment to prevent hardening the steel. Do not cut material freehand.
- 504.20 **Edge Hardness** - Edge Hardness testing is not required.
- 504.21 **Edge Planing** - Plane sheared edges of plates greater than 5/8" thick to a depth of 3/16".
- 504.22 **Bent Plates** - Cold-bend rolled steel plates in accordance with the AASHTO/NSBA S 2.1 Steel Bridge Fabrication Guide Specifications, Table 4.2 and the following:
- (a) The bend line will be at right angles to the direction of rolling.
 - (b) The radius of bends shall be such that no cracking of the plate occurs. Measure the radii at the concave surface as follows (see Table on next page):

MATERIAL		Radius in terms of plate thickness (inches)*		
ASTM Specification	Grade	T<1	1<t<2	2<t
ASTM A709	Gr. 36	1.5t	1.5t	2.0t
ASTM A709	Gr. 50, Gr.50W	1.5t	2.0t	2.5t
ASTM A709	Gr. 70W	1.5t	2.5t	3.0t
* A radius of 5t is required if the plate is subject to calculated stresses				

- (c) If a smaller radius is required, heat the bend line to a temperature between 1000°F and 1150°F before bending. Heat plates greater than 2" in

thickness to a temperature of between 900°F and 1150°F before bending.
Do not heat HPS70W without written approval of the Fabrication Engineer.

- 504.23 **Die Stamping** - Die stamp primary members (including splice material, diaphragms and cross frames on curved bridges) in no-stress locations. No-stress locations include the ends of girders within the cross-sectional area, web splice plates in the middle third of the plate height and outside the outermost row of bolt holes and flange splice plate ends between the outermost row of holes and the edge. Use blunt-nose, low-stress dies.
- 504.24 **Camber and Curvature** - When camber or curvature is required for stringers or girders, it will be specified on the Plans. Measure and record specified camber or curvature using the same ordinates shown on the Plans after all welding is complete. When no camber or curvature is specified, variations in straightness of rolled shapes, with and without cover plates, shall not exceed the tolerances of AASHTO M 160 (ASTM A6).
- 504.25 **Heat Cambering and Curving** - Minor correction of camber or sweep of welded plate girders is considered part of ordinary shop fabrication practice and does not require an approved procedure, however, use the following guidelines:
1. Notify the QAI prior to beginning heat correction
 2. Do not use hammers
 3. Have suitable temperature indicating crayons at the work station
 4. Do not exceed 1150°F
 5. Cool in still air to 600°F. Below 600°F compressed air may be used

All cambering and curving operations that are not corrective shall meet the following:

- Use a camber/curving procedure reviewed by the Fabrication Engineer. The procedure shall include:
 1. The heating pattern and sequencing of heating
 2. Method of support of the member
 3. Proposed minimum and maximum base metal temperature
 4. Method of heating (fuel, nozzle size, etc.)

Clean structural steel to SSPC SP-6 prior to heating. Heat both the flanges and the web using two torches (one torch on either side of the plate). Do not use restraint or jacking devices unless approved by the Fabrication Engineer. Submit calculations showing that the nominal bending stress in the member does not exceed 0.60 F_y if restraint or jacking is proposed.

The target temperature for all ASTM A709 steel is 1100°F. Steel heated in excess of 1200°F will be subject to rejection. Measure the temperature of the steel with temperature indicating crayons applied to the heated area 10-15 seconds after the torch is removed or with a pyrometer that has been calibrated within the past year. Provide temperature-indicating crayons in increments of 50°F between

1050°F and 1250°F to each torch operator. Stop the cambering/curving operation if a torch operator fails to demonstrate the proper skill and technique necessary to prevent potential damage to the steel.

Camber stringers and girders using a “V” pattern with a 10-15° included angle that extends the full web depth, less 2" at the apex. Heat the web first beginning at the apex of the triangle and proceeding toward the base. Begin heating the flange immediately after completion of the web.

The Contractor may curve stringers and girders using a combination of line heats applied to the edge of both flanges simultaneously with automatic track torches and “V” heats. “V” heats shall have an included angle of 15-30° and a minimum height of 65% of the flange width. Apply heat to adjacent areas on both flanges simultaneously.

Perform all cambering and curving in the presence of the QAI. Heating a structural member without the QAI present shall be cause for rejection of the member. Measure and record camber and sweep after the steel has reached ambient temperature and all stiffeners and connection plates have been welded.

504.26 **Welding** - Qualify welders and WPSs in accordance with the D1.5 Code. Provide a list of qualified welders including process and position to the QAI prior to beginning fabrication. Submit the WPS to the Fabrication Engineer for review prior to beginning work. WPSs previously reviewed and still valid in accordance with the D1.5 Code are acceptable without re-submission.

504.27 **Welding Requirements** - Calibrate welding equipment at the intervals indicated in the D1.5 Code. Meters shall be accurate within 2% throughout the range of the WPS. Work done with equipment that is not properly calibrated will be rejected. Provide copies of the calibration records to the QA. The QAI can require the Contractor to demonstrate the accuracy of the meters at any time.

Display a copy of the applicable WPS at each welding station. Weld within the parameters of the WPS. Failure to display a WPS at the welding station will make all welding performed at that station subject to rejection.

Perform all preheat, welding and postheat in accordance with the D1.5 Code and this Specification.

Provide the appropriate temperature indicating crayons at each workstation to verify preheat. Calibrated digital thermometers may be used with the approval of the Fabrication Engineer instead of temperature indicating crayons.

Weld flange plate and web plate butt joints, web to flange welds, stiffener and connection plate to web welds, and cover plate to flange welds using an automatic weld process.

Make repairs with the same process used for the original welds, except that repairs less than 12" in length may be made with a different process using an

approved WPS. Do not blend repair welds by grinding unless the original weld requires grinding.

- 504.28 **Welded Fabrication** - Each side of complete joint penetration welds, once begun, shall be welded to completion without interruption or a delay between passes except as necessary to maintain interpass temperature requirements. After backgouging, the groove and 3" on either side of the groove and through the thickness of the steel shall be preheated in accordance with the D1.5 Code immediately before the resumption of welding.

Single-pass fillet welds may be qualified by a Fillet Weld Soundness Test performed in accordance with the D1.5 Code as modified herein. Perform the "T" test by welding the smallest fillet weld to be used in production on one side and the largest fillet weld used in production on the other side of the "T". Macroetch the test specimens in accordance with the requirements of Clause 7.18 - Method of Testing Specimens, of the D1.5 Code. Acceptance and re-testing, if required, shall be in accordance with Clause 7.19 - Test Results Required and Clause 7.20 - Retests, of the D1.5 Code.

The minimum heat input for single-pass fillet welds during testing and production shall be 35 kilojoules/in.

- 504.29 **Welding ASTM A709 HPS 70W Steel** - In addition to 504.28, use the most recent edition of the D1.5 Code and the Fab Guide as amended herein when welding ASTM A709 Gr. HPS 70W. Use only consumables that produce weld metal with diffusible hydrogen of H8 or less. Handle and store consumables in accordance with the requirements of Clause 12 of the D1.5 Code. Preheat in accordance with Clause 6 of the D1.5 Code through the thickness of the steel and 3" in all directions from the weldment. Failure to properly preheat the steel will result in rejection of the weld metal. Remove and re-weld rejected weldments.

HPS 70W may be joined to Grade 50W steel using a WPS qualified for Grade 50W steel if the diffusible hydrogen content of the deposited weld metal is H8 or less. Use minimum preheat temperature for Gr. HPS 70W in accordance with the D1.5 Code.

- 504.30 **Nondestructive Testing** - Perform nondestructive testing in accordance with the D1.5 Code and these Specifications. The QAI will witness nondestructive testing. Give the QAI adequate notice to facilitate the QAI's presence. Failure to notify the QAI will result in re-testing with the QAI present. Document nondestructive testing on the appropriate forms the D1.5 Code, or an equivalent form.

- 504.31 **Shop Assembly** - Assemble stringers and girders in accordance with the shop assembly drawings. Measure and record the bearing-to-bearing dimensions, the bearing-to-field-splice dimensions and the offset from the reference line dimensions as shown on the shop assembly drawings. Give the QAI the opportunity to verify the measurements prior to disassembly.

- 504.32 **Tolerances** - Dimensional tolerances for welded plate girders are described in the D1.5 Code. Dimensional tolerances for rolled shapes are described in AASHTO M 160 (ASTM A6). The tolerance for the length of any primary bridge member is $\pm\frac{1}{4}$ ". The bearing-to-bearing tolerance is $\pm\frac{1}{8}$ ". The bearing elevation tolerance is $\pm\frac{1}{8}$ ". The offset tolerance for bolted field splices is $\pm\frac{3}{4}$ ".
- 504.33 **Match marking** - Match mark drill assembled or ream assembled field splice material prior to disassembly. Preserve the match marking through field erection.
- 504.34 **Holes for High Strength Bolts** - Oversize holes are not allowed unless noted on the Plans. Drill bolt holes full-size. Splice plates may be used as one-time templates to drill webs and flanges. The plates shall remain with the splice. Replace damaged plates used as a template. The Contractor may temporarily tack weld web splice plates to the web in the middle $\frac{1}{3}$ of the web only. Completely remove tack welds by grinding and MT the tack areas. Do not tack weld flange splice plates to flanges.
- Holes for cross frames, diaphragms and associated connection plates may be punched when the thickness of the plate is $\leq \frac{3}{8}$ ". The diameter of the die shall not exceed the diameter of the punch by more than $\frac{1}{16}$ ". Holes shall be clean cut, without torn or ragged edges.
- Make holes cylindrical and perpendicular to the member. Remove burrs from parts after drilling or reaming. Remove all visible drilling oil, lubricants and coolants, including water soluble lubricants and coolants from faying surfaces in accordance with SSPC-SP 1-Solvent Cleaning.
- The Contractor may thermal cut holes in bearing base plates using an automatic process. Do not exceed a surface roughness of ANSI 1000 micro-inches.
- 504.35 **Accuracy of Holes** - Following the completion of the drilling of holes in a contiguous group, with all plies of a connection in their proper position for assembly, all bolt holes shall accept a pin $\frac{1}{32}$ " smaller in diameter than the nominal bolt hole diameter. Provide a pin of the applicable diameter for inspection purposes.
- No finished bolt hole shall be located more than $\frac{1}{8}$ " from its theoretical location. The repair of mislocated holes shall be subject to the approval of the Fabrication Engineer.
- 504.36 **Shop Bolts** - Install shop bolts in accordance with this Specification except that adequately lubricated fastener assemblies that have been Rotational Capacity (Ro Cap) tested by the supplier do not need to be Ro Cap tested prior to installation. As an alternative, Tension Control (TC) bolts meeting the requirements of ASTM F1852 may be used with the approval of the Fabrication Engineer. Submit a tensioning procedure for TC bolts to the Resident for review.
- 504.37 **Bearings** - Finish bearings, base plates and other contact surfaces to the requirements of Section 523.

- 504.38 **Marking and Delivery** - Mark each piece as shown on the Shop Drawings. Place erection marks, match marks and piece marks where they will not be exposed on the finished structure.

Notify the Fabrication Engineer after the girders and stringers have been loaded on trailers and prior to shipment. Furnish the Resident copies of shipping documents and erection diagrams.

Package bolts of each length and diameter, along with the required number of nuts and washers in waterproof containers. Attach a list of the fastener assemblies, including the identifying shipping lot number and Rotational-Capacity lot number in a waterproof envelope to the outside of the container.

- 504.39 **Handling and Storing Materials** - Store beams and girders in an upright position on platforms, skids or other supports above the ground. Support material in a manner that will prevent damage due to excessive deflection and torsion. Do not use chains and wire rope slings in direct contact with fabricated members when being lifted or transported. Store bolts under sheltered conditions at all times.

BRIDGE STEEL ERECTION

- 504.40 **Plans** - Provide the Resident with a steel erection plan for review prior to beginning steel erection. Schedule a pre-steel erection meeting at the jobsite prior to the delivery of the steel to discuss the erection plan, personnel qualifications, adequacy of tools and equipment and any other areas of concern to the Resident. If fabrication and erection of the Superstructure are done under separate Contracts, the Department will furnish detailed Plans for the Bridge or Bridges to the Contractor.

- 504.41 **Methods and Equipment** - Submit plans for any false work and/or modifications to an existing structure necessitated by construction loading to the Fabrication Engineer. The false work and/or modifications shall be designed, constructed and maintained for the loads placed upon it. False work calculations and design shall be stamped by a licensed Professional Engineer. The review by the Fabrication Engineer shall not relieve the Contractor of the responsibility for the safety of the method, equipment or from carrying out the work in accordance with the plans and Specifications. Do not build or erect false work until the Fabrication Engineer has reviewed and returned the plan.

- 504.42 **Bearings and Anchorages** - Finish bridge seats true to line and grade. Do not place bearings upon bridge seats that are improperly finished.
- Cast anchor rods in place or set them in drilled holes. If the anchor rods are set in drilled holes, use an anchoring material from the Department Qualified Products List. Anchor rods shall be capable of

developing unconfined pullout strength of 30 Kips and 70 Kips for 1" and 1½" anchor rods respectively.

The Department reserves the right to perform in-place pullout tests. Replace bolts failing to meet the pullout strength requirements.

Set bearings so that they are plumb or centered at 45°F.

- 504.43 **Assembling Steel** - Clean all faying surfaces before assembly. Use drift pins in both the web and flange connections to assure alignment of all holes. Use a minimum of eight drift pins in each flange and web connection. Install and tension a minimum of 50% of the bolts in each contiguous group before the member is released from the crane. Tension field splices within 72 hours of bolt installation. Protect splices from rain or other conditions that will, in the opinion of the Resident, degrade the lubrication on the bolts.
- 504.44 **Connections Using High Strength Bolts** - Provide all necessary torque and power wrenches, calibration equipment, feeler gauges and labor required for the testing, calibration, installation and inspection of high strength bolts. Provide a tension-measuring device (Skidmore-Wilhelm or approved equal) and torque wrench, both of which have been calibrated within 12 months, and are in good condition. Provide calibration documentation. Both the tension-measuring device and the torque wrench shall remain at the job site during steel erection. The torque wrench shall have a maximum capacity that is approximately 100% greater than the anticipated job torque. Torque wrenches shall be equipped with a dial face gauge and a memory pointer that remains at the applied torque reading. Torque wrenches shall be graduated in increments not to exceed 2% of the maximum capacity of the wrench and shall be readable to 1% of the maximum capacity.
- 504.45 **Bolts, Nuts, Washers and Direct Tension Indicators** - Protect fasteners from dirt and moisture. Take only as many fasteners as anticipated to be installed during a work shift from protected storage. Return unused fasteners to protected storage at the end of the workday. Clean and lubricate rusty and dirty fasteners prior to installation with a lubricant recommended by the bolt supplier or manufacturer. Tension Control (TC) fasteners shall only be re-lubricated by the manufacturer.

Surfaces in contact with the bolt head and nut shall not have a slope more than 1 to 20 with respect to a plane normal to the bolt axis. Where an outer face of the bolted parts has a slope of more than 1 to 20 with respect to a plane normal to the bolt axis, a hardened beveled washer shall be used. Bolted parts shall fit solidly together when

assembled. All faying surfaces shall be free of mill scale, dirt, burrs, or other material that would prevent solid seating of the parts.

Install bolts with a hardened washer under the element turned in tightening. Hardened washers are required over slotted and oversize holes.

504.46 **Fastener Assemblies for Testing** - Provide fastener assemblies (bolt, washer, nut and DTI, if required) to the Resident 2 weeks prior to beginning steel erection for testing. Randomly select and package four assemblies of each lot, length and diameter for independent verification testing. Identify each size fastener assembly separately with the lot numbers of the bolt/washer/nut/DTI combinations clearly marked. The cost of the assemblies is incidental to the appropriate Contract items. Replace unacceptable fastener assembly lots.

504.47 **Verification** - Perform a Rotational Capacity Test (RCT) for each Rotational Capacity (R-C) lot at the job site immediately prior to installation. Do not use fasteners assemblies that have been used to perform the RCT in the final assembly of the steel.

If DTI's are used, perform a DTI Verification Test for each production lot immediately prior to installation.

Give the Department adequate notification in order to witness both the RCT and DTI verification tests.

504.48 **Rotational Capacity Test** - The RCT is intended to verify the effectiveness of the lubricant and the compatibility of the components of the fastener assembly. The test shall be conducted using a tension-measuring device (Skidmore-Wilhelm or equivalent) and a torque wrench. Select two fastener assemblies of each length and diameter from each R-C lot. Perform the RCT in the following manner:

1. Insert the fastener assembly in the tension-measuring device using enough hardened washers under the nut (a minimum of one) so that there is full nut engagement (threads flush with the end of the nut) and no more than 3 threads visible after the assembly is brought to a snug-tight condition with a hand wrench (approximately 10% of the Minimum Installation Tension from Table 1).
2. Mark the faceplate of the tension measuring device with a line at 0°, 120°, 180°, and 240°. Mark the torque wrench socket so that the total amount of nut rotation can be measured and recorded.

Note: the lines are for measuring total rotation of the turned element and have nothing to do with minimum installation tension.

3. Bring the fastener assembly to *at least* the Minimum Installation Tension from Table 1 using the torque wrench.
4. At a point *after* the required Minimum Installation Tension has been achieved, measure and record the tension and the torque. Take the reading as close as possible to the Minimum Installation Tension from Table 1.

**TABLE 1 - MINIMUM INSTALLATION TENSION REQUIREMENTS
AND TURN TEST TENSION-U.S. CUSTOMARY**

Bolt Diameter (inches)	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
Installation Tension (kips)	19	28	39	51	56	71	85
Turn Test Tension (kips)	22	32	45	59	64	82	98

5. Further tighten the fastener assembly to the total rotation (from snug tight) specified in Table 2 below:

TABLE 2 - TOTAL FASTENER ROTATION FROM SNUG TIGHT

Bolt length up to and including 4 diameters	2/3 turn (240°)
Bolt length over 4 diameters up to and including 8 diameters	1 turn (360°)
Bolt length over 8 diameters and less than 12 diameters	1 1/6 (420°)
12 diameters and greater	test not applicable

6. Measure and record the tension after total rotation of the nut. The measured tension must be equal to or greater than the Turn Test Tension value shown in Table 1 for the diameter bolt being tested. If the measured tension is less than the required Turn Test Tension, the fastener assembly has failed.
7. Upon completion of Steps 1 through 6:
 - (a) The torque measured in step 4 shall not exceed the value obtained by the following equation:
 Measured Torque $\leq 0.25PD$ where:
 $P = \text{Measured Bolt Tension - pounds (Step 4)}$
 $D = \text{Nominal Bolt Diameter - feet}$
 (bolt diameter in inches divided by 12)
 - (b) If the torque measured in Step 4 is greater than the torque calculated in Step 7, the fastener has failed the test. Re-lubricate all fasteners in the lot and re-test.
 - (c) Disassemble each fastener assembly and run the nut down the full length of the threads excluding the grip length (the length between the bolt head and washer face)

of the nut). If evidence is found of torsional failure, shear failure or stripping of the threads, the assembly failed the test. Slight necking in the grip length is not a failure.

- (d) If either bolt assembly fails the test, the R-C lot has failed. Re-lubricate all bolts from that lot and perform the test again. If either bolt fails the second test, the R-C lot shall be rejected.

8. Test bolts that are too short to fit in the tension-measuring device in a solid joint such as a bearing stiffener or connection plate. The hole in the joint may not be more than 1/16" greater in diameter than the bolt being tested. Randomly select two fastener assemblies from each R-C lot. Mark the nut relative to the steel joint in such a manner that rotation can be measured. Snug tighten the bolt with a spud wrench using approximately the same effort used to snug-tighten longer bolts in a tension measuring device. Restrain the bolt with a wrench to prevent rotation. Rotate the nut from snug tight to 1/3 turn with a torque wrench. Record the torque required to reach that rotation while the turned element is in motion. If the measured torque exceeds the maximum torque listed in Table 3 the fasteners have failed the test. If the fasteners fail the first test, re-lubricate all fasteners from that R-C lot, randomly select two samples and re-test. If there is no stripping or fracture the fasteners pass. If either fastener fails the second test, the R-C lot is rejected.

TABLE 3 - MAXIMUM ALLOWABLE TORQUE

Bolt Diameter (inches)	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
Torque (ft-lb)	500	820	1230	1500	2140	2810	3690

9. Discard bolts used for the Rotational Capacity Test.

504.49 **DTI Verification Test** - Perform the DTI Verification Test for each production lot of DTIs in combination with each R-C lot of fasteners. If any of the three test assemblies fails, three additional samples from the same production lot shall be tested as the first. If any of the three samples fails the second test, the lot shall be rejected. Perform the test in TWO STEPS:

1. **Step 1** - is a test to determine that the DTI's are acceptable when the fastener is brought to the minimum allowable tension.
 - a) Randomly select three fastener assemblies from each R-C lot.

- b) Install each bolt in the tension-measuring device with the bolt head bearing against the faceplate (the front of the tension-measuring device). Place the DTI under the bolt head with the protrusions bearing against the washer face of the bolt. This is done so that the DTI is accessible for inspection with a feeler gauge. Install the nut and hardened washer using a filler sleeve between the bolt bushing (the back of the tension-measuring device) and the hardened washer under the nut. Two or more hardened washers may be used under the nut instead of a filler sleeve if the washers do not interfere with the proper operation of the tension-measuring device. When the bolt is brought to snug-tight condition, there should be 3 to 5 threads visible.
- c) Using two wrenches, one to restrain the unturned element of the bolt assembly, tighten the nut to the Bolt Tension listed in Table 4. If an impact wrench is used, tighten the bolt to approximately 50% of the required tension and use a torque wrench to bring the fastener to the required tension.

TABLE 4- MINIMUM INSTALLATION TENSION

U.S. Customary							
Bolt Diameter (inches)	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2
Bolt Tension (kips)	20	29	41	54	59	75	108

- d) Using a thickness gauge provided by the DTI manufacturer, record the number of spaces between the protrusions on the DTI that a 0.005" thickness gauge is refused.
- e) If the number of refusals exceeds the number in Table 5, the DTI has failed the DTI Verification Test for minimum tension. Reject the DTI lot.

TABLE 5

Bolt Diameter (inches)	3/4, 7/8	1, 1 1/8	1 1/4, 1 3/8
Number of Spaces in DTI	5	6	7
Maximum Number of gaps in which gauge is refused *	2	2	3
* If the test is a coated DTI, the maximum number of spaces the gauge is refused is the number of spaces on the DTI minus one			

2. **Step 2** - is to determine the maximum bolt tension allowable using a DTI.
 - a) After completing Step 1, the bolt shall be further tightened to the smallest gap to be used during installation. Normally, this is defined as a condition where all gaps refuse a 0.005" gauge but at least one visible gap remains.
 - b) Remove the bolt from the tension measuring device and turn the nut on the threads of the bolt by hand. If the nut can be run the length of the threads, excluding the thread run out, the DTI lot is acceptable. If the nut is unable to run the thread length at the smallest gap condition (defined in a) above), the test shall be performed again using a larger acceptance gap.

504.50 **Installation and Tensioning High Strength Bolts** - Select one of the methods listed below for installing and tensioning high strength bolts. Do not use standard torque determined by the use of tables or formulas that attempt to relate torque to tension.

504.51 **Installation** - Install a hardened washer under the turned element and a hardened washer on oversize holes. Install fasteners in all holes in a contiguous group, except for holes containing drift pins and bring them to a snug tight condition, progressing systematically from the most severely restrained location in a connection to the free edges. Do not remove the drift pins until a minimum of 50% of the fasteners have been tensioned. Do not force the bolts. If the bolts cannot be installed easily by hand, correct the hole alignment by installing more drift pins.

504.52 **Tensioning** - Install and tension bolts by (1) the Calibrated Wrench method, (2) the Turn of Nut method, (3) with Direct Tension Indicators or (4) Alternative Design Fasteners. Tension the fasteners systematically from the most rigid part of the joint to the free edges.

1. **The Calibrated Wrench Method** - Adjustable pneumatic wrenches, adjustable hydraulic wrenches or torque wrenches may be used.

Calibrate the wrench used for tensioning bolts at least once each shift with fastener assemblies of each diameter, length and R-C lot to be installed. Calibrate pneumatic wrenches any time a section of hose has been added or eliminated. Calibrate pneumatic wrenches any time the compressor is changed.

Randomly select five fastener assemblies of each length and R-C lot for wrench calibration. Install each of the fastener

assemblies in the tension measuring device and install enough washers so at least three but no more than five threads are showing. Install at least one hardened washer under the turned element. Snug the bolt using the same procedure to be used during installation.

If the wrench is an adjustable pneumatic wrench or an adjustable hydraulic wrench, set the adjustment so that each of the three assemblies is tensioned to no less than the Minimum Installation Tension specified in Table 4 above.

If a torque wrench is used, tension five randomly selected fastener assemblies to the minimum tension specified in Table 4. Record the torque readings. Discard the high and low torque reading. The job installation torque shall be the average of the three remaining torque values.

When bolts are too short to fit in the tension-measuring device, install five randomly selected fasteners in a solid joint with a hole diameter no greater than 1/16" the nominal bolt diameter. Rotate each assembly 1/3 turn and record the torque. Discard the high and low torque reading. The job installation torque shall be the average of the three remaining torque values.

Bolts used to calibrate wrenches may be re-used.

2. ***The "Turn of Nut" Method*** - Perform the Turn of Nut calibration once, prior to fastener installation, for each diameter, length and R-C lot.

Select a random sample of no less than three fastener assemblies of each diameter, length and R-C lot. Install each assembly in a tension-measuring device. Bring the fastener assembly to snug tight (approximately 10% of the minimum installation tension from Table 4). Match mark the socket to reference points on the tension-measuring device in order to accurately determine nut rotation. Tighten the bolt to the required rotation specified in Table 6. Record the tensions for each diameter, length and R_C lot. The average of the three tension readings shall be no less than the Minimum Installation Tension specified in Table 4. If any of the three fastener assemblies does not achieve minimum installation tension at the specified rotation, select three more and re-test. Increase the minimum rotation if necessary.

Snug all the bolts in a contiguous group. Rotate the turned element the appropriate amount rotation specified in TABLE 6.

The unturned element shall be held by a wrench to prevent rotation during tightening.

TABLE 6 - NUT ROTATION FROM SNUG TIGHT^{1, 2, 3}

Disposition of Outer Faces of Bolted Parts			
Bolt Length Measured from Underside of head to extreme of point	Both Faces Normal to Axis 3	One Face Normal to Bolt Axis and Other Face Sloped Not More Than 1 to 20 (bevel washer not used) 3	Both Faces Sloped Not More Than 1 to 20 from Normal to Axis (bevel washer not used) 3
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters 2	2/3 turn	5/6 turn	1 turn
¹ Nut rotation is relative to bolt, regardless of the element (nut of bolt) being turned. ² For bolts tensioned with 1/2 turn or less, the tolerance shall be plus or minus 30°. For bolts tensioned with more than 1/2 turn, the tolerance shall be plus or minus 45°. ³ No research work has been performed by the Research Council on Riveted and Bolted Structural Joints to establish the turn-of-nut procedure when bolt lengths exceed 12 diameters, therefore, the required rotation must be determined by actual tests in a suitable tension-measuring device simulating the actual condition.			

3. **Tensioning Fastener Assemblies** - with DTI's Tension fasteners using DTI's so that a 0.005" feeler gauge is refused in at least the number of gaps shown in Table 7 and a minimum of one visible gap remains. Tightening beyond crushing the DTI shall be cause for rejection of the fastener assembly.

TABLE 7

Inspection Criteria for DTI's						
Number of gaps in DTI	4	5	6	7	8	9
Minimum number of gap refusals	2	3	3	4	4	5

4. **Alternate Design Fasteners** - Alternate design fasteners that are designed to indicate bolt tension indirectly or tension bolts automatically may be used only with the approval of the Fabrication Engineer. Alternate design fasteners shall meet

the chemical and mechanical requirements of AASHTO M 164M / M 164 (ASTM A325/ A325M) and shall have the same body diameter of similar traditional fasteners and not less than the same bearing area under the head and nut as a similar heavy hex fastener.

Provide a detailed written installation procedure from the fastener manufacturer to the Fabrication Engineer for approval prior to beginning bolt installation. The Fabrication Engineer may modify or place restrictions on the installation procedure prior to approval.

Calibrate three random samples in a tension-measuring device. Each fastener shall achieve the Minimum Bolt Tension from Table 4 when installed and tensioned in accordance with the approved installation procedure. If any of the three fasteners fails to achieve 100% of the Minimum Bolt Tension, a retest of five fastener assemblies from the same lot may be performed. If any of the five fastener assemblies fails to achieve 100% of the Minimum Bolt Tension, the lot shall be rejected. The Resident may require re-calibration of the fasteners if the condition of the fasteners has significantly changed.

Tension alternate design fasteners immediately after installation. Alternate design fasteners are extremely dependent on proper lubrication and thread condition. Handle and store fasteners in accordance with the manufacturer's recommendations. Fasteners that have been improperly handled or stored shall be rejected.

504.53 **Inspection** - Inspect all completed joints within 72 hours following completion of tensioning each joint or contiguous group of fasteners.

Use the following inspection procedure:

1. The Contractor, in the presence of the Resident shall use a calibrated torque wrench as an inspection tool.
2. At least once each Day, tighten a representative sample of five bolts from each diameter, length and Ro-Cap lot used in the work in the tension-measuring device to the Minimum Bolt Tension specified in Table 6. Place a washer under the turned element of each bolt assembly. The job inspection torque shall be the average of three values after rejecting the high and low values.
3. Bolts represented by the sample in the preceding paragraph which have been tightened in the structure shall be inspected

by applying, in the tightening direction, the inspection wrench and the job inspection torque to a minimum of 10% of the bolts, but not less than two bolts, selected at random, in each connection. If any nut or bolt is turned more than 5° (approximately 1" at a 12" radius) by the application of the job inspection torque, all bolts in the connection shall be tested. Alternatively, the Contractor or Erector may re-tighten all the bolts in the connection before the specified inspection.

4. For joints using DTI's, inspection will consist of verifying that the DTI has the minimum number of refusals required from Table 9 and the minimum gap allowed in the work (from the DTI Verification Test) remains in at least one space.
5. At the Resident's option, if the Quality Assurance Inspector witnesses the initial and final tensioning of fasteners in a joint using the "Turn of Nut" method and finds it acceptable, no further inspection will be required.

504.54 **Reuse of Bolts** - Reuse only black AASHTO M 164M/M 164 (ASTM A325/A325M) bolts. Do not reuse galvanized fasteners.

504.55 **Field Welding and Repairs** - Field welding and nondestructive testing of field welds shall be done in conformance with the requirements of the D 1.5 Code, except that field welds made to bearings, joints and drains and the welds to attach ancillary bridge products to the primary structural members shall be done in conformance with the requirements of the D1.1 Code and the following:

- The Contractor shall provide a QC Inspector to perform QC for the welds in accordance with the AWS D1.1 welding code. The QC Inspector shall be an AWS Certified Welding Inspector (CWI) in conformance with the requirements of AWS QC1, Standard for AWS Certifications of Welding Inspectors. The Contractor may submit, in lieu of a CWI, an alternative QC Inspector with documented training and experience in metals fabrication, inspection, and testing for approval by the Fabrication Engineer. The QC Inspector shall be someone other than the welder performing the welds to be inspected.
- No additional NDT testing beyond visual testing will be required for field welds made to ancillary bridge products as defined in this section.
- The QC Inspector shall inspect all production stages of the welded splice to ensure that workmanship and materials meet the requirements of the AWS D1.1 welding code and the Contract. The QC Inspector shall submit a signed record of all

weld inspection documentation to the Resident after welding is completed.

Record of weld inspection shall include, but not be limited to, the following:

- Name of QC Inspector
- Project WIN and Location
- Date
- Weather conditions
- Type, size, length, and location of welds.
- Confirmation of appropriate equipment and materials used, including proper handling of welding electrodes.
- Confirmation that welder has approved WPS onsite, and welding is performed in accordance with approved WPS.
- Confirmation that welder is qualified to perform work per approved WPS. Include name and certifications of qualified welder who performed the work.
- Confirm that 100% visual testing, in accordance with AWS D1.1 Table 8.1, has been conducted and any subsequent repairs are made prior to non-destructive testing (NDT).
- Document NDT testing including name of NDT technician, NDT personnel qualifications, type and extent of NDT testing performed, and include NDT testing reports provided by the NDT testing technician.

Structural steel that is damaged during construction, to include but not be limited to, saw cut damage, nicks/gouges, and deformations shall be repaired by the Contractor in accordance with Section 104.3.10. The Contractor shall submit a structural steel repair procedure for review by the Fabrication Engineer. The repair procedure shall be prepared by a licensed Professional Engineer in the State of Maine and the repair procedures shall be in accordance with the AASHTO/NSBA Guidelines for Field Repairs and Retrofits of Steel Bridges, G14.2-2023. No structural steel repairs shall commence without an approved repair plan.

When welding is anticipated per the Contract Plans and/or is required as part of a repair procedure, the Contractor shall submit a Field Welding QC Plan for review by the Fabrication Engineer.

The Field Welding QC Plan shall, at a minimum, contain the following pieces of information:

- 1) Scope of Anticipated Field Welding
- 2) WPSs/PQRs
- 3) QC Inspector Qualifications
- 4) Welder Qualification
- 5) NDT
 - a. NDT Technician Qualifications
 - b. Type/Quantity of NDT Required
- 6) Acceptance Criteria

Qualify QC Inspectors and NDT Technicians in accordance with Section 504.061, except as noted otherwise in this section.

Qualify welders in accordance with Section 504.26.

Welding shall not be done when: the ambient temperature is below 0°F; the surfaces are damp or exposed to rain, snow, or high wind; or the welders or welding operators are exposed to inclement conditions.

Power sources for welders shall have meters indicating amperage/voltage that have been calibrated within 1 year at the time of welding.

The Contractor shall provide the Department with notice, a minimum of, 7 Days prior to the start of any welding.

Do not perform field welding without approved Field Welding QC Plan and approved WPS(s).

- 504.56 **Misfits** - The correction of misfits involving minor reaming will be considered a legitimate part of steel erection. Errors in shop fabrication or deformation from handling and transportation that prevents the proper assembling and fit-up of parts by the use of drift pins or by reaming (not to exceed 10% of the holes in a contiguous array) shall be reported immediately to the Resident. Provide a written proposal for correction to the Fabrication Engineer. Do not make any field corrections that involve cutting or welding without the permission of the Resident.

ANCILLARY BRIDGE PRODUCTS and SUPPORT STRUCTURES

- 504.57 **Ancillary Bridge Products** - Ancillary bridge products are defined in Subsection 713.01 of the Standard Specifications. Fabricate ancillary bridge products in accordance with the D1.5 Code as applicable to ancillary bridge products and this Specification. Welds attaching ancillary products to structural members shall meet all requirements

of the D1.5 code. Fabricate tubular products in accordance with the AWS D1.1 Structural Welding Code (the D1.1 Code).

- 504.58 **Support Structures** - Weld support structures in accordance with the D1.1 Code. Support structures shall include, but not be limited to, non-vehicular bridges, high mast poles, light and signal poles, dual purpose poles, strain poles and sign supports; cantilever, bridge and butterfly support structures.
- 504.59 **Materials** - Materials for ancillary bridge products will be specified in the Contract documents. When AASHTO M 270M/M 270 (ASTM A709/A709M) steel is specified for ancillary bridge products, equivalent ASTM grades of steel may be substituted. Provide Certified Mill Test Reports for all material.
- 504.60 **Holes for Base Plates** - Holes in base plates may be drilled or thermal cut at the Contractor's option. The roughness shall not exceed condition of AWS C4.1-77, Sample 4. Do not deviate from specified dimension for thermal cut holes by more than 1/16" in any direction.
- 504.61 **Bolted Connections** - Holes for bolted connections shall meet the requirements of Subsections 504.34 and 504.35. High strength bolts shall be installed, tensioned and inspected in accordance with Subsections 504.50 through 504.54.
- 504.62 **Anchor Rods** - Anchor rods shall be as shown on the Plans or in the Standard Details. Anchor rods shall meet the material requirements of 720.07.
- 504.63 **Support Structures** - Qualify Weld Procedure Specifications, welders and welding operators in accordance with the D1.1 Code.
- Circumferential shop splices for poles shall be full penetration, butt welds. Welded longitudinal seams shall have 100% penetration for 6" on either side of a shop splice, and for the splice length plus 6" at the field splice end(s) of a shaft section. The remainder of the seam weld shall have a minimum effective weld throat of 60% of the wall thickness. Pole to base welds may be complete joint penetration welds or socket-type joints with two fillet welds.
- Prior to erection, the assembled shaft or structure shall not exhibit a sweep in excess of 0.2% of the nominal pole height or length, as measured with the pole or structure in a horizontal position. Shafts that are to remain unpainted shall have the lower edge of all field slip connections sealed around the entire circumference with a sealant that will remain flexible and not degrade from exposure to ultraviolet light.

504.64 **Non Destructive Testing-Ancillary Bridge Products and Support Structures** - Unless otherwise specified, nondestructive testing shall be as follows:

1. Examine 10% of fillet or partial penetration welds on each production lot using Magnetic Particle (MT) inspection. If any welds examined require a welded repair, an additional 10% of the original lot number will be examined using MT. If any welds in the second 10% require a welded repair, test all welds in that production lot using MT.
2. For the purposes of this Specification, a production lot shall be defined as a Day's production of small parts (e.g. post to base welds), each discrete segment of complex structures (e.g. overhead sign supports, mast arm poles, etc.) or other grouping or unit not to exceed 1 week's production at the discretion of the Fabrication Engineer.
3. Inspect 100% of all circumferential welds and the full penetration sections of the longitudinal seam welds by radiographic examination (RT). Inspect 100% of tube to plate welds: full penetration by RT, partial penetration and fillet by MT. Inspect 25% of the partial penetration sections of the longitudinal seam welds (MT). Ultrasonic testing (UT) may be used on material $\geq (5/16")$ thick and properly qualified UT may be used on thicknesses $< 5/16"$.

504.65 **Method of Measurement** - Unless otherwise specified, structural steel will be measured as one lump sum complete and accepted, consisting of all metal and related materials in the fabricated and erected structure as shown on the Plans, excluding railings and drains. Related materials shall include, but not be limited to, preformed pads placed under the bearings and, when required, self-lubricating bronze or copper-alloy bearing and expansion plates.

504.66 **Basis of Payment** - Structural steel will be paid for at the Contract lump sum price for the respective Contract items.

Payment will be made under:

Pay Item		Pay Unit
504.70	Structural steel fabricated and delivered	Lump Sum
504.701	Structural steel fabricated and delivered, roll	Lump Sum
504.702	Structural steel fabricated and delivered, welded	Lump Sum
504.71	Structural steel erection	Lump Sum

SECTION 505 - STUD WELDED SHEAR CONNECTORS, ANCHORS, & FASTENERS

- 505.01 **Description** - This work consists of furnishing and installing steel stud welded shear connectors, concrete anchors and threaded fasteners in accordance with the AASHTO/AWS D1.5 Bridge Welding Code (D1.5) and these Specifications.
- 505.02 **Materials** - Materials shall meet the requirements of Section 711.06 - Stud Shear Connectors, Anchors, and Fasteners. The Contractor shall provide the stud manufacturer's certification that the studs meet the material requirements prior to beginning welding.
- 505.03 **Quality of Work** - The studs shall be free from rust, scale, oil, and other contaminants that would adversely affect the welding operation.
- Weld locations shall be free of scale, rust, oil and other deleterious material. The Contractor may clean the weld locations by any method that results in satisfactory welds.
- The arc shields, or ferrules, shall be kept dry. Ferrules showing signs of moisture shall be oven dried at 250°F for two hours prior to use.
- The longitudinal spacing of shear connectors shall vary no more than ± 1 " from that shown on the Plans. The minimum edge distance shall be 2".
- Arc shields or ferrules shall be removed from studs after welding.
- 505.04 **Technique** - Studs shall be welded with automatically timed stud welding equipment connected to a suitable direct current, electrode negative (DCEN) power source.
- If more than one stud-welding gun is operated from the same power source, they shall be interlocked so that only one gun can operate at one time.
- Welding shall not be done when the base metal temperature is below 0°F or when the surface is wet or exposed to rain or snow.
- Studs may be fillet welded using SMAW with the approval of the Fabrication Engineer.
- 505.05 **Construction Requirements** - At the beginning of each Day or shift and after any change in set-up, the first two studs welded shall be tested. The studs shall be visually inspected for a full 360° weld flash. In addition to visual examination, the test shall consist of bending the studs after they are allowed to cool, to an angle of approximately 30° from their original axes by either striking the studs on the head with a hammer or placing a pipe or other suitable hollow device over the stud and manually or mechanically bending the stud. At temperatures below 50°F, bending shall preferably be done by continuous slow application of load.
- If on visual examination the test studs do not exhibit 360° flash, or if on testing, failure occurs in the weld zone of either stud, the WPS shall be corrected, and

two more studs shall be welded to separate material or on the production member and tested as stated above. If either of the second two studs fails, additional welding shall be continued on separate plates, which are representative of the grade and thickness of the material being welded in production, until two consecutive studs are tested and found to be satisfactory before any more production studs are welded to the member.

While in operation, the welding gun shall be held in position without movement until the weld metal has solidified.

If an unacceptable stud has been removed from an area subject to tensile stresses or stress reversal, and no base metal has been removed, the weld area shall be ground flush with the grinding performed parallel to the direction of primary stresses (i.e., with the girder direction). If base metal has been pulled out in the course of stud removal, the member shall be repaired in accordance with the requirements of Section 504.55 - Field Welding and Repairs.

If an unacceptable stud has been removed from an area subject to compression, Base metal repairs shall be the same as the repairs for tension areas except that if the depth of the pocket is less than $\frac{1}{8}$ " it shall be faired out by grinding. Replacement studs shall be welded no closer than 1" from the repair area.

505.051 **Inspection** - Studs will be visually inspected for a full 360° weld flash. Studs not having a full 360° weld collar shall be bent 15° from its original position in a direction away from the missing weld flash. Studs not developing a crack or tear will be considered acceptable and may remain in the bent position. Failing studs shall be removed, replaced and weld areas repaired.

505.06 **Method of Measurement** - Shear connectors shall be measured as one lump sum, consisting of all shear connectors required and acceptably installed. Stud welded anchors and fasteners will be considered incidental to the pay item for which they are required.

505.07 **Basis of Payment** - The accepted quantity of shear connectors will be paid for at the lump sum price.

Payment will be made under:

Pay Item		Pay Unit
505.08	Shear Connectors	Lump Sum

SECTION 506 - SHOP APPLIED PROTECTIVE COATING - STEEL

506.01 **Description** - This work shall consist of applying protective coating to steel substrate in accordance with the Plans and this Specification. The protective coating system shall be as specified on the Plans.

ALL REQUIREMENTS IN THIS SPECIFICATION ARE THE RESPONSIBILITY OF THE CONTRACTOR UNLESS NOTED OTHERWISE.

506.02 **Materials** - Materials shall comply with the requirements of the respective Subsections of this Specification.

506.03 **Submittals** - Submit the following, as applicable:

- A. The manufacturer's product data sheet for the specified protective coating system(s).
- B. Safety Data Sheets.
- C. Facility Certification, Endorsement or other Qualification(s).
- D. Quality Control Plan.
- E. Quality Control Inspector (QCI) qualifications.

506.04 **General Specifications** - Specifications for the protective coating and/or protective coating systems are:

- Zinc Rich Coating System +- Subsections 506.10 through 506.19
- Hot-Dip Galvanizing - Subsections 506.20 through 506.29
- Thermal Spray Coating - Subsections 506.30 through 506.39
- Fusion Bonded Epoxy Coating - Subsections 506.40 through 506.49

506.05 **Inspection** - Quality Control (QC) is the responsibility of the Contractor. Inspect all aspects of the work and supervise all sampling, measurements and testing. Record measurements and test results in a clear and legible manner in a format acceptable to the Fabrication Engineer. Reject materials and workmanship that do not meet Contract requirements. The QCI may perform sampling, measurements and testing in addition to the minimum required. Make the results of all sampling, measurements and testing available to the Quality Assurance Inspector (QAI).

Training in surface preparation, coatings application, and inspection is required for QCI's. Acceptable training includes one or more of the following:

- A. AMPP Basic Coatings Inspector/CIP Level 1 (minimum)
- B. AMPP BCI Coatings Inspection Training and Certification for the Bridge Industry: (Level I without certification), or Level II
- C. Other training that is acceptable to the Department.

Quality Assurance (QA) is the prerogative of the Department. The QAI's responsibility is to ensure that the QC personnel are performing acceptably, verify documentation, periodically inspect workmanship and witness sampling, measurements and testing. The QAI will schedule measurements and testing deemed necessary by the Resident in addition to the minimum requirements in a manner that minimizes interference with the production schedule.

The QAI has the authority to reject material or workmanship that does not meet the Contract requirements. The acceptance of material or workmanship by the

QAI will not preclude subsequent rejection, if found unacceptable by the Department.

506.06 **Non-Conforming Work** - Submit a non-conformance report to the Fabrication Engineer describing the deficiencies and proposed solution. Correct or replace rejected coatings as directed by the Fabrication Engineer.

506.07 **Facilities for Inspection** - Provide a private office at the fabrication plant for the Department's inspection personnel, or QAI's. The office shall be in close proximity to the work. The office shall be climate controlled to maintain the temperature between 68°F and 75°F and have the exit(s) closed by a door(s) equipped with a lock and 2 keys which shall be furnished to the Inspector(s).

The QAI's office shall meet the following minimum requirements:

Description	Quantity
Office area (minimum ft ²)	100
Drafting Table Surface (ft ²)	35
Drafting stools-each	1
Office Desk	1
Ergonomic Swivel Chairs	1
Folding Chairs	2
High-speed internet connection (ports) or wireless	1
Fluorescent Lighting of 100 foot-candles minimum for all work areas	2
110 Volt 60 Cycle Electric Wall Outlets	3
Wall Closet	1
Waste Basket with trash bags	1
Broom	1
Dustpan	1
Water Cooler	1
Cleaning materials-floor, surfaces, windows	for duration of the Project

The Contractor will be responsible for disposing of trash and supplying commercially bottled water for the water cooler.

The QAI has the option to reject any furniture or supplies provided to the QAI's office, based on general poor condition.

Provide parking space for the QAI(s) in close proximity to the entrance to the QAI's office. Maintain the pathway between the parking area and the QAI's office so that it is free of obstacles, debris, snow and ice.

The facilities and all furnishings shall remain the property of the Contractor upon completion of the Work. Payment for the facilities, heating, lighting, telephone installation, internet connection, basic monthly telephone and internet charges and all furnishings shall be incidental to the Contract.

Failure to comply with the above requirements will be considered denial of access to the Work for the purpose of inspection. The Department will reject all Work done when access for inspection is denied.

506.08 **Applicator Qualification** - Shop-applied paint systems shall be applied by applicators that hold a current AISC Complex Coatings Endorsement (CCE) or are qualified in accordance with NACE NIICAP. Thermal Spray Coating (TSC), including sealers and top coating shall be applied at facilities with a minimum of 5 years experience with additions of the certifications in the previous section or qualified in accordance with AMPP QP 6, Contractor Metallizing. Fusion bonded coatings and hot-dip galvanizing shall be applied in facilities with a minimum of 5 years experience of satisfactory performance. The Fabrication Engineer may accept other shop qualifications based on experience and/or an audit by the Department.

506.09 **Inspection** - Measure and record the following, as applicable to the coating application, in a Job Control Record (JCR):

- A. Surface preparation - cleanliness and anchor profile.
- B. Environmental conditions – ambient temperature, surface temperature, relative humidity, dew point.
- C. Coating batch and/or lot number, date of manufacture and shelf life.
- D. Mixing/thinning.
- E. Dry Film Thickness (DFT) for each coat.
- F. Cure data-time/temperature/relative humidity.
- G. Final inspection and acceptance by the QCI.

Submit the format for the JCR to the Fabrication Engineer for review prior to beginning application of protective coating.

Provide work area illumination as follows:

Work Area Illumination Requirements in Foot-Candles		
Description of Work	Minimum	Recommended
General Work Area Illumination	10	20
Surface Preparation and Coating	20	50
Inspection	50	200

Provide a light meter that measures illumination in foot-candles.

Use SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning or SSPC-VIS 3, Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning as required in order to determine acceptable surface cleanliness.

Measure and record the environmental conditions during application and during the entire curing cycle. Failure to provide accurate and complete environmental data may result in rejection of the coating or an extended cure time as determined by the Fabrication Engineer.

Measure and record the DFT of each coat in accordance with SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages (PA 2).

ZINC RICH COATING SYSTEM

506.10 **Description** - This work shall consist of surface preparation and application of coating systems in accordance with the Plans and this Specification. The color of structural steel painted in its entirety shall comply with SAE AMS-STD-595 – Colors Used in Government Procurement Color No. 14272 (Green), unless otherwise specified in the Contract. The color of partially painted weathering steel shall comply with SAE AMS-STD-595 – Colors Used in Government Procurement Color No. 30045 (Brown), unless otherwise specified in the Contract. All other coating colors shall be as specified in the Contract.

506.11 **Materials** - Coatings systems shall be from the Northeast Protective Coating Committee (NEPCOAT) Qualified Products List (QPL), list A or B. The list may be found through NEPCOAT's Web page: <http://www.nepcoat.org>.

Provide the paint batch description, lot number, date of manufacture, shelf life and the manufacturer's storage requirements to the QAI. Provide the manufacturer's published data sheet for each coat of the coating system including equipment, surface cleanliness, anchor profile, mixing, thinning, application, and cure time for the entire range of allowable environmental conditions and the DFT.

506.12 **Limits of Work** - Coat all surfaces exposed in the assembled product unless otherwise specified. Apply a mist coat, 0.5 to 1.0 mils, of primer only to surfaces to be embedded in concrete.

Apply primer to faying surfaces of bolted connections that develop a class B slip coefficient in accordance with the "Specification for Structural Joints Using ASTM A325 or A490 Bolts" by the Research Council of Structural Connections (RCSC). Provide documentation to demonstrate that the primer was tested and the requirements were met. Do not exceed the DFT applied for test purposes.

506.13 **Surface Preparation** - Surface cleanliness shall be SSPC-SP 10, Near-White Blast Cleaning (SP 10) unless a higher standard of surface cleanliness is required by the manufacturer's published data sheet. Round all corners exposed in the assembled product to approximately a 3/32" radius, prior to abrasive blast cleaning. A series of tangents that approximate a radius may be considered as a rounded edge if there are no sharp breaks. Provide radius gauges to inspect corner preparation. The radius shall be the minimum specified above, but not greater than 3/16".

The abrasive blast media shall meet the requirements of SSPC-AB 1, Mineral and Slag Abrasives, AB 2, Cleanliness of Recycled Ferrous Metallic Abrasives and/or AB 3, Ferrous Metallic Abrasive. The anchor profile shall be angular and meet the requirements of the coating manufacturer's published data sheet.

If compressed air is used for abrasive blast cleaning, perform a blotter test ASTM D4285 at the beginning of each shift and at any time requested by the QAI. Notify the QAI prior to performing the test.

Measure and record the anchor profile in accordance with ASTM D4417 Method C (replica tape). If the anchor profile fails to meet the minimum requirements, re-blast the substrate until the required anchor profile is achieved. If the anchor profile exceeds the maximum allowed, generate a Non-Conformance Report (NCR) describing the condition of the substrate and a proposed solution and submit it to the Fabrication Engineer for review.

Measure the anchor profile of the substrate on every plane of each beam or girder. If it has been established to the satisfaction of the QAI that the abrasive blast equipment is capable of providing uniform, acceptable anchor profile, a diminished degree of testing may be allowed at the discretion of the Fabrication Engineer.

The allowable time between abrasive blast cleaning and primer application shall not exceed the manufacturer's published recommendations or one work shift, whichever is less. Any evidence of rust bloom, flash rust or other surface conditions that cause the substrate cleanliness to fall outside the specified cleanliness standard will be rejected. Inspect all substrate immediately prior to coating application. Re-blast steel substrate that does not meet the surface cleanliness requirements.

Steel shall meet the requirements of SSPC SP 8 Pickling prior to being immersed in the zinc tanks. Verification of the surface preparation shall be included in the QC documentation."

- 506.14 **Mixing and Application** - Record the batch and lot numbers of the coating, the type and amount of thinner used, the time and pot life of the coating.

Add thinner in accordance with the manufacturer's published data sheet. Measure thinner with a graduated cup, or other container, that clearly indicates the amount of thinner being added. Record the amount of thinner added. Mix the paint using the method, equipment and time recommended by the coating manufacturer. Mix each component separately and mix all components together for at least the minimum time recommended on the Manufacturer's Product Data Sheet but not less than 2 minutes.

Measure the environmental conditions in the immediate vicinity of the piece(s) being coated during the coating operation and during the entire cure period. Provide two data loggers capable of measuring ambient humidity and temperature. The data loggers shall come with software that can download the data onto a computer. Print out the data and provide a copy to the QAI for review prior to applying the subsequent coat of paint. Place the data loggers in the immediate vicinity of the coating operation during the entire application and curing cycle. The data will be used to determine that the cure/recoat time requirements for each coat have been met. Failure to comply will result in the

coating being cured for the maximum time necessary to assure adequate cure, as determined by the Fabrication Engineer.

Stripe all corners, fasteners, welds and locations with poor access, in accordance with SSPC-PA 1, Shop, Field and Maintenance Painting of Steel (PA 1). Do not stripe using inorganic zinc primer (IOZ). Stripe the IOZ primer between the primer and intermediate coats using the intermediate coating.

Apply the coating using equipment recommended in the Manufacturer's Product Data Sheet, or equal. Apply the coating in a uniform manner without sags, runs or drips.

506.15 **Dry Film Thickness** - Measure and record the DFT of each coat in accordance with PA 2. Record the following:

- A. Gauge type/manufacturer/model
- B. Serial number
- C. Coat/shim used for calibration (e.g., Primer Coat or 5 mil shim)
- D. Measurements/spot average/location
- E. Cure time
- F. Non-conforming areas and determination for correction

Each piece or area presented for acceptance, regardless of size, shall be considered a separate structure for purposes of determining the number of spot measurements to be taken, except that large quantities of small parts and/or secondary framing members coated at the same time may be measured at a lesser frequency, as directed by the Fabrication Engineer. When random DFT testing of a large quantity of small parts and/or secondary framing members results in unacceptable DFT's, the Contractor shall have the option of measuring and documenting the DFT of each piece or removing the coating and/or recoating all pieces represented in the production lot.

506.16 **Touch-up and Repairs** - Touch-up is the repair of minor blemishes, including but not limited to, scratches and abrasions that do not penetrate underlying layers of coating. Perform touch-up using the same coating and methods specified in the Manufacturer's Product Data Sheet. Cure the touch-up coating in the same manner as the original coating.

Repair coating damage that penetrates underlying layers in accordance with the Manufacturer's Product Data Sheet and this Specification. Prepare areas to be repaired in a manner that assures the proper adhesion of each coat. Feather back each damaged layer so that each repair coat is continuous with each corresponding existing coat. The topcoat shall be smooth and uniform in appearance. Repair damaged or unacceptable shop coating before the piece is removed from the paint area.

506.17 **Handling and Storage** - Handle coated members in a manner that avoids damage to the coating. Lift and move members using non-metallic slings,

padded chains and beam clamps, softeners or by other non-injurious methods. Store painted material in a manner that prevents damage to the coating.

Document damage to the coating that is discovered after the product is loaded for shipment to the job site. Minor damage as a result of handling shall be considered field repair unless, in the opinion of the Fabrication Engineer, the damage is the result of negligence or poor handling methods. Damage that is deemed to be the result of negligence or poor handling methods shall be repaired as directed by the Fabrication Engineer.

506.18 **Reserved**

506.19 **Reserved**

HOT-DIP GALVANIZING

506.20 **Description** - This work shall consist of surface preparation and application of hot-dip galvanizing in accordance with the Plans and this Specification. Hot-dip galvanizing shall meet the requirements of AASHTO M 111/ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel (A123), including any applicable requirements listed in Section 2 - Referenced Documents. The minimum average coating thickness grade shall conform to Table 1. The frequency of testing shall be in accordance with Section 6. The choice of the test method is the prerogative of the Contractor. Record the test results and provide them to the Department. Provide certification of compliance and written test results to The Department in accordance with A123 - Section 10.

506.21 **Surface Preparation** - Abrasive blast-clean the steel to a minimum of SSPC-SP 6, Commercial Blast Cleaning (SP6) prior to galvanizing. Grind all corners exposed in the assembled product to a 1/16" radius prior to galvanizing.

506.22 **Repairs** - Repairs to galvanizing shall be in accordance with ASTM A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings (A 780), Annex A1 or A3. Zinc-rich paints for repairs may only be used with approval of the Fabrication Engineer.

506.23 **Top-coating Galvanized Surfaces** - Areas of galvanized surfaces to be top-coated will be described on the Plans or in the Special Provisions.

Do not use chromate quenching or other types of quenching after galvanizing. Remove runs, sags, dross and other deleterious material from surfaces to be painted. Provide a smooth uniform surface, free of heavy build areas or other discontinuities that will Project through the finish coat. Perform repairs to galvanizing in accordance with A 780. Remove visible surface contaminants in accordance with SSPC-SP 1, Solvent Cleaning (SP 1) prior to blast cleaning. Blast-clean surfaces to be coated in accordance with SSPC-SP 7/NACE No.4-Brush-Off Blast-Cleaning (SP 7). Measure the anchor profile in accordance with ASTM D4417 Method C (replica tape). Record the results in a manner acceptable

to the Fabrication Engineer. Assure that the anchor profile corresponds with the anchor profile requirements on the Manufacturer's Product Data Sheet.

- 506.24 **Materials** - Provide materials in accordance with 506.11.
- 506.25 **Mixing and Application** - Mix and apply in accordance with 506.14.
- 506.26 **Dry Film Thickness** - Measure and record the DFT in accordance with 506.15.
- 506.27 **Touch-up and Repairs** - Perform touch-up and repairs in accordance with 506.16.
- 506.28 **Handling and Storage** - Handle and store material in accordance with 506.17.
- 506.29 **Reserved**

THERMAL SPRAY COATING

- 506.30 **Description** - This work shall consist of surface preparation and application of Thermal Spray Coatings (TSC) in accordance with the Plans and this Specification. Application of TSC to steel substrate shall be done in accordance with requirements, recommendations and appendices of the current Joint Standard AASHTO S 8.2: Specification for the Application of Thermal Spray Coating Systems to Steel Bridges (The Standard) and this Specification.

The applicator shall provide copies of application procedures, operator qualifications, QC Manuals and repair procedures.

- 506.31 **Submittals** - Submit an application procedure and QC Plan for review by the Department prior to beginning work. Submit a certified analysis of the feedstock to the Department. Submit sample copies of QC records for review. Submit copies of applicator qualifications, job history, etc. Provide the name and qualifications of the QCI.

- 506.32 **Surface Preparation** - Prior to abrasive blast cleaning, round all corners exposed in the assembled product to approximately a 3/32" radius. A series of tangents to the approximate radius will be considered acceptable. Remove hardened condition on thermal cut surfaces. Abrasive blast clean all surfaces to be coated in accordance with The Standard and SSPC-SP 5, White Metal Blast Cleaning (SP 5). Use SSPC-VIS. 1 as a visual standard to determine acceptable cleanliness. Inspect the substrate immediately before spray application.

The anchor profile shall be per The Standard (minimum 2.5 mils). Measure and record the anchor profile in accordance with ASTM D4417 Method B or C (Replica Tape) or both on each plane to be sprayed or at 120° intervals on pipe or tube. Measure at the frequency in The Standard. Angular blast media shall conform with The Standard. If the anchor profile fails to meet the minimum required profile, re-blast the substrate until the required anchor profile is achieved.

If compressed air is used for abrasive blast cleaning, perform a blotter test in accordance with ASTM D4285 at the beginning of each shift. Empty moisture

traps at the beginning of each shift and at any time thereafter when moisture appears to be present on the substrate. Notify the QAI prior to performing the test in order that the QAI can witness the blotter test.

- 506.33 **TSC Requirements** - The coating thickness shall be a minimum of 14 mils. The DFT on faying surfaces shall not exceed the thickness tested for Class B slip coefficient rating. The TSC shall have a minimum tensile bond per The Standard. Test the tensile bond in accordance with ASTM D4541. The frequency of testing shall be per The Standard. The test location will be as directed by the QAI. The specified tensile force shall be applied to the TSC and removed. If the test does not reveal a failure of the TSC, the tensile bond shall be considered acceptable. Repair or recoat unacceptable work. Tensile testing may be performed on witness panels coated by each technician on each shift TSC is applied; notify the QAI so witness panel coating may be observed.

Perform a bend test as described in The Standard, at the beginning of each shift. If the bend test fails, take corrective action and perform another test. After performing the bend test successfully a number of times, the Fabrication Engineer may reduce the frequency of testing. Document the results of the tensile bond test and bend test and provide the results to the Department. Satisfactory bend test results with 7-12 mils thickness will be acceptable.

The TSC shall have a uniform appearance, free from blistering, cracks, loose particles, or exposed steel substrate when examined with 10-X magnification.

- 506.34 **TSC Application** - Record the batch and lot numbers of the consumables. Measure the environmental conditions in the immediate vicinity of the piece(s) being coated during the coating operation and during the entire cure period for intermediate and top coat. Provide two data loggers capable of measuring ambient humidity and temperature. The data loggers shall come with software that can download the data onto a computer. Print out the data and provide a copy to the QAI for review prior to applying the subsequent coat of paint. Place the data loggers in the immediate vicinity of the coating operation during the entire application and curing cycle. The data will be used to determine that the cure/recoat time requirements for each coat have been met. Failure to comply will result in the coating being cured for the maximum time necessary to assure adequate cure as determined by the Fabrication Engineer.

- 506.35 **Seal Coat and Top Coat Application (Paint)** - Apply a wash primer and/or seal coat of 2 to 3 mils thickness. The seal coat shall be compatible with an epoxy intermediate coat and a polyurethane top coat from the NEPCOAT QPL. Provide certification of compatibility between the seal coat and intermediate coat from the intermediate coat/top coat manufacturer. Top flanges of beams requiring shear connectors shall receive a seal coat only.

- 506.36 **Materials** - Provide materials in accordance with 506.11.

- 506.37 **Mixing and Application** - Mix and apply in accordance with 506.14.

- 506.38 **Dry Film Thickness** - Measure and record the DFT in accordance with 506.15.
- 506.39 **Touch-up and Repairs** - Repair damage to TSC by re-blasting the damaged area and re-applying TSC in accordance with this Specification. Perform touch-up and repairs to paint in accordance with 506.16.

FUSION BONDED EPOXY COATING

- 506.40 **Description** - This work shall consist of surface preparation and application of Fusion-Bonded Epoxy (FBE) coating, in accordance with the Plans and this Specification, including measuring and documenting DFT and testing for holidays and other discontinuities in the epoxy coating. The FBE shall be applied to all surface areas indicated on the Plans.

Perform surface preparation and application of FBE in accordance with the following Specifications:

- A. **Steel pipe pile** - ASTM A972, Fusion Bonded Epoxy-Coated Pipe Pile
 - B. **H-pile and sheet pile** - ASTM A950, Fusion Bonded Epoxy-Coated Structural Steel H-Piles and Sheet Piling
 - C. **Reinforcing steel** - ASTM A775, Epoxy-Coated Steel Reinforcing Bars
- 506.41 **Materials** - The FBE coating shall meet all of the physical and testing requirements of the applicable Specifications above (including Annexes). Provide a certification that identifies the coating, batch or lot number, date of manufacture and test results. Supply patching material from the same manufacturer.
- 506.42 **Surface Preparation** - Prepare the surface(s) in accordance with applicable Specifications listed above. Grind all welds flush on spiral welded pipe pile prior to abrasive blast cleaning.
- 506.43 **Inspection** - The DFT shall be between 12 mils and 20 mils, unless otherwise specified. Measure the DFT using a fixed-probe gauge in accordance with SSPC-PA 2. The testing procedure and reporting shall be in accordance with ASTM G12. The frequency of testing shall be each piece coated, unless a lesser frequency of testing is directed by the Fabrication Engineer.
- After curing, the coating shall be checked for holidays (pinholes not visible to the unaided eye) using a 67½ Volt d-c, wet sponge, holiday, detector, in accordance with the requirements of ASTM G62, Test Methods for Holiday Detection in Pipeline Coatings. An average of more than 5 holidays per foot, in the coated length of a pile, will be cause for rejection of that pile.
- 506.44 – 516.59 **Reserved**
- 506.60 **Method of Measurement** - Protective coating shall be measured by the lump sum, complete and accepted. The coating limits shall be as shown or described in the Contract Documents.

- 506.61 **Basis of Payment** - All work for Protective Coating will be paid for at the lump sum price for the respective item. Payment will be full compensation for all labor, materials and equipment required to complete the surface preparation and coating work, including, but not limited to, coating and cleaning materials, staging or accessing, testing, surface preparation, cleaning, application, curing and repairs.

Payment will be made under:

Pay Item		Pay Unit
506.9102	Zinc Rich Coating System (Shop Applied)	Lump Sum
506.9103	Galvanizing	Lump Sum
506.9104	Thermal Spray Coating (Shop Applied)	Lump Sum
506.9106	Fusion Bonded Epoxy Coating	Lump Sum

SECTION 507 - RAILINGS

- 507.01 **Description** - This work shall consist of furnishing all materials for, and construction of, bridge rail, handrail, barrier mounted bridge rail, and steel approach rail in accordance with these specifications and the lines and grades shown on the Plans.

- 507.02 **Materials** - Materials shall meet the requirements of the following Sections of Division 700 - Materials:

Steel Bridge Rail:	Structural Steel	713.01
	Preformed Pads	713.03
Aluminum Rail:	Preformed Pads	713.03
	Aluminum Railings	716.01

Pipe for Steel Pipe Hand Railing shall conform to the requirements of ASTM A53, Grade A or B.

- 507.03 **Drawings** - The Contractor shall prepare shop detail, erection, and other necessary Working Drawings in accordance with the requirements of Section 105.7 - Working Drawings.

- 507.04 **General** - Anchor bolts or anchor bolt sleeves shall be set with a template and shall be securely placed in their final position prior to the placement of the embedding concrete. Post anchor assemblies shall be installed to within 3/16" of the theoretical horizontal and vertical location. No field drilling will be allowed to install anchor bolts without approval of the Resident. Post bearing areas shall be dressed smooth and true to grade. Prior to post erection, each rail post location shall be finished to the theoretical elevation determined from profile grade, cross slope and curb height and will not be acceptable until it is within 3/16" of the theoretical elevation, as measured at the top of concrete. Preformed pads shall be used to adjust the rail posts for height and alignment. The number of preformed pads supplied shall be 10% more than the theoretical minimum

number required. After erection of the railing, the Contractor shall clean the whole assembly, to present a neat and uniform appearance.

Approach railings shall be positioned so as to provide a neat and smooth transition from the bridge railing to the highway guardrail, without kinks or abrupt change in orientation. Embankment material around the approach rail posts shall be thoroughly compacted. Curbing shall be set flush with the face of the bridge curb.

On 4-bar approach railing installations, the bottom tube rail that extends past the approach railing under the bridge transition guardrail will be considered part of this work. HSS spacer blocks and all hardware to attach bottom rail to guardrail posts will also be considered part of this work.

- 507.05 **Steel Bridge Railing** - Steel railings shall be fabricated in accordance with the requirements of Section 504 - Structural Steel. When called for on the Plans, railings shall be galvanized and/or coated in accordance with Section 506 - Shop Applied Protective Coating - Steel.

Rail bars to be used on a radius of 1,000 ft, or less, shall be curved before the application of any galvanizing and/or coating. Bending tolerance from theoretical horizontal curvature shall be plus or minus $\frac{1}{8}$ " per yard, not to exceed $\frac{1}{2}$ ", total.

- 507.06 **Steel Pipe Hand Railing** - Steel pipe hand railings shall be fabricated in accordance with the requirements of Section 504 - Structural Steel. When called for on the Plans, railings shall be galvanized and/or coated in accordance with Section 506 - Shop Applied Protective Coating- Steel.

- 507.07 **Aluminum Bridge Railing** - Aluminum sections may be sheared, sawed, or milled. Cut edges shall be smooth and free of burrs.

Holes for rivets shall be drilled full size from the solid or sub punched and reamed.

Rivets shall be cold-driven in the "as-received" condition and the driven head shall be of the cone-point type.

Welding shall be done in conformance with the latest edition of AWS Structural Welding Code-Aluminum D1.2 (AWS D1.2). No welding shall be performed before the approval of the appropriate weld procedures. No field welding is permitted.

All welds shall be inspected and conform with AWS D1.2, Clause 5, Inspection. 100% of welds shall be visually examined (VT). In addition to VT, 10% of all partial joint penetration (PJP) and fillet welds shall be dye penetrant tested (PT); locations to be PT examined will be designated by the QAI. 25% of complete joint penetration (CJP) welds shall be either, ultrasonic tested (UT) or PT based on the thinner material in the welded joint; joints with thinner material thicknesses less than 0.25" shall be PT examined and joints with thinner material thickness equal

or greater than 0.25" shall be UT examined. Locations to be UT examined will be designated by the QAI. Extent of testing shall conform with AWS D1.2, Clause 5.

To facilitate bending, aluminum extrusions of Alloy 6061-T6 or 6351-T5 may be heated to a maximum temperature of 400°F for a period of not more than thirty minutes.

Threaded fasteners shall conform to the requirements of ANSI Standard B 1.1, Class 2A for external and Class 2B for internal threads.

- 507.08 **Method of Measurement** - Bridge or Hand Railing will be measured as one lump sum unit, fabricated, delivered, erected, and accepted.

Approach Railing will be measured as one unit for each transition, fabricated, delivered, erected, and accepted.

- 507.09 **Basis of Payment** - Bridge or Hand Railing will be paid for at the Contract lump sum price, complete in place. Payment for galvanizing and/or protective coating, when required, shall be included in the lump sum price.

Approach Railing will be paid for at the Contract unit price for each installation. Such payment includes fabrication and installation of the railing components, attachment to the bridge railing system and guardrail transition, bottom tube rail for 4-bar approach railing, and any related connection hardware.

Payment will be made under:

Pay Item		Pay Unit
507.0811	Steel Bridge Railing, 2 Bar	Lump Sum
507.0812	Steel Approach Railing, 2-Bar	Each
507.08161	Steel Approach Railing, 4-Bar	Each
507.0821	Steel Bridge Railing, 3 Bar	Lump Sum
507.0822	Steel Approach Railing, 3 Bar	Each
507.0831	Steel Bridge Railing, 4 Bar	Lump Sum
507.0841	Steel Pipe Hand Railing	Lump Sum
507.0846	Barrier Mounted Steel Bridge Rail: 1 Bar	Lump Sum
507.0848	Barrier Mounted Steel Bridge Rail: 2 Bar	Lump Sum
507.0951	Aluminum Bridge Railing, Pedestrians	Lump Sum
507.0961	Aluminum Bridge Railing, Pedestrian, with Pales	Lump Sum

SECTION 508 - WATERPROOFING MEMBRANE

- 508.01 **Description** - This work shall consist of furnishing and applying an approved waterproofing membrane to concrete deck surfaces, or other concrete surfaces, with a barrier type membrane in accordance with this specification, other applicable Contract documents and the manufacturer's published recommendations, complete, in place and accepted. Waterproofing membrane shall be either peel and stick sheet waterproofing membrane (sheet membrane)

or torch or spray applied high performance waterproofing membrane (high performance membrane).

508.02 **Materials** - Sheet membrane and high performance membrane shall include all materials, as recommended by the manufacturer, to produce a waterproof barrier on the specified concrete surface. In addition to the membrane, these materials may include primer, hot-applied rubberized asphalt sealer, mastic, flashing, aggregate scatter and tack coat. The list of acceptable sheet membrane products is included on the Department's Qualified Products List (QPL), of Waterproofing Membranes: Standard Systems. The list of acceptable high performance membrane products is included on the Department's QPL of Waterproofing Membranes: High-Performance (Spray Applied) or High Performance- (Torch Applied).

508.04 **Construction - General** - The Contractor shall store and install the membrane and all associated components in accordance with the manufacturer's published recommendations.

Existing membrane waterproofing remaining on structures to be rehabilitated shall be completely removed to the primed surfaces. At the discretion of the Resident, tightly adhered membrane residue that cannot reasonably be removed by scraping using industry standard practices, may be left in place.

Prior to application of primer or installation of membrane: Concrete shall be cured in accordance with applicable Contract requirements; areas where rapid setting patching materials have been placed shall be cured for a minimum of 72 hours, or as recommended by the product manufacturer.

The entire surface of concrete structures specified to receive waterproofing membrane shall be shot blasted to achieve a surface which is clean and free of laitance, oil, grease and any foreign materials, as well as any sharp protrusions or sharp indentations. For superstructure decks, including, but not limited to, precast box beams, voided slabs, and NEXT beams, shot blasting shall be accomplished using self-contained, self-propelled equipment to achieve a consistent anchor profile; areas that are not accessible to self-propelled shot blasting equipment, as determined by the Resident, shall be blasted with appropriate equipment utilizing either mineral grit or steel grit and air pressure sufficient to achieve an acceptable surface profile. Surfaces of structures other than superstructure decks, such as box culverts or arches, that are to receive waterproofing membrane may be high-pressure (minimum of 8,000 psi) water blasted or sandblasted, in lieu of being shot blasted, as approved by the Resident. The Contractor shall have a copy of Technical Guideline No. 03732, published by the International Concrete Repair Institute. The final concrete surface profile shall range between a CSP 1 and a CSP 5, as defined by this Guideline, or as approved by the membrane manufacturer's representative. All surfaces shall then be cleaned to remove all loose dust and debris.

Priming and membraning shall only be done when the air and concrete temperatures are above 40° and the surfaces that are to receive the primer and membrane have a moisture content at, or below, 6%. Primer or membrane shall not be applied or installed until the concrete has been in place for a minimum of 10 Days. The Contractor shall supply a portable electronic moisture meter capable of measuring the moisture content of concrete surfaces in percent. The list of acceptable moisture meters is included on the Department's QPL under Waterproofing Membranes. The moisture meter shall be calibrated annually and a certificate of calibration from the moisture meter manufacturer shall accompany the meter. The Contractor shall perform moisture testing of the concrete substrate using the Contractor- provided moisture meter. Moisture tests shall be performed at locations determined by, and in the presence of, the Resident. Written test results shall be submitted to the Resident prior to beginning the priming and membraning operations.

Membrane shall be installed in a shingled pattern so that water is permitted to drain to the low areas of the structure without accumulating against seams, and pressed or rolled into place to assure bond with the primed surface and to eliminate air bubbles. Lap joints at the beginning and end of rolls shall be staggered with those of adjacent rolls. All overlapping joints shall be sealed in accordance with the manufacturer's recommendations.

Care shall be taken to ensure that the waterproofing membrane is properly sealed around the 1" diameter superstructure deck drains and that the drains are completely opened prior to paving over them. Any drainage slots in the bridge drains shall be opened both before and after placing the bituminous pavement.

Waterproofing membrane over which hot mix asphalt (HMA) pavement will be placed shall receive a bituminous tack coat, in accordance with Standard Specification Section 409, with a coverage rate of between 0.01 and 0.02 gal per square yard. Alternately, if a membrane manufacturer recommends its own tack coat as part of its waterproofing system, then this tack material shall be applied in accordance with the manufacturer's recommendations. Prior to tacking, the membrane shall be clean and free from loose debris, moisture or other contaminants. Membrane surfaces that have been tacked shall be paved within 48 hours of application of the tack coat.

The required laydown temperature of HMA pavement placed on high performance membrane shall be within the tolerances included in the membrane manufacturer's written recommendations, with the target temperature to be at the high end of the given range, but not to exceed 330°F, measured at the HMA pavement plant. Paving operations shall be done in a manner to permit water to drain to the low area of the deck without entrapment. No vehicles, other than the HMA paving equipment, will be permitted on the membrane prior to placing the HMA pavement. The first layer of HMA pavement placed on a superstructure deck shall be placed with an approved rubber mounted bituminous paver of such type and operated in such a manner that the

waterproofing membrane will not be damaged in any way. Paving equipment wheels and tires shall be clean and free from stones or other material that could penetrate the membrane. The tack coat and HMA pavement may be applied immediately after the membrane is installed. For high performance membrane, the primer and membrane shall be applied by a manufacturer certified applicator. Applicators shall be individuals who have been thoroughly trained by the manufacturer, in all aspects of application of the membrane system. Although an individual may be certified as both an applicator and a representative, the individual shall not serve in both capacities at the same time. Upon certification, the manufacturer shall issue a badge to the applicator that includes the manufacturer's name and logo, a current photograph of the applicator, the applicator's full name and the word "Applicator". The text of the badge shall be clearly printed in English. The applicator shall have the badge on and prominently displayed at all times, while installing the membrane system.

The Contractor shall arrange for a manufacturer's representative to be present at all times during the installation of high performance membrane, including application of the primer and tack coat. The representative shall also be present for placement of the HMA binder course over the membrane. The representative shall be readily identified by a photo identification badge, issued by the manufacturer, that includes the manufacturer's name and logo, a current photograph of the representative, the representative's full name and the word "Representative". The text of the badge shall be clearly printed in English. The representative shall have the badge on and prominently displayed at all times, while overseeing this work.

Overlap of side seams and end laps and application procedures not addressed by this specification shall be done in accordance with the membrane manufacturer's published recommendations. Torn or damaged membrane shall be repaired in accordance with manufacturer's recommendations. Blistering of membrane at any time prior to Final Acceptance shall be repaired in accordance with the manufacturer's recommendations. At least 1 week prior to installation of any waterproofing membrane, the Contractor shall submit the manufacturer's written requirements pertaining to overlapping of seams, application procedures, repairing of damaged membrane and treatment of blistering of the membrane, including treatment of blistering either before, during or after the first lift of HMA pavement is placed on the membrane, to the Resident.

- 508.05 **Installation - Sheet Membrane** - All construction joints and all joints between precast concrete elements (e.g., box culverts, three-sided boxes, arches, box beams, voided slabs) shall be double covered with membrane by first applying a sheet with a minimum width of 12", centered along the joint.

The perimeter of all membrane placed in a given Day's operation shall receive a seal of mastic over the edge of the membrane. Areas around drains or protrusions shall be liberally coated with mastic at the edges. When the

membrane is completed, the perimeter shall receive an additional seal of mastic along the edge of the membrane.

- 508.06 **Installation - Torch Applied High Performance Membrane** - The waterproofing membrane shall be heat welded onto the prepared substrate. Care shall be taken to assure that the membrane is completely bonded to the primed surface. The Contractor shall be responsible for protection of adjacent areas. Machines used to apply membrane shall be fully functional, including thermostats.

When the surface area of a superstructure deck is greater than 8,000 square feet, the membrane shall be machine applied. The machine shall be capable of handling rolls of at least 100 square yards, shall be self-propelled and shall be capable of automatically following the edge of previously placed membrane.

Corner detail at edge of superstructure slab/vertical surfaces (e.g., curb or permanent barrier): Membrane material or special flashing shall be installed in corners, in accordance with the manufacturer's recommendations, to within ½" of the top of the HMA wearing surface. In the absence of a manufacturer's recommended flashing or if the manufacturer does not recommend bending membrane material to conform to this corner configuration, then the following procedure shall be used: The membrane shall be heat welded to the slab to within 1" of the vertical surface; the vertical surface shall be protected to prevent damage or permanent discoloring of the vertical surface; the remaining area between the edge of the membrane and the vertical surface shall be completely sealed with hot-applied rubberized asphalt material, meeting the requirements of the membrane manufacturer's recommendations; the hot-applied rubberized asphalt material shall be applied so as to form a complete seal between the membrane and the vertical surface and shall extend up the vertical surface to within ½" of the top of the HMA wearing surface.

Corner detail at end of superstructure slab/vertical surface (e.g., backwall): The waterproofing system shall be placed on vertical surfaces, at the ends of slabs, down the vertical face, a minimum of 1 ft, unless otherwise shown on the Plans.

All joints between buried precast concrete elements (e.g., box culverts, three-sided boxes, arches) shall be double covered with membrane by first applying a strip with a minimum width of 12", centered along the joint.

For superstructure decks: Immediately prior to application of the tack coat, the entire surface of the membrane shall be rolled with a rubber tired roller and any blisters found in the membrane shall be repaired with guidance from the manufacturer's representative, as per the manufacturer's recommendations; similarly, if blisters appear during or after placement of the first lift of HMA pavement, the membrane shall be repaired with guidance from the manufacturer's representative, as per the manufacturer's recommendations.

- 508.07 **Installation - Spray Applied High Performance Membrane** - Spray applied membrane shall be installed in accordance with the manufacturer's recommendations.

Corner detail at edge of superstructure slab/vertical surfaces (e.g., curb or permanent barrier):

- The waterproofing system shall be placed to within ½" of the top of the HMA wearing surface.

Corner detail at end of superstructure slab/vertical surface (e.g., backwall):

- The waterproofing system shall be placed on vertical surfaces, at the ends of slabs, down the vertical face, a minimum of 1 ft, unless otherwise shown on the Plans.

Aggregate scatter shall be applied to the final coat of membrane, in accordance with the manufacturer's recommendations. Materials for aggregate scatter shall be in accordance with the manufacturer's requirements.

508.08 **Method of Measurement** - Waterproofing Membrane will be measured for payment as one lump sum.

508.09 **Basis of Payment** - Waterproofing Membrane will be paid for at the Contract lump sum price, which shall be payment in full for furnishing all materials, labor and equipment, including cleaning of concrete surfaces and providing a moisture meter, and all incidentals necessary to provide a waterproof barrier on the specified concrete surface that is properly adhered to the concrete substrate. Tack coat provided as part of the waterproofing membrane manufacturer's system shall be included in the lump sum price for waterproofing membrane; bituminous tack coat provided in accordance with Standard Specification Section 409 - Bituminous Tack Coat, shall be paid for under Item 409.15 - Bituminous Tack Coat, Applied. Payment for repair of surfaces to which membrane is to be applied shall be paid for separately, when applicable repair items are included in the Contract. Damage to new concrete surfaces, resulting from the Contractor's placement or curing operations, or any damage caused by the Contractor's operations shall be repaired at no cost to the Department.

Payment will be made under:

Pay Item		Pay Unit
508.13	Sheet Waterproofing Membrane	Lump Sum
508.14	High Performance Waterproofing Membrane	Lump Sum

SECTION 509 - STRUCTURAL PLATE PIPES, PIPE ARCHES, ARCHES, AND METAL BOX CULVERTS

509.01 **Description** - This work shall consist of furnishing and installing structural plate pipes, pipe arches, arches, and metal box culverts in accordance with these specifications and in reasonably close conformity with the lines and grades shown in the Contract Documents.

509.02 **Materials** - Material shall meet the requirements of the following Sections of Division 700 - Materials:

Asphalt Filler for Structural Plate Arches	702.09
Steel Structural Plate Pipe, Pipe Arches, Arches, Box Culverts and Fasteners	707.09
Aluminum Alloy Structural Plate Pipe, Pipe Arches, Arches, Box Culverts and Fasteners	707.14

509.03 **Fabrication** - Structural plate pipes shall be circular with a vertical elongation of approximately 5%, unless otherwise specified on the Plans.

Plates shall be formed to provide lap joints for bolted assembly. Joints shall be staggered so that no more than three plates come together at one point.

Bolt holes shall be made so that all plates having like dimension, curvature and the same number of bolts per foot of seam shall be interchangeable. Each plate shall be curved, before assembly, to the radius necessary to produce the final cross section called for.

End plates shall be neatly cut to the skew and slope shown on the Plans. Burnt edges shall be free of oxide and burrs, and shall be completely galvanized.

Special plates and part plates shall be legibly marked to correspond to markings on an erection/assembly diagram, which shall be furnished by the Contractor.

The Contractor shall prepare and submit Shop Drawings, erection/assembly diagrams, or other necessary Working Drawings in accordance with Section 105.7. These drawings will be reviewed and approved in accordance Section 105.7.

Bolt holes along those edges of the plates that will form longitudinal seams in the finished structure shall be staggered in 2 rows, 2" apart for steel structural plates and shall be in 2 rows, 1¾" apart for aluminum structural plates. Holes shall be in the valley and crest of the corrugations. Bolt holes along those edges of the plates that will form circumferential seams in the finished structure shall be no more than 12" apart. The distance from the center of a hole to the edge of the plate shall not be less than 2 times the diameter of the bolt. The nominal diameter of the bolt holes, not including corner holes in the longitudinal seam, shall be ⅛" greater than the diameter of the bolts.

509.04 **General** - Excavation for the structure and for the bedding material shall be in conformance with Section 206 - Structural Excavation.

Structures shall be assembled in the sequence and manner recommended by the manufacturer and in such a way that no distortion of plates would occur.

Bolts of the manufacturer's recommended length shall be used in all holes. Nuts shall be tightened to 200 ft-lb, plus or minus 100 ft-lb, of torque. Aluminum nuts, used with aluminum structural plate structures, shall be tightened to 125 ft-lb, plus or minus 10 ft-lb of torque. Any nuts loosened by subsequent procedures shall be retightened.

The Contractor shall provide the Resident with a calibrated torque wrench for use during construction. The Contractor shall provide proof to the Resident that the torque wrench has been calibrated within the past 6 months.

Steel plates or accessory materials, on which the zinc metallic coating has been burned by welding or has otherwise been damaged in fabrication or handling, shall be repaired in the field. The Resident shall determine if repairs are needed to the coating and will mark the areas to be repaired. The damaged areas shall be cleaned to bright metal by blast cleaning, power disk sanding, or wire brushing. The cleaned areas shall extend ½" into the undamaged section of the coating. The cleaned areas shall be coated within 24 hours of the cleaning using an approved zinc-rich paint. The zinc-rich paint shall be applied to a dry film thickness of at least 0.005" over the damaged sections and surrounding cleaned areas.

The Contractor shall maintain a minimum cover of 3 ft over the top of the structure where construction equipment is used, or traffic is maintained.

- 509.05 **Structural Plate Pipes and Pipe Arches** - The use of cofferdams and dewatering of the stream will not be a requirement for the installation of pipes and pipe arches unless otherwise specified in the Contract Documents. Prior to placing the structure or any plates, the bed shall be brought to the required line and grade and shaped to its required section, as much as practicable. When practicable, the pipe or pipe arch shall be moved back and forth longitudinally on the bedding material to shape and compact the bedding material prior to releasing the structure in its final position. The bedding material and structure shall not be placed at times of high water. The Contractor shall obtain approval before placing the bedding material and the structure.

The specified bedding material may be omitted if the existing material under the pipe is suitable.

When not otherwise specified in the Contract Documents, backfill shall be a selected material of a granular nature with a minimum of clay. It shall contain neither frozen material, vegetable matter nor anything that will not pass through a 3" square opening screen. The 3" size limitation shall not apply to areas 5 ft or more from the structure. When Granular Borrow is called for in the Contract Documents to be placed around Structural Plate Pipes and Pipe Arches, Granular Borrow, Material for Underwater Backfill, shall be used.

Fill material shall be deposited evenly on both sides of the structure in layers not exceeding 6" in depth, loose measure, until the three-quarter point is reached. It shall be thoroughly compacted under the pipe or pipe arch, on both sides of the structure. Above the three-quarter point, fill layers shall not exceed a depth of 8", loose measure. Backfilling and compacting shall be done in the presence of the Resident.

- 509.06 **Structural Plate Arches** - Structural plate arches shall be anchored to the concrete substructure by unbalanced channels, as shown on the Plans. When

erection is complete and before any backfilling is done, the spaces between the structural plates and the legs of the unbalanced channels, on both sides, shall be completely filled with asphalt filler. Aluminum channels used with aluminum structural plate structures shall not be in direct contact with concrete. An appropriate material, approved by the Resident, shall be used between the aluminum channel and the concrete.

When backfilling arches before headwalls are built, a narrow ramp of backfill material shall be built up evenly at each side of the arch and midway between its ends until a minimum cover of 3 ft over the top of the arch is reached. The backfill material used in the ramps shall be thoroughly compacted as it is placed. The remainder of the backfill shall be deposited from the top of the ramp, both ways from the center toward the ends as evenly as possible on the sides of the arch.

If the headwalls are built before the arch is backfilled, the same procedure as above shall be followed, except that the backfill material shall first be placed in the form of a narrow ramp adjacent to one headwall. When the aforementioned height above the arch is reached, the backfill material shall be deposited from the top of the ramp toward the other headwall.

In all cases, the filling material shall be thoroughly, but not excessively, compacted. Compacting the backfill by means of flooding or ponding the material with water will not be permitted.

- 509.07 **Structural Plate Box Culverts** - Box culverts shall be assembled in accordance with the Shop Drawings provided by the manufacturer and per the manufacturer's recommendations. The box culverts shall be installed in accordance with the Contract Documents and the manufacturer's recommendations. End treatments and the type of invert and/or foundation shall be as indicated on the Plans. The Contractor shall use caution during backfilling operations so that any anchor rods attached to the headwalls and wingwalls are not damaged.

Structural plate box culverts on concrete substructures shall be anchored to the substructure by unbalanced channels as shown on the Plans. When erection is complete and before any backfilling is done, the spaces between the structural plates and the legs of the unbalanced channels, on both sides, shall be completely filled with asphalt filler meeting the requirements of 702.09. Aluminum channels used with aluminum structural plate structures shall not be in direct contact with concrete. An appropriate material approved by the Resident shall be used between the aluminum channel and the concrete.

- 509.08 **Method of Measurement** - Structural plate pipe, pipe arches, arches and plate box culverts will be measured as one lump sum.

- 509.09 **Basis of Payment** - The accepted structure will be paid for at the respective Contract lump sum price, which price shall be full compensation for: Preparation of the bed for pipes and pipe arches; the asphalt filler and unbalanced channel for arches and metal box culverts; the horizontal end reinforcing ribs for

aluminum alloy structural plate pipe and pipe arches; the headwalls, wingwalls, toe-walls, full metal invert and/or footing pads for metal box culverts; anchor bolts embedded in concrete; the receiving channels for metal box culverts on concrete substructures; and all incidental items required to complete the work, including, but not limited to, the calibrated torque wrench for use by the Resident.

Reinforced concrete headwalls and wingwalls are not included for payment under this item.

Whenever the minimum cover material extends above the subgrade line, the removal of the material which is necessary to complete the work in accordance with the Plans will be measured and paid for as Common Excavation as provided in Section 203 - Excavation and Embankment.

Payment will be made under:

Pay Item		Pay Unit
509.11	Steel Structural Plate Pipe	Lump Sum
509.12	Steel Structural Plate Pipe Arch	Lump Sum
509.13	Steel Structural Plate Arch	Lump Sum
509.141	Steel Structural Plate Box Culvert	Lump Sum
509.18	Aluminum Alloy Structural Plate Pipe	Lump Sum
509.19	Aluminum Alloy Structural Plate Pipe Arch	Lump Sum
509.20	Aluminum Alloy Structural Plate Arch	Lump Sum
509.411	Aluminum Structural Plate Box Culvert	Lump Sum

SECTION 510 - SPECIAL DETOURS

- 510.01 **Description** - This work shall consist of the design, construction, maintenance in good condition and removal of temporary structures and approaches required for the satisfactory maintenance of vehicular and pedestrian traffic.

Easements or right-of-way for the Special Detour will be furnished by the Department and will be shown on the Contract Plans. If the Contractor proposes an alternative location for the Special Detour, and the alternative location is approved by the Department, that easement may only be acquired by the Department. All additional costs associated with the acquisition, including, but not limited to, obtaining easements, environmental mitigation, restoration and Department time, shall be borne by the Contractor.

- 510.02 **Materials** - Materials used for the Special Detour structure and approaches shall conform to the detailed plans and specifications submitted by the Contractor.
- 510.03 **Vehicular and Pedestrian Traffic Not Separated** - The Special Detour shall be located as close as practicable to the new Work, or as shown on the Plans.

The Special Detour, including the temporary structure and approaches, shall be designed and sealed by a Professional Engineer, licensed in accordance with the laws of the State of Maine. The Contractor shall submit the design computations and detailed plans of the temporary structure and approaches that will serve as the Special Detour to the Department for review prior to beginning construction of the Special Detour. Review will be according to Section 105.7 - Working Drawings.

If the Department requires changes to the Special Detour plans or computations, based on Contract requirements, then the Contractor shall implement the changes at no additional cost to the Department.

The Department shall have no obligation to review or comment on any design, construction, maintenance or removal of Special Detours. No review or comment by the Department, or any lack of review or comment by the Department, shall relieve the Contractor of its responsibility to properly design, construct, maintain in good condition, and remove Special Detours in accordance with the Contract, or shall shift any responsibility to the Department. The Contractor shall be responsible for all damages resulting from the failure of temporary structures or approaches.

The Special Detour shall not be opened to traffic until the Contractor's Professional Engineer inspects the temporary structure and provides the Department with a signed and sealed document certifying that the structure was built in accordance with the previously submitted sealed plans and design details of the structure and approaches.

510.031 **Structure Design** - Temporary structures shall be designed in accordance with the current edition of the AASHTO LRFD Bridge Design Specifications, except as noted herein, and meet live load requirements of HL-93, Maine Modified. Overstress will not be permitted for any structural or foundation element. Structural elements considered as bracing shall be proven by calculation to meet strength and stiffness requirements.

- a. **Deflections** - Primary structural members shall be designed so that deflection due to live load plus impact shall not exceed $1/300$ of the span.
- b. **Fatigue Stresses** - Fatigue stresses for steel need not be considered if the steel is judged by the Contractor's Professional Engineer to be in sound structural condition.
- c. **Bridge Railing Loads** - Bridge railing shall be designed in accordance with the current edition of the AASHTO LRFD Bridge Design Specifications meeting the geometry and load demands of Test Level 3.

- d. **Waterway Opening** - The minimum waterway opening of the temporary structure shall be designed to pass the Design Discharge indicated in the Contract Specifications, without any overtopping of the roadway.
- e. **Foundations** - Temporary foundations, embankment foundations and earth retaining structures shall be designed in accordance with the current edition of the AASHTO LRFD Bridge Design Specifications and AASHTO LRFD Bridge Construction Specifications, except as noted herein. The Contractor is responsible for determining the ultimate load carrying capacity of the foundation materials and foundation elements for the Special Detour. The determination of the ultimate load carrying capacity may require characterization of the subsurface conditions by the Contractor by means of subsurface investigation.

Foundations shall be designed for all applicable loads, forces, and load combinations. Load and force assumptions as well as load and resistance factors used for each foundation design shall be clearly stated in the submitted calculations.

510.032 **Geometric and Approach Design** - The geometric design of the Special Detour, except as otherwise shown on the Plans or as noted herein, shall be designed in accordance with the current AASHTO Specification "A Policy on Geometric Design of Highways and Streets."

- a. **Horizontal Alignment** - Horizontal curve radius shall not be less than 200 ft at the centerline of roadway, except as otherwise shown on the Plans.

The minimum roadway width, that is the clear distance between rails or curbs, shall be as indicated in the Contract. The approach roadway shall have a minimum of 2 ft wide shoulders, to the roadway berms, where guardrail is not required, in addition to the minimum roadway width stated above.

The roadway width shall be increased on curved portions of the Special Detour to account for the off tracking characteristics of a WB-62 vehicle in accordance with the AASHTO publication "A Policy On Geometric Design of Highways and Streets," Chapter 3 tables entitled "Derived Traveled Way Widths for Turning Roadways for Different Design Vehicles" and "Design Widths of the Traveled Way for Turning Roadways."

- b. **Vertical Alignment** - Grades shall not exceed 10% and any change in grade shall accommodate all legal highway vehicle components or attached loads.
- c. **Approach Road Guardrail** - The Special Detour approaches shall have guardrail or concrete barrier where side slopes are steeper than 3 horizontal to 1 vertical, or as specified on the Plans. Approach guardrail shall be Type 3 guardrail or an approved equal and shall be attached to the bridge rail in a manner that develops the guardrail in tension. Approach barrier shall be attached to the bridge rail with a rigid connection with a similar strength capacity to the bridge rail. If the Plans specify a type of rail or barrier, that type shall be used.

The termination of approach guardrail or barrier and the end treatment of the rail shall be in accordance with the current AASHTO Roadside Design Guide.

- d. **Approach embankments** - The earth material used for approach embankments shall have sufficient strength under the placement method specified in the Contractor's plans to maintain stability throughout the duration of the Special Detour.
- e. **Approach Road Base Drainage** - The approach road base structure shall consist of a 1 ft thick layer, minimum, of aggregate subbase course gravel, Type D or E. This layer shall be designed to support legal loads during the use of the detour. Drainage shall be designed to drain the approach area.
- f. **Approach Road Surface** - The approach road surface, including the shoulders, shall be paved with a 3", minimum, thickness hot bituminous pavement layer, except when specified to be a gravel surface. When a gravel surface is specified, it shall consist of an approved gravel.
- g. **Design Speed** - The design speed of the Special Detour shall be not less than the construction area posted speed limit, or the advisory speed limit, as applicable, unless otherwise indicated in the Contract.

510.04 ***Pedestrian Traffic Only*** - The provisions of Section 510.03 - Vehicular and Pedestrian Traffic Not Separated, shall apply to this Section with the following modifications:

- a. Structures shall be designed for a live load of 75 lb/ft² (unfactored).
- b. The Special Detour shall have a minimum clear width of 5 ft or as specified in the Contract.
- c. Vertical alignment and ramps shall be ADA compliant.
- d. Deflections due to live load shall not exceed 1/300 of the span.

510.05 ***Vehicular and Pedestrian Traffic Separated*** - The provisions of both Section 510.03 - Vehicular and Pedestrian Traffic Not Separated, and Section 510.04 - Pedestrian Traffic Only, shall apply to this Section. If vehicles and pedestrians are carried on the same structure, each shall have its own lane as specified. The pedestrian lane shall be protected from vehicular traffic by being at least 9" above the roadway surface or suitably protected by means of an adequate curb at least 9" in height above the roadway surface. No bridge rail will be required between vehicle traffic and pedestrian traffic, unless otherwise specified, but shall be located at the exterior side of the pedestrian lane.

510.06 ***Special Detour Construction*** - The Special Detour, including temporary structures and approaches, shall be constructed in accordance with the plans submitted by the Contractor. Barricades, warning signs, lights and other traffic control devices shall be provided in accordance with the Contract and the approved Traffic Control Plan.

The deck and floor members of the temporary structure shall be fastened or anchored so that all contact surfaces with adjacent supporting members bear continuously. If timber plank decking is used, it shall be secured into timber nailer strips with screw-type nails, or securely fastened by an alternate method that will prevent the decking from loosening. Immediate corrective action shall be taken by the Contractor to remedy any condition in the structure that results in objectionable or distractive noise levels, or results in the decking becoming loose, when subject to traffic loads.

Screw-type nails will not be required to anchor timber plank decking for pedestrian traffic use.

The approach road surface, including shoulders, whether paved or graveled, shall be maintained in a compacted and smooth condition. The temporary structure travel surface shall be constructed and maintained in an acceptably smooth condition, as determined by the Resident. Immediate corrective action shall be taken by the Contractor to remedy objectionable roughness of the Special Detour riding surface.

Provisions shall be made for a skid resistant wearing surface throughout the period of time the temporary structure is open to public travel for vehicular and pedestrian traffic. A steel grid floor may be used for vehicular traffic if installed in accordance with the design plans and these specifications.

Erosion control shall be accomplished in accordance with Section 656 - Temporary Soil Erosion and Water Pollution Control.

When the Project has been opened to traffic, the temporary structure and approaches shall be removed to, or below, the streambed, finish ground line or original ground line, as applicable. All approach materials shall be removed and the disturbed areas shall be stabilized to original, or better than original, conditions. The provisions of Section 104 - General Rights and Responsibilities, shall apply.

510.07 **Contractor's Responsibility** - The Contractor shall be responsible for removal of snow from areas provided for pedestrian traffic as well as vehicular traffic in accordance with Section 105 - General Scope of Work. In addition to normal maintenance, should any part, or all, of the Special Detour be damaged or destroyed by high water, or any other cause, prior to, or after, opening the Special Detour to traffic, it shall be repaired or replaced by the Contractor without additional compensation.

510.08 **Method of Measurement** - Special Detours will be paid by the lump sum.

510.09 **Basis of Payment** - The accepted Special Detour will be paid for at the Contract lump sum price which price shall be full compensation for the respective items, as called for in the Contract, including design, construction, maintenance, complete removal, rehabilitation and permanent stabilization including loaming, seeding and mulching. All gravel or borrow material and excavation needed to accommodate changes in elevation between temporary structures and existing roadways shall be incidental to this item. All guardrail or concrete barrier required solely for the Special Detour shall be incidental to this item. The lump sum price shall also include the cost of furnishing and revising, as necessary, all plans, computations and certifications, as called for in the Contract. Payment will be made as follows:

- 60% of the lump sum price will be paid when the Special Detour is acceptable and open to traffic;
- another 20% of the lump sum price will be paid when the Special Detour is no longer needed and is closed to traffic;
- the final 20% of the lump sum price will be paid when the Special Detour is removed and the area encompassing the Special Detour is acceptably restored.

Traffic control devices, work zone crash cushions, temporary erosion control, pavement, and dust control will be paid for in accordance with the applicable Contract items

Payment will be made under:

Pay Item		Pay Unit
510.10	Special Detour, Vehicular and Pedestrian Traffic Not Separated	Lump Sum
510.11	Special Detour, Pedestrian Traffic Only	Lump Sum
510.12	Special Detour, Vehicular and Pedestrian Traffic Separated	Lump Sum

SECTION 511 - COFFERDAMS

- 511.01 **Description** - This work shall consist of the complete design, construction, maintenance and removal of cofferdams and other related work, including dewatering and inspection, required to allow for the excavation of foundation units, to permit and protect the construction of bridge or other structural units and to protect adjacent Roadways, embankments or other structural units, in accordance with the Contract.
- 511.02 **Materials** - As specified in the cofferdam Working Drawings.
- 511.03 **Cofferdam Construction**
- A. **Working Drawings** - The Contractor shall submit Working Drawings, showing the materials to be used and the proposed method of construction of cofferdams to the Department. Construction shall not start on cofferdams until such Working Drawings have been submitted. Any review of or comment on, or any lack of review of or comment on, these Working Drawings by the Department shall not result in any liability upon the Department and it shall not relieve the Contractor of the responsibility for the satisfactory functioning of the cofferdam.
 - B. **Construction** - Construct cofferdams in conformance with the submitted Working Drawings. Cofferdams shall, in general, be carried below the elevation of the bottom of footings to adequate depths to ensure stability and adequate heights to seal off water. Cofferdams shall be braced to withstand pressure without buckling, secured in place to prevent tipping or movement and be as watertight as necessary for the safe and proper construction of the substructure Work inside them. With the exception of construction of a concrete foundation seal placed under water, the interior dimensions of cofferdams shall provide sufficient clearance for the construction and inspection of forms and to permit pumping outside of forms. The Contractor shall be responsible for the righting and resetting of cofferdams that have tilted or moved laterally, as required for construction.

During the placing and curing of seal concrete, maintain the water level inside the cofferdam at the same level as the water outside the cofferdam, to prevent flow through the concrete.

No timber or bracing shall be used in cofferdams in such a way as to remain in the substructure Work.

Cofferdams shall be constructed to protect fresh concrete against damage from the sudden rising of the water body, to prevent damage by erosion and to prevent damage to adjacent Roadways, embankments or other structural units.

Unless otherwise noted, cofferdams, including all sheeting and bracing involved, shall be removed after the completion of the substructure work in a manner that prevents disturbance or injury to the finished Work.

Cofferdams shall be constructed, dewatered and removed in accordance with the requirements of Section 656 - Temporary Soil Erosion and Water Pollution Control and related Special Provisions.

- C. **Inspection of Seal Cofferdams** - Seal cofferdam excavations shall initially be inspected and approved by the Contractor.

For each seal cofferdam excavation, the Contractor shall submit a written procedure to the Resident for sediment/overburden removal and excavation inspection. For cofferdams where seal concrete is to be placed on bedrock, the inspection procedure shall describe the Contractor's final cleaning and inspection process for attaining cleanliness of each cofferdam excavation. For cofferdams where seal concrete is not excavated to bedrock, the procedure shall describe the Contractor's final cleaning and inspection process for attaining the bottom of seal elevation shown on the Plans.

The Contractor shall notify the Resident at least 48 hours prior to when each seal cofferdam excavation will be ready for final inspection by the Department. The Contractor shall allow adequate time for each occurrence of cofferdam excavation inspection by the Department. The Contractor shall provide and maintain access and equipment, such as steel probes, for the Resident and/or the Department's Dive Team to independently inspect each cofferdam excavation.

No seal concrete placement shall begin until the Department has approved the cofferdam excavation.

- 511.04 **Pumping** - Pumping from the interior of any cofferdam shall be done in such a manner as to prevent any current of water that would carry away or segregate the concrete.

Pumping to dewater a sealed cofferdam shall not commence until the seal concrete has set sufficiently to withstand the hydrostatic pressure and meets the

following minimum curing time, after the completion of the installation of the seal concrete:

1. When the temperature of the water body outside the cofferdam is greater than 40°F, a minimum of 5 Days.
2. When the temperature of the water body outside the cofferdam is less than 40°F, a minimum of 7 Days.

Procedures for the removal of all water and materials from cofferdams shall be described in the Soil Erosion and Water Pollution Control Plan as required in Section 656 - Temporary Soil Erosion and Water Pollution Control and related Special Provisions.

511.05 **Method of Measurement** - Cofferdams will be measured as one lump sum unit, as indicated on the Plans or called for in the Contract.

511.06 **Basis of Payment** - The accepted quantity of cofferdam will be paid for at the Contract lump sum price for the respective cofferdam items, which price shall be full compensation for design, construction, maintenance, inspection and removal.

When required, the elevation of the bottom of the footing of any substructure unit may be lowered, without change in the price to be paid for cofferdams. However, if the average elevation of more than 25% of the area of the excavation is more than 3 ft below the elevation shown on the Plans, and if requested by the Contractor, then the additional costs incurred that are included in the cofferdam Pay Item will be paid for in accordance with Section 109.7 - Equitable Adjustments to Compensation and Time. The Contractor shall immediately notify the Department when these additional costs commence. Failure of the Contractor to provide this notification will result in undocumented additional work that will be non-reimbursable. The Department will evaluate this additional work to determine an appropriate time extension, if warranted.

All costs for sedimentation control practices, including, but not limited to, constructing, maintaining, and removing sedimentation control structures, and pumping or transporting water and other materials for sedimentation control will not be paid for directly, but will be considered incidental to the cofferdam Pay Item(s).

All costs for related temporary soil erosion and water pollution controls, including inspection and maintenance, will not be paid for directly, but will be considered incidental to the cofferdam Pay Item(s).

All costs associated with preparation of Working Drawings, design calculations, written procedure for sediment/overburden removal and excavation inspection, and the inspection of the seal cofferdam excavation shall be considered incidental to the cofferdam Pay Item(s). There shall be no additional payment for repeated inspection by the Department of the same cofferdam excavation.

All costs for cofferdams and related temporary soil erosion and water pollution controls, including inspection and maintenance, will be considered incidental to related Pay Items, when a specific Pay Item for cofferdams is not included in the Contract.

Seal concrete will be evaluated under Section 502.

Payment will be made under:

Pay Item		Pay Unit
511.07	Cofferdam	Lump Sum

SECTION 512 - FRENCH DRAINS

512.01 **Description** - This work shall consist of furnishing, placing and compacting stone and gravel and furnishing and placing erosion control geotextile for French drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown in the Contract.

512.02 **Materials** - Materials shall meet the requirements of the following Sections of Division 700 - Materials.

Aggregate for Subbase	703.06(b)
Gravel Borrow	703.20
Stone for French Drains	703.24
Erosion Control Geotextile	722.03 (Class
1)	

Gravel for French drains shall meet the requirements of either Aggregate for Subbase, Type D, or Gravel Borrow, at the Contractor's option.

512.03 **Drains** - Stone shall be placed behind and against the structures with the bottom of the stone at the elevation of the flow line of the weeper drains. The stone shall form a box section, 2 ft wide and 2 ft high, for the entire length of the structure. Erosion control geotextile shall be installed to separate the stone box section from the surrounding gravel. Installation of the erosion control geotextile shall be in accordance with Section 620 - Geotextiles. Gravel shall be placed to form a box section around the stone, to the limits of 2 ft above the stone, 2 ft behind the stone and 2 ft below the stone, but not to be placed below the top of the footing.

Gravel for French drains shall be compacted to the same requirements as the adjacent embankment.

512.04 **Method of Measurement** - French drains will be measured as one lump sum unit, satisfactorily placed and accepted.

Excavation for French drains will be measured for payment in accordance with Section 206 - Structural Excavation.

- 512.05 **Basis of Payment** - French drains will be paid for at the Contract lump sum price, complete in place.

Payment will be made under:

Pay Item		Pay Unit
512.081	French Drains	Lump Sum

SECTION 513 - SLOPE PROTECTION

- 513.01 **Description** - This work shall consist of excavating for, and placing of, a protective covering on designated slopes in accordance with these specifications and in reasonably close conformity with the lines, grades and thickness as shown in the Contract.

- 513.02 **Materials** - Materials shall meet the requirements of the following Sections of Division - 700 Materials.

Crushed Stone 703.31

Reinforcing Steel 709.01

Portland Cement concrete for slope protection shall be Class "A" and shall meet the requirements of Section 502 - Structural Concrete.

- 513.03 **Portland Cement Concrete** - The slope on which the reinforced concrete for slope protection is to be placed shall be free of frost and frozen material and shall be well compacted. If additional fill material is required to bring the slope to the proper grade, it shall be of the same type material as that required for the slope protection foundation. Immediately prior to placing the concrete, the area to be covered shall be thoroughly dampened.

The Portland Cement concrete shall be placed in alternate sections. Each individual section shall be placed by starting at the lowest extremity of the section and progressing upward on the slope. The reinforcement shall not extend through the construction joints and the bond between sections shall be broken by the application of approved asphalt cement on the edges of the previously placed slabs.

The surface of the concrete shall be float finished in accordance with the requirements of Section 502 - Structural Concrete and textured by applying a uniform light broom finish using an approved broom. An edging tool shall be used on the surface edges of each section and a groover at the transverse centerline of each section. The exterior surface from the edging or grooving shall be finished to match the interior surface.

Construction procedures shall be in accordance with Section 502 - Structural Concrete.

- 513.04 **Crushed Stone** - Crushed stone shall be placed on granular material as shown on the Plans. The finished slope shall be worked to present a smooth and uniform surface.
- 513.05 **Drains or Weep Holes** - Drains or weep holes through the slope protection shall be pipe of the size and shape shown on the Plans and shall be constructed of approved cast iron, tile, fiber or other material that will maintain its shape and alignment during placement of the concrete. Care shall be taken not to cover the drains when installed, or when concrete is placed.
- 513.06 **Method of Measurement** - Slope protection will be measured by the number of square yards of surface area acceptably covered in accordance with the Contract.
- 513.07 **Basis of Payment** - The accepted quantity of slope protection will be paid for at the Contract unit price per square yard. Payment will be full compensation for excavating, shaping and compacting the slope prior to placing bedding and slope protection and shall also include the bedding material. Excavating from original ground to the face of the slope protection will be paid under the appropriate Contract item.

Payment for Portland Cement concrete slope protection shall be full compensation for furnishing and placing all material, including reinforcement, and for all labor and other incidentals, including drains and weep holes, necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
513.09	Slope Protection - Portland Cement Concrete	Square Yard
513.22	Crushed Stone Slope Protection	Square Yard

SECTION 514 - Reserved

SECTION 515 - PROTECTIVE COATING FOR CONCRETE SURFACES

- 515.01 **Description** - This work shall consist of furnishing and applying a protective coating on concrete surfaces as called for on the Plans or as designated by the Resident in accordance with these specifications and the manufacturer's published recommendations.
- 515.02 **Materials** - Materials shall meet the requirements of Type 1c penetrating silane concrete sealers, and be listed on the Department Qualified Products List (QPL).
- 515.03 **Surface Preparation** - On surfaces to be treated, all voids shall be filled with mortar and the entire surface shall be dressed by dry rubbing to remove form marks and blemishes to present a neat appearance. The concrete shall remain

dry for at least 48 hours before treatment and shall be free of laitance, oil, grease, dirt, dust, curing compound or any other deleterious materials. All traces of dust shall be removed immediately before applying the silane sealer.

The treatment shall not be done until at least 14 Days after casting the concrete, or in accordance with the manufacturer's published recommendations, and completed at least 24 hours before the treated portion is opened to traffic.

- 515.04 **Application** - The application rate and method of application shall be in accordance with the manufacturer's published recommendations.

When practical, treatment of the concrete surfaces shall be completed before exposure to deicing salts. The temperature of the concrete to be treated shall be above 40°F at the time of application, or per the manufacturer's published recommendations.

- 515.05 **Method of Measurement** - Protective coating for concrete surfaces will be measured for payment by the square yard or lump sum unit as specified, satisfactorily applied and accepted.

- 515.06 **Basis of Payment** - Protective coating for concrete surfaces will be paid for at the Contract unit price per square yard or lump sum, as specified.

Payment will be made under:

Pay Item		Pay Unit
515.20	Protective Coating for Concrete Surfaces	Square Yard
515.21	Protective Coating for Concrete Surfaces	Lump Sum

SECTION 516 - STYRENE-BUTADIENNE LATEX MODIFIED PORTLAND CEMENT MORTAR AND CONCRETE - Reserved

SECTION 517 – SHOTCRETE - Reserved

SECTION 518 - STRUCTURAL CONCRETE REPAIR

- 518.01 **Description** - This work shall consist of repairing existing structural concrete as shown on the Plans and/or as directed by the Resident. Repairing structural concrete shall include removal and disposal of deteriorated concrete, cleaning exposed reinforcing steel, cleaning of concrete surfaces in repair areas, application of bonding agent and placing and curing repair material. All work shall be in conformance with applicable provisions of Sections 202, 502, and 503.

Upward Facing Surfaces are defined as any concrete surfaces where the slope is less than or equal to 15% from the horizontal. Overhead Surfaces are defined as

any concrete surfaces where the slope is overhanging more than 15% from plumb. All other surfaces shall be defined as Vertical Surfaces.

518.02 **Repair Materials** - A material that has been AASHTO Product Evaluation & Audit Solutions tested and from the Department's Qualified Products List (QPL) of Rapid Setting Concrete Patching Materials may be used instead of concrete for any depth of placement, at the Contractor's option, providing that all requirements of the manufacturer's published recommendations are met. All materials used for repair of concrete or reinforcing steel shall meet the applicable requirements of Division 700 as specified in Standard Specification Sections 502 and 503, respectively. When concrete is used as the repair material, it shall conform to the requirements of Table 1 of Section 502.05 for Class A Concrete.

Where the depth of placement is equal to or greater than 1", the Contractor may use concrete as the repair material. When concrete is used, the coarse aggregate shall conform to the requirements of the table below and Standard Specification Section 703.02 - Coarse Aggregate for Concrete, or 703.03 - Combined Aggregate Grading for Concrete.

Where the depth of placement is equal to or greater than 1", the Contractor may use concrete as the repair material. When concrete is used, the coarse aggregate shall conform to the requirements of the following tables.

Thickness of Placement			
Coarse Aggregate Gradation Designation	1 to 3"	3 to 6"	> 6"
SP-1-7	X		
SP-1-78	X		
SP-2-8	X		
SP-2-89	X		
Class AA		X	
Class A or AA		X	X

A bonding material shall be used for bonding fresh concrete or patching material to existing hardened concrete. The bonding material shall consist of the following, except that, in the case where patching materials from the QPL are used in the repair areas, the manufacturer's published recommendations regarding application and use of bonding materials shall take precedence:

- a) **For repair of Upward Facing Surfaces** - the bonding grout shall have Portland Cement and fine aggregate proportioned 3 to 1, respectively, by volume. The fine aggregate shall be from the same source as that used in the repair concrete. All material greater than 1/8" shall be removed from the fine aggregate. The sand and cement shall be measured separately in equal sized containers. The sand shall be added prior to the cement. Water shall be added during the mixing process a little at a time until

sufficient water has been added to result in a workable consistency. A workable consistency is defined as the minimum water necessary to allow flow of most of the grout without segregation of the grout ingredients. Alternately, the Contractor may use a product from the Department's QPL of Concrete Bonding Agents in accordance with the manufacturer's published recommendations.

- b) ***For repair of Vertical and Overhead Surfaces*** - the Contractor shall use a product from the Department's QPL of Concrete Bonding Agents, in accordance with the manufacturer's published recommendations.

518.03 ***Removal of Unsound Concrete*** - Removal of existing concrete shall be accomplished without damage to the portion of the structure that is to remain. The deteriorated or delaminated concrete shall first be removed from areas designated by the Resident. The initial classification of an area as sound concrete does not prevent its subsequent reclassification upon further inspection. After the initial removal of unsound concrete, the Resident shall inspect the area again to determine whether additional areas of unsound concrete were revealed by removal operations and if additional concrete removal is required in the areas to be repaired. This process shall continue until additional areas of unsound concrete are not revealed. After the Resident has determined that the deteriorated concrete has been completely and satisfactorily removed, the perimeter of each cavity created by the removal of concrete shall be saw cut to a minimum depth of $\frac{5}{8}$ ", unless a lesser depth is required to avoid reinforcing steel. The saw cut shall be approximately perpendicular to the original surface. Edges of the cavity shall not be feathered. Unless otherwise approved by the Resident, the equipment used for removal of unsound concrete shall be chipping hammers weighing a maximum of 35 lb and only chisel point bits will be allowed.

The surface area and depth of removal for concrete repairs shall be subject to the approval of the Resident.

Deteriorated concrete shall be removed to one of the following depths, whichever is greatest:

- a) Sound substrate.
- b) To the minimum depth required per the manufacturer's recommendations, when a material from the Department's QPL of Rapid Setting Concrete Patching Materials is used.
- c) To the minimum depth indicated in the Thickness of Placement Table, when concrete is used, depending on the coarse aggregate gradation.
- d) When reinforcing steel is exposed or encountered, the minimum depth shall be 1" behind reinforcing steel for Upward Facing Surfaces and 1½" behind reinforcing steel for Vertical and Overhead Surfaces.

- 518.04 **Reinforcing Steel** - All existing reinforcing steel exposed by concrete removal, which is to remain in the structure, shall be cleaned of all loose rust by sand blasting, wire brushing, machine wire brushing or other methods approved by the Resident. Where reinforcing steel is to remain in the structure, care shall be taken to prevent damage to the reinforcing steel or its bond to the surrounding concrete.
- All existing main reinforcing steel which is broken, or has lost 25%, or more, of its original cross sectional area, shall be supplemented with new reinforcing steel. The total area of supplemental bars plus existing bars with section loss shall have the same total area as the original bar. Supplementary reinforcing steel shall be lap spliced a minimum length of 30 bar diameters for bars with section loss of up to 75% of the original bar area, and per Section 503 - Reinforcing Steel, for all other bars. Reinforcing steel shall be wired to the existing steel or, where designated by the Resident, the existing reinforcing steel shall be cut and supplementary reinforcing steel spliced in with tension couplers.
- 518.05 **Surface Preparation** - The surfaces to receive repair material shall be free of oil, solvent, grease, dirt, loose particles and foreign matter. Cleaning of repair areas shall be performed by sandblasting or other methods approved by the Resident. All surfaces receiving new material are to be sandblasted not more than 36 hours ahead of the placement of the repair material, or as per the bonding agent manufacturer's recommendations. Any sandblasted areas that have been rained on, exposed to high humidity or fog, or contaminated in any other manner shall be sandblasted again before the repair material is applied. All debris from the cleaning operations shall be thoroughly removed from the cleaned surfaces and adjacent areas using compressed, dry, air, prior to the application of repair materials. All air compressor lines used for cleaning of repair areas shall be equipped with effective oil traps.
- 518.06 **Application of Bonding Agent** - When bonding grout is used on repair of upward facing surfaces the following shall apply, except that, in the case where products from the Department's QPL of Rapid Setting Concrete Patching Materials are used in the repair areas, the manufacturer's published recommendations regarding application and use of bonding materials shall take precedence. Once a workable consistency has been reached, additional water shall not be added. The grout must be used or discarded within 30 minutes of the time water is added to the mix. The grout shall be applied no greater than 1/8" thick with stiff bristled, nylon, street brooms. The Contractor shall prevent the grout from drying by beginning the grout application immediately prior to the concrete placement and limiting the area of grout application ahead of concrete placement. If the grout begins to dry prior to concrete placement, additional grout may be brushed on the area as directed by the Resident. Should the grout become thoroughly dry it shall be removed by sand blasting or other methods as approved by the Resident.

When a product from the Department's QPL of Concrete Bonding Agents is used, it shall be applied in accordance with the manufacturer's published recommendations.

- 518.07 **Placing Repair Materials** - When concrete is used as the repair material the provisions of Section 502 shall apply. Additionally, concrete shall not be placed when either the ambient air temperature or the existing concrete temperature is below 45°F. When a patching material is used, the Contractor shall follow the manufacturer's published recommendations for mixing and placing the material.

Forms shall be erected to the neat lines of the existing structure and the new concrete placed. For overhead and vertical repair areas, sufficient concrete shall be removed to ensure that air within the area to be patched can effectively escape during the placement of the repair material.

- 518.08 **Curing** - Curing of concrete shall conform to the requirements of Section 502. For Overhead and Vertical Surfaces, curing compounds may be used, in accordance with the manufacturer's requirements. Patching materials shall be cured in accordance with the manufacturer's published recommendations.

- 518.09 **Inspection** - The Contractor shall make provisions to allow safe access to the work for the Resident in order to inspect the work, facilitate ongoing inspection of the work and to measure the work for payment purposes.

- 518.10 **Method of Measurement** - Repair of structural concrete is divided into repair areas less than 8" in depth and repair areas 8" in depth or greater. The repair depth shall be considered the average thickness of an individual repair area. The Resident shall make the final determination as to whether the average depth of repair is less than 8", or 8" or greater.

Concrete repair will be measured for payment by the square foot of all surfaces repaired where the average depth of repair is less than 8", complete and accepted.

Concrete repair will be measured for payment by the cubic yard for all repairs where the average depth of repair is 8" or greater, complete and accepted. The quantity will be determined from the theoretical yield of the design mix, or in the case of transit mixed concrete, by delivery ticket, as directed by the Resident.

Supplementary reinforcing steel will be measured for payment by the pounds of steel provided and installed and paid for under Item 503.12 - Reinforcing Steel, Fabricated and Delivered, and Item 503.13 - Reinforcing Steel, Placing, respectively, except that Reinforcing Steel, Placing, will be measured for payment as 1.5 times the actual number of pounds placed. Reinforcing steel required to supplement reinforcing steel damaged by the Contractor shall be supplied and installed at the Contractor's expense.

Tension couplers will be measured for payment as the number of splices satisfactorily installed and accepted. Payment will be made under Item 503.17 - Mechanical/Welded Splices. Couplers required to repair reinforcing steel

damaged by the Contractor shall be provided and installed at the Contractor's expense.

Temporary support beams or girders required to repair bridge seats or pier caps will be paid for separately, as approved by the Resident.

- 518.11 ***Basis of Payment*** - The repair of structural concrete will be paid for at the Contract unit price as indicated in the Schedule of Items for the respective Contract item involved.

The following will be included in the unit price for the respective concrete items, complete and accepted: Removal of existing concrete; cleaning of existing reinforcing steel to remain in the structure; cleaning of existing concrete surfaces in repair areas; furnishing and installing bonding materials; providing, installing and removal of all formwork; furnishing and placing new concrete or other approved concrete patching materials in areas where existing concrete is removed; curing of concrete or patching materials; disposal of all demolition material and debris.

Payment for any staging, platforms or lifts required by the Contractor to gain access to the work in order to perform the work, or to provide access to the Resident in order to inspect or measure the work, shall be considered incidental to related Contract items unless the Contract provisions specify separate payment for such access devices.

Fabrication, delivery and placing of reinforcing steel, and mechanical couplers if required, will be paid for under separate Contract items.

The payment for each Contract item will also be full compensation for furnishing all materials, labor, equipment, and all other incidentals necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
518.50	Repair of Upward Facing Surfaces- to Reinforcing Steel < 8"	Square Foot
518.51	Repair of Upward Facing Surfaces- below Reinforcing Steel < 8"	Square Foot
518.52	Repair of Upward Facing Surfaces > 8"	Cubic Yard
518.60	Repair of Vertical Surfaces < 8"	Square Foot
518.61	Repair of Vertical Surfaces > 8"	Cubic Yard
518.70	Repair of Overhead Surfaces < 8"	Square Foot
518.71	Repair of Overhead Surfaces > 8"	Cubic Yard

SECTION 519 - EXPANSION DEVICES – ASPHALTIC PLUG JOINT

- 519.01 **Description** - This work consists of furnishing and installing asphaltic plug joint systems at the locations shown on the Plans, in accordance with these Specifications, and as directed by the Resident. This work shall include furnishing, installation, and removal of all bond breaking materials used to prevent asphalt pavement layers from adhering to waterproofing membrane, all temporary header(s) installed with the intent to form the asphaltic plug joint channel, and all preparation required for the installation of the asphaltic plug joint.

This work shall also include having the approved manufacturer provide a qualified technical representative to supervise the installation of the joint systems. The representative shall instruct, train, and supervise the Contractor's personnel in the proper methods of installation. All costs associated with this service shall be included in the unit price of the work.

- 519.02 **Submittals** - Prior to construction, the Contractor shall submit the following to the Resident for review and approval:
- (a) Complete and detailed Shop Drawings of the asphaltic plug joint system. Shop Drawings shall include information covering materials, their properties, installation procedures, storage and handling requirements, and Safety Data Sheets.
 - (b) The resume of the manufacturer's technical representative, which shall include the representative's experience installing the asphaltic plug joint system along with the names and telephone numbers of contact persons for recent Projects where technical assistance was provided.
 - (c) Certified test reports of the asphaltic binder, closed cell foam backer rod, and the plastic compound.
 - (d) Certificates of Compliance for bridging plates, centering nails, and aggregate.

- 519.03 **Materials** - An asphaltic plug joint system from Department's Qualified Products List for Expansion Devices – Non-Modular (Asphaltic Plug Joints) shall be used.

The bridging plate shall be ASTM A36 steel, a minimum of ¼" thick, and galvanized. Holes for the centering nails shall be approximately 1 ft center to center along the centerline of plates.

Centering nails shall be 16d or larger and hot dip galvanized in accordance with ASTM A153.

- 519.04 **Installation** - The asphaltic plug joint system shall be installed in accordance with the manufacturer's latest instructions and this specification. Manufacturer's representatives shall be present during the entire installation to ensure satisfactory results are obtained.

The asphaltic plug joint system shall allow total joint movement for up to 2". The installation shall be centered over the expansion joint gap as indicated on the Plans. It shall not be installed when ambient or substrate temperatures are below 40°F, when rain is imminent, or as directed by the Resident. The area shall be free of dirt, dust, moisture, petroleum, or solvents that might contaminate the joint materials or reduce the bond of the joint system to the substrate or vertical faces. The use of compressed air and heat may be required to dry the area before installing the joint system.

The asphalt pavement layers shall be removed to the required dimensions shown on the plans. The asphalt pavement shall be sawcut to a depth that will not damage the waterproofing membrane, but permit the removal of the asphalt pavement layer. The pavement layer shall be removed in a manner that will not damage the waterproofing membrane. Bond breakers such as interlayers and fabrics, or temporary header(s), may be used with new hot mix asphalt placements to avoid unnecessary sawcuts and protect the waterproofing membrane from damage. The method of attaching temporary header(s) to the concrete deck shall be approved by the Resident. The use of a temporary header shall not be allowed if it will need to be anchored into a precast prestressed concrete member. Should a concrete levelling course be required before installing the bridging plates, and the membrane layer is removed in the process, it shall be replaced before the asphaltic plug joint system is installed. Vertical surfaces of the asphalt pavement layers shall be cleaned to remove all water, dust, or other contaminants.

Backer rods shall be installed in expansion joint openings at a minimum of 1" depth or as indicated on the Plans.

Unless otherwise specified by the asphaltic plug joint system manufacturer, liquid asphalt binder meeting the requirements of a 64-28 or 58-28 PGAB shall be used to coat the membrane and bridging plate surfaces.

The binder shall be heated to 350°F to 410°F, or a safe temperature as recommended by manufacturer. Heating kettles shall be equipped with continuous agitation system, temperature controller, calibrated thermometer, and double steel jacket with an oil layer in between, to prevent scorching of the binder. During application, the temperature of the binder shall be maintained at a minimum of 350°F, but not greater than 410°F. It shall be poured and leveled into the expansion joint openings until overfilled, and the excess binder spread over the area covered by the bridging plates.

Steel bridging plates shall be placed from curb to curb on the roadway portion of expansion joints. The plates shall be centered over the joint opening. Centering nails shall be placed in pre-drilled holes and hammered in to secure the plates.

Once the bridging plates are installed, liquid asphalt binder shall be poured and leveled over the bridging plates and adjacent membrane surfaces in a manner

that ensures full coverage. Areas with excessive application, such as pooling of liquid, should be removed or dispersed along the joint area.

Asphaltic plug joint system aggregate shall be heated in a rotating drum mixer to a minimum of 350°F but not greater than 410°F, or as recommended by the manufacturer. The thermoplastic polymeric modified asphalt binder shall be added to the mixer to pre-coat the aggregates.

Coated aggregate shall be placed into blockouts in layers as recommended by the manufacturer. Blockouts shall be overfilled with coated aggregate as required to compensate for compaction. Equipment for compaction shall be as recommended by the manufacturer. Additional thermoplastic polymeric modified asphalt binder shall be screeded over the compacted joint to fill all surface voids.

Top dressing aggregate shall be applied per the manufacturer's recommendation.

Plastic compound shall be used for repairing overcuts in bituminous concrete. Cleaning, mixing, and application shall be in conformance to the manufacturer's instructions.

Vehicular traffic may pass over finished joints 2 hours after compaction, or as recommended by the manufacturer.

519.05 **Method of Measurement** - A new Asphaltic Plug Joint system installation will be measured by the linear foot along the top surface of installed joints to the limits shown on the Plans. Preparation of surfaces for the proposed joint system including cutting, grinding, and cleaning will not be measured separately for payment, but shall be incidental to the Asphaltic Plug Joint.

519.06 **Basis of Payment** - A new Asphaltic Plug Joint system installation will be paid for at the Contract unit price per linear foot, which price shall be full compensation for all labor, materials, equipment, and incidentals required for furnishing and installing the Asphaltic Plug Joint system as shown on the Plans, in accordance with these Specifications, and as directed by the Resident. Payment shall also include all work required to repair the concrete deck where anchors were used with a temporary header, and all patching needed for the waterproofing membrane.

Payment will be made under:

Pay Item		Pay Unit
519.60	Expansion Device - Asphaltic Plug Joint	Linear Foot

SECTION 520 - EXPANSION DEVICES - NON-MODULAR

520.01 **Description** - This work shall consist of furnishing and installing expansion devices including the seals, anchorage system and curb, sidewalk expansion

dams and barrier sliding plates, where required, as shown on the Plans, in accordance with these specifications and per the seal manufacturer's published recommendations.

Seals for expansion devices shall be either gland seals or compression seals as specified on the Plans.

- 520.02 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Expansion Device – Gland Seal

Stud Shear Connectors, Anchors and Fasteners	711.06
Structural Steel	713.01
High Strength Bolts	713.02
Steel Extrusions	713.08
Elastomer for Seal Elements	714.01
Lubricant Adhesive	714.03
Gland Type Seals	714.06

Expansion Device – Compression Seal

Stud Shear Connectors, Anchors and Fasteners	711.06
Structural Steel	713.01
High Strength Bolts	713.02
Elastomer for Seal Elements	714.01
Lubricant Adhesive	714.03
Sealant	714.04
Compression Seals	714.05

Gland and compression seals shall be of the general configuration as shown on the Contract documents and shall be one of the seals listed on the Department's Qualified Products List.

- 520.03 **Fabrication** - All work shall conform to the applicable provisions of Section 504 - Structural Steel.

The Contractor shall submit Working Drawings in accordance with Section 105.7 - Working Drawings.

Seals shall be furnished and installed in one continuous length and splices will not be allowed, except as specified hereafter.

As received from the supplier of the seal, seals may contain one splice for each continuous length of 50 ft or greater. Sections under 50 ft long shall not have any splices. Splices at abrupt angular changes in horizontal alignment will be allowed. Splices in gland type seals shall be shop vulcanized by the seal supplier. Splices in compression seals may be either vulcanized or adhesive bonded. At abrupt angular changes in vertical alignment, the lower 75% of the depth of compression seals may be cut to allow short radius bends.

- 520.04 **Protective Coating** - The expansion device, including the curb and sidewalk expansion dams and barrier sliding plates, shall be galvanized in accordance with the requirements for Protective Coatings in Section 504 - Structural Steel. The galvanizing on the metal surfaces in direct contact with neoprene seals shall be lightly sandblasted to a dull gray appearance in order to promote a high strength bond between the seal and mating surface, and for smoothness for installation purposes. Alternately, this galvanized surface may be prepared to the manufacturer's published recommendations for installation and bonding of seals.

When specified on the Contract Plans, reinforcing steel shall be anchored into drilled holes.

- 520.05 **Delivery** - Unless otherwise specified on the Plans, expansion devices shall be shipped fully assembled and shall be installed as a unit. The unit shall be equipped with shipping and temperature adjustment devices approved by the Fabrication Engineer, and shall be preadjusted, in the fabrication facility, to the opening required at 45°F.
- 520.06 **Installation** - Expansion Devices shall be erected following placement of the structural deck slab. The devices shall be lowered into the blocked-out area of the deck slab, adjusted for the temperature in accordance with the Plans and Working Drawings, set to the proper height and fastened in place, in accordance with the Standard Details. Once the expansion devices are set in their final positions, all shipping and temperature adjustment apparatuses shall be removed and the concrete for the slab and abutment backwall blocked-out area shall be placed immediately.

Seal elements shall be installed in accordance with the manufacturer's recommendations, using equipment manufactured specifically for the purpose of installing the seal elements. The equipment shall not cause structural damage to either the seal or the joint armor and shall not twist, distort or cause other malformations in the installed seal element. Any perforation or tearing of a seal element due to installation procedures or construction activities will be cause for rejection of the installed seal element, requiring replacement by the Contractor at no cost to the Department.

Immediately prior to the installation of the seal element, the metal contact surfaces of the joint armor shall be clean, dry, and free of oil, rust, paint, or foreign material. Unless otherwise recommended by the seal manufacturer, the contact surfaces of the seal element shall be cleaned with normal butyl-acetate, using clean rags or mops, immediately prior to application of the lubricant-adhesive or sealant. The lubricant adhesive or sealant shall be applied to the seal element and joint armor contact surfaces at the rate recommended by the manufacturer of the seal.

The exposed ends of compression seals shall be sealed with appropriately shaped pieces of foam rubber, bonded in place with sealant as described in Section 714.04 - Sealant, or a bonding agent approved by the Resident.

520.07 **Method of Measurement** - Expansion devices will be measured by each unit, complete in place and accepted. Each unit shall consist of one pair of matching elements, including anchorage system, seal, shipping and temperature adjustment devices, curb and sidewalk expansion dams and barrier sliding plates, as required.

520.08 **Basis of Payment** - The accepted quantity of expansion devices will be paid for at the Contract unit price each, which shall be full compensation for all materials including anchorage system, protective coating, equipment, labor and incidentals necessary for furnishing and installing the expansion devices and, if required, curb and sidewalk expansion dams and barrier sliding plates.

Payment will be made under:

Pay Item		Pay Unit
520.21	Expansion Device - Gland Seal	Each
520.22	Expansion Device - Compression Seal	Each

SECTION 521 - FINGER JOINT AND FABRIC TROUGH/FABRIC CURTAIN

521.01 **Description** - This work shall consist of fabricating and installing finger joint expansion devices and fabric troughs or fabric curtains when required, including the anchorage system, curb and sidewalk expansion dams, barrier sliding plates as required, support components for fabric troughs or curtains when required, and any metal downspout(s) and/or chute(s) used to guide the discharge from the trough(s) when required, and all necessary materials and equipment required to complete the work as shown on the Plans and in accordance with these specifications.

521.02 **Materials - Finger Joints** - Plates requiring a non-skid surface shall conform to the requirements of ASTM A786 or ASTM A36. Other plates shall conform to the requirements of ASTM A36 or ASTM A572. Shapes shall conform to the requirements of ASTM A500, Grades A and B, or ASTM A992. Other weldable steels may be used with approval of the Fabrication Engineer. Anchor studs shall conform to the requirements of Section 711.06 - Stud Shear Connectors, Anchor and Fasteners. Bolts shall conform to the requirements of AASHTO M 169 (ASTM A325).

521.03 **General** - All work shall conform to the applicable provisions of Section 504 - Structural Steel. Completed expansion devices and any required support components for troughs or curtains, expansion dams, barrier sliding plates, downspouts and chutes shall be hot dipped galvanized to the requirements of

AASHTO M 111 (ASTM A123). Anchorage parts encased in concrete may be supplied in the ungalvanized condition.

Each expansion device shall be shipped fully assembled, shall be installed as a unit, and shall be equipped with shipping and temperature adjustment devices approved by the Resident. When a Project is built in stages, and if desired by the Contractor, the expansion device may be shipped in two or more sections, as approved by the Fabrication Engineer, with appropriate provisions for field splicing.

- 521.04 **Materials - Fabric Trough or Curtain** - The fabric for the trough or curtain shall be $\frac{1}{8}$ to $\frac{3}{16}$ " in thickness and shall consist of a single layer of 14.6 oz woven nylon fabric, or the equivalent in multiple layers of woven nylon fabric, laminated between two or more layers of neoprene rubber. The neoprene shall conform to the following requirements:

Physical Properties	
Grade (Duro)	60
Original Physical Properties	60 +/- 5
Hardness ASTM D2240	
Tensile Strength, Minimum	850 psi
ASTM D412	
Elongation at Break, Minimum Accelerated Test to Determine Long Term Aging Characteristics Oven Aged - 70 Hours/212°F, ASTM D573	300%
Hardness, Points Change, Maximum	+15
Tensile Strength, Change, Maximum	-15%
Elongation at Break, Change, Maximum	-40%
Ozone - 1 PPM in Air by Volume 20% Strain	No cracks
100 +/- 2°F - ASTM D1149*	100 hours
Compression Set - 22 Hours/ /212°F	
ASTM D395 - Method B, 0/0 Maximum	35%
ASTM D746 - Procedure B	-40°F
Brittleness at No Failure	
Fluid Resistance - ASTM D471	
70 Hours/212°F in ASTM Oil No. 3	
Change in volume, Maximum	+120%
Change in tensile strength, Maximum	-70%
Change in ultimate elongation, Maximum	-55%
* Samples shall be solvent wiped before test to remove any traces of surface impurities.	

The finished fabric shall have a minimum breaking strength of 700 lb/in when tested by ASTM Test Method D5034. The minimum breaking strength shall be determined on a sample taken transverse to the centerline of the trough, or a random sample taken from the curtain.

When delivered to the job site, each separate length, roll or container shall be clearly tagged or marked with the manufacturer's name, trade mark and lot number. A lot is defined as that amount of fabric manufactured at one time from one batch of elastomer. A batch is defined as that amount of elastomer prepared and compounded at one time.

Not less than 30 Days prior to the installation of the trough, a sample length of each lot of fabric, not less than 3 ft long, shall be submitted to the Resident for testing. All samples shall be taken from the lot(s) to be furnished, shall be tagged for identification purposes and shall be furnished to the Resident, at no additional cost to the Department. Approval of the material must be obtained before the material is incorporated in the work.

- 521.05 ***Fabrication*** - The Contractor shall submit Working Drawings in accordance with Section 105.7 - Working Drawings. These drawings shall include, but not be limited to, the following information: The complete details of the method, materials and equipment proposed to be used in the installation operation. Such details shall give complete specifications and details of the elastomeric trough or curtain, and other data pertaining to the installation operation.

Installation holes shall be cut round and cleanly with a sharp tool. Holes having jagged or roughly cut edges will be cause for rejection of the trough or curtain unit.

- 521.06 ***Construction of Fabric Trough*** - Where a splice is required for staged construction, the upper section of the trough shall be fitted inside the lower section of the trough in such a manner that any water spillage through the splice shall be eliminated.

- 521.07 ***Method of Measurement*** - Expansion Device Finger Joint will be measured by each unit, complete in place and accepted. Each unit shall consist of one pair of matching devices including anchorage system, curb and sidewalk expansion dams, barrier sliding plates as required, and, if shown on the Plans, trough or curtain components, downspouts and chutes.

Fabric Trough or Fabric Curtain for Finger Joint will be measured for payment by each unit complete in place and accepted.

- 521.08 ***Basis of Payment*** - The accepted quantity of Expansion Device - Finger Joint will be paid for at the Contract unit price each, which payment shall be full compensation for all materials including anchorage system, curb and sidewalk expansion dams, barrier sliding plates, trough or curtain support systems, downspouts and chutes, galvanizing, equipment, labor and incidentals necessary for furnishing and installing the expansion devices and expansion dams. The accepted quantity of Fabric Trough or Fabric Curtain for Finger Joint will be paid for at the Contract price each, complete in place and accepted, which price shall include all materials, equipment, tools, labor and incidentals necessary for furnishing and installing the trough or curtain.

Payment will be made under:

Pay Item		Pay Unit
521.23	Expansion Device - Finger Joint	Each
521.32	Fabric Trough for Finger Joint	Each
521.33	Fabric Curtain for Finger Joint	Each

SECTION 522 - EXPANSION DEVICES - MODULAR

522.01 **Description** - This work shall consist of furnishing and installing shop fabricated modular expansion devices. This shall include, but not be limited to, neoprene seal elements, steel transverse dividers and end channels, support bars and bearings, anchorages, sidewalk, median and curb expansion dams and barrier slide plates, all as specified herein or specified in the Contract documents.

522.02 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Stud Shear Connectors, Anchor and Fasteners	711.06
Structural Steel	713.01
High Strength Bolts	713.02
Steel Extrusions	713.08
Lubricant Adhesive	714.03
Gland Type Seals	714.06

All steel divider bars, end channels and support bars shall conform to the requirements of ASTM A572 Grade 50 Steel. Other steel plates shall conform to the requirements of ASTM A36 or ASTM A572. Shapes shall conform to the requirements of ASTM A500, Grades A and B, or ASTM A992. Other weldable steels may be used with the approval of the Fabrication Engineer. The entire assembly, unless otherwise indicated on the Contract Plans, shall be hot dip galvanized in conformance with AASHTO M 111 (ASTM A123). All miscellaneous materials such as stainless steel sliding surfaces, bearings, etc. shall be as recommended by the manufacturer, and as approved by the Fabrication Engineer. The manufacturer shall submit full information on material specifications and dimensional data for approval.

522.03 **Design** - The modular expansion devices shall incorporate divider bars, end channels, divider bar supports, seals, a system to maintain the seals at a substantially equal spacing at all times, and joint armor incorporating a support system for the divider bar supports and an anchoring system for fixing the expansion device to the supporting concrete. The expansion devices shall be capable of accommodating the movements specified in the Contract Documents.

The system maintaining the seal spacing shall be subject to prior approval by the Fabrication Engineer and shall be a design that does not employ a rigid scissor-

type mechanical system. The seal spacing system shall at all times exert a positive control force, and shall have a certain amount of flexibility to absorb shock loads such as snowplow impacts.

The sealing elements shall be gland type seals, and shall be fabricated with lugs or other protrusions designed to have a positive interlocking action with the divider bars. Sealing elements that are continuous over the full width of the joint, and require a clamping element to fix the sealing element to the top surface of the divider bar(s), will not be accepted. The minimum joint opening between adjacent divider bars shall be ½", and the maximum joint opening shall be ¾".

The divider bars and end channels shall be extruded or rolled shapes, designed to positively interlock with the sealing elements, and capable of sustaining all vertical and horizontal loads imposed by the traffic.

The divider bar supports shall be supported on the joint armor in a manner incorporating sufficient flexibility to absorb vertical shock loads.

The divider bars, divider bar supports and associated bearings, hardware, etc. shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications. The manufacturer shall submit computations and data to verify appropriate load carrying capacity and said computations shall show conformance to all applicable requirements, including fatigue criteria, of the AASHTO LRFD Bridge Construction Specifications.

522.04 ***Fabrication*** - The expansion joints shall be shop assembled in accordance with the manufacturer's recommendations and in conformance with the details shown in the Contract Documents and in these specifications.

All work shall be in accordance with the applicable provisions of Section 504 - Structural Steel. Twenty-five percent of full penetration welds shall be inspected by ultrasonic (UT) or radiographic (RT) examination. Twenty-five percent of fillet welds and partial penetration welds shall be inspected by magnetic particle method (MT). Acceptance criteria shall be in accordance with the AWS D1.5 Bridge Welding Code. All shop welding shall be completed to the greatest extent possible before the steel is galvanized. Any welds to be made after the steel is galvanized shall be identified on the Shop Drawings. Steel surfaces welded subsequent to galvanizing shall be repaired to the requirements of ASTM A780 and Annexes A1, A2 or A3. The dry film thickness shall be within the range of 3 mils to 5 mils. Damaged areas of the galvanizing shall be similarly treated.

The galvanizing on the metal surfaces in direct contact with the neoprene seals shall be lightly sandblasted to a dull gray appearance to provide a high strength bond between the seal and mating metal surfaces, and to provide an appropriate surface smoothness for installation. Alternately, this galvanized surface may be prepared per the manufacturer's published recommendations for installation and bonding of the seals.

Seal elements shall be furnished and shop installed in one continuous length. Splices in seals will be permitted at abrupt changes in horizontal alignment. Abutting surfaces of splices shall be shop-vulcanized together.

The Contractor shall submit computations, Shop Drawings, erection drawings, and other Working Drawings in accordance with Section 105.7 - Working Drawings.

The fabricated expansion device shall be preset by the manufacturer, before shipment, to the dimensions for 45°F. Hardware for leveling, shipping and adjusting the device shall be supplied as part of the assembled expansion device. Final width adjustments of the prefabricated expansion device shall be made in the field, immediately prior to the final concrete placement.

- 522.05 **Delivery** - Modular expansion devices shall be delivered to the job site in one unit, fully assembled. No field joints will be allowed, unless shown on the Contract Documents, or approved by the Fabrication Engineer before shop fabrication.
- 522.06 **Installation** - Following completion of the structural deck slab, the expansion devices shall be installed in the blocked out portion of the slab and abutment backwall. Following final adjustment, the device shall be permanently fixed in place, all shipping and adjustment devices shall be removed, surfaces shall be repaired as specified in Section 522.014 - Fabrication, and concrete shall be placed to complete the deck slab and backwall to the lines and grades shown on the Contract Documents.
- 522.07 **Method of Measurement** - Modular Expansion Devices will be measured by each unit, complete in place and accepted. Each unit shall consist of a modular expansion device, including anchorage system, seals, shipping and temperature adjustment devices, curb, sidewalk and median expansion dams and barrier sliding plates, as required.
- 522.08 **Basis of Payment** - The accepted quantity of Modular Expansion Devices will be paid for at the Contract unit price each, which payment shall be full compensation for all materials, equipment, labor and incidentals necessary for furnishing and installing the expansion devices, curb, sidewalk and median expansion dams and barrier sliding plates, as required.

Payment will be made under:

Pay Item		Pay Unit
522.06	Modular Expansion Devices	Each

SECTION 523 - BEARINGS

523.01 **Description** - This work shall consist of designing, furnishing, testing and installing bearings in accordance with this specification and in conformance with the details shown on the Plans.

523.02 **Materials**

Elastomer	711.11
Stainless Steel	711.12
Polytetrafluoroethylene (PTFE)	711.13
Structural Steel	713.01
Preformed Pads	713.03
Bronze or Copper-Alloy Bearing and Expansion Plates	713.04
Anchor Rods	720.07

Miscellaneous materials, caulking or lubricant shall be as recommended by the manufacturer of the bearings.

523.03 **Submittals** - The Contractor shall prepare shop detail, erection and other necessary Working Drawings in accordance with Section 105.7 - Working Drawings. The drawings will be reviewed in accordance with the applicable requirements of Section 105.7. Changes and revisions to the reviewed Working Drawings shall require further review by the Fabrication Engineer.

523.04 **General Requirements** - Requirements for the type of bearing furnished are as follows:

- Steel Bearings - Sections 523.10 through 523.19
- Elastomeric Bearings - Sections 523.20 through 523.29
- Pot or Disc Bearings - Sections 523.30 through 523.39
- Spherical Bearings - Sections 523.40 through 523.49

Design of bearings shall be in accordance with AASHTO LRFD Bridge Design Specifications and AASHTO/NSBA Steel Bridge Collaboration G9.1 Steel Bridge Bearing and Design Guidelines.

523.05 **Fabrication** - Steel fabrication work, for all types of bearings, shall comply with Section 504, Structural Steel.

523.051 **Protective Coating** - Steel parts of bearings shall have protective coating applied to the areas described within this section in accordance with Section 506 - Shop Applied Protective Coating- Steel.

Masonry plates shall, at the Contractor's option, be galvanized or metalized. The masonry plates shall be top coated to match the coating of the superstructure beams when beams are coated.

Portions of bearings between the masonry plate and sole plate that will be exposed after installation shall, at the Contractor's option, be

galvanized or metalized. Steel between the masonry and sole plates shall be top coated to match the color of the superstructure beams when the adjacent superstructure beams are coated. Stainless steel and /or machined surfaces with a roughness height of 125 micro-inches or smoother shall not be coated. Machined surface finishes with a roughness height of 125 micro-inches or smoother, except stainless steel, shall be lubricated with a non-corrosive, waterproof, high pressure lubricant having a temperature range of -30°F to 150°F, National Lubrication and Grease Institute number not lower than 2 and an OK load of not less than 20 lb, as measured by the requirements of ASTM D2509. Metal surfaces designed for sliding in contact with Teflon (PTFE) coated surfaces shall not be lubricated.

Sole plates shall have the same finish as the adjacent structural steel. When adjacent structural steel is coated, the sole plate shall be galvanized/or metalized, at the option of the Contractor. Sole plates shall be top coated to match the color of the superstructure beams. When the adjacent structural steel is bare and uncoated, the sole plate shall be bare and uncoated. When the adjacent beams are concrete, the sole plates shall be galvanized. Areas to be field welded shall not be coated prior to welding; they shall be touched up after welding.

Anchor rods shall be galvanized. When anchor rods are designated to secure bare unpainted steel or painted steel, a dielectric coating (epoxy or bituminous type coatings are acceptable) shall be applied to the anchor rod and/or adjacent steel to prevent contact between galvanized surfaces and painted or unpainted steel.”

523.06 ***Fabrication Tolerances*** - Fabrication tolerances for all bearings shall comply with Section 18.1 of AASHTO LRFD Bridge Construction Specifications (Table 18.1.4.2-1) unless otherwise noted on the Plans or in this Section 523 - Bearings.

523.061 ***Material Friction Test*** - The coefficient of friction (COF) between the two mating surfaces shall be measured. Tests shall be made either on samples taken from the same batch of materials as those used in the prototype bearings or the tests may, at the manufacturer’s option, be conducted on finished bearings. Only new materials shall be used; material that has been previously tested shall not be used.

The surfaces shall be thoroughly cleaned with a degreasing solvent. No lubrication, other than that specified for the prototype bearings, shall be used. The mating surfaces for the test pieces shall have a common area no less than the smaller of the bearing area or 7.0 square inches.

The test piece shall be loaded in compression to a stress corresponding to their maximum service dead load plus live load,

which shall be held for 1 hour prior to, and throughout the duration of, the sliding test. At least 100 cycles of sliding, each consisting of at least 1.0" of movement, shall then be applied at a temperature of 68°F ± 2°F. The uniform sliding speed shall be 2.5" per minute.

The breakaway COF shall be computed for each direction of each cycle and its mean and standard deviation shall be computed for the sixth through twelfth cycles. The initial static breakaway COF for the first cycle shall not exceed twice the design COF. The maximum COF for all subsequent cycles shall not exceed the design COF. Failure of a single sample shall result in rejection of the entire lot.

Following the 100 cycles of testing, the breakaway COF shall be determined again and shall not exceed the initial value. The bearing or specimen shall show no appreciable sign of wear, bond failure, or other defects.

- 523.07 **Inspection** - The Contractor shall notify the Fabrication Engineer at least 10 Days in advance of the start of fabrication so that inspection of the work can be provided by the Department. All work will be subject to inspection by the Fabrication Engineer.

Quality Control (QC) is the responsibility of the Contractor. The Quality Control Inspector (QCI) shall inspect all aspects of the work and shall supervise all testing. The QCI shall record measurements and test results in a Job Control Record (JCR). The QCI shall reject materials and workmanship that do not meet Contract requirements. The Contractor may perform testing in addition to the minimum required. The results of all measurements and testing shall be made available to the Quality Assurance Inspector (QAI).

Quality Assurance (QA) is the prerogative of the Fabrication Engineer. The QAI will ensure that the Contractor's QC is performing properly, verify documentation, periodically inspect workmanship and witness testing. QA testing deemed necessary by the Fabrication Engineer in addition to the minimum testing requirements shall be scheduled to minimize interference with the production schedule.

- 523.08 **Certification** - The Contractor shall furnish a materials certification letter in accordance with Division 700.

- 523.09 **Installation of Bearings** - Bearings shall be placed upon bridge seats that are properly finished. Bridge seat elevations shall be within + ¼" of the elevation shown on the Plans and the differential elevation between any two adjacent bearing areas shall not exceed + ⅜".

When the bearings are to be set directly on the concrete bridge seats, as indicated on the Plans, the bridge seats shall be dressed 1" larger all around than the bottom member of the bearing and to the exact elevations shown on the Plans or as determined by the Resident. If dressed areas are lower than the

surface of the surrounding bridge seat, a channel 2" wide and with a minimum slope of 4%, shall be cut to the edge of the bridge seat for drainage.

Masonry plates shall be set level in their exact position and shall have a full and even bearing upon the masonry. They shall be placed on a preformed pad, the same size and shape as the masonry plate with holes to match the masonry plate.

523.091 **Anchor Rods** - The Contractor shall drill the holes and set the anchor rods with a chemical or cementitious Anchoring Material from the Department Qualified Products List. The Anchoring Material shall completely fill the holes. In place anchor rods shall be capable of developing unconfined pullout strength of 30 kips and 70 kips for M24 and M36, 1" and 1½" anchor bolts, respectively.

523.092 **Grout Pads** - When the bearings are to be set on a grout pad, the grout shall be a non-shrink cementitious grout from the Grout Materials list of the Department Qualified Products List. The grout shall have a minimum design compressive strength of 6,000 psi at 28 Days, unless otherwise specified in the Contract.

The grout shall be well bonded to the adjacent concrete and shall be placed under pressure to ensure that all anchor holes and the entire area under the masonry plate is free of voids.

523.093 **Sliding Surfaces** - The sliding surfaces of bearings shall be installed level. Special care shall be exercised at all times to ensure protection of the stainless steel and the PTFE surfaces from coming in contact with any foreign matter.

At no time shall any forms, debris, or other material interfere with the free action of the bearing assemblies.

When bronze or copper-alloy bearing and expansion plates are used, the sliding surfaces or the steel in contact with the bearing and expansion plates shall be recoated immediately prior to installation with a lubricant recommended by the manufacturer of the bronze or copper-alloy plates.

523.094 **Final Adjustment** - Bearings shall not be connected in place until the deck is in place. Final adjustment of the bearings for temperature shall be made after the deck is in place. Connecting of the bearing sole plate to the girder flange shall be done only after all adjustments have been made.

Sliding expansion bearings shall be set so that slotted holes in the sole plate will be centered on the anchor bolts, and rocker bearing assemblies shall be set so as to be plumb at 45°F. When determining temperature adjustments for bearings, the difference between the

steel temperature (not the ambient temperature) and 45°F shall be used.

Nuts on anchor rods shall be brought in contact with the masonry plate or sole plate as shown on the Plans. Threads on anchor rods shall be upset with a punch to prevent easy removal of the nuts. When anchor rods extend through slotted holes in a sole plate, the lower of double nuts shall be left loose, bring to contact and loosen approximately ¼ turn, to allow movement of the sole plate.

Bearing sole plate to girder flange welds shall be performed in accordance with Standard Specification Section 504.55 - Field Welding and Repairs.

STEEL BEARINGS

- 523.10 **Steel Bearings** - Structural steel bearings- rocker type and sliding plate type- shall be fabricated in accordance with the dimensions and finishes shown on the Plans, Standard Details and the requirements of Section 504 - Structural Steel.

Bearings, base plates and other contact surfaces shall be finished to the following tolerances:

Surface Roughness Requirements	
Steel slabs	ANSI 2000 micro-inches
Bearing sole plates	ANSI 1000 micro-inches
Milled ends to compression members, milled or ground ends of stiffeners or rockers	ANSI 500 micro-inches
Bridge rockers and rollers	ANSI 250 micro-inches
Sliding bearings	ANSI 125 micro-inches
Pins and pin holes	ANSI 125 micro-inches

Bearing mating surfaces (including steel to steel, or steel to bronze and steel to elastomeric material) shall have a minimum of 90% contact area. Flatness (the permissible variation from a true plane) shall be a maximum of 1/32".

- 523.11 **Materials** - Materials shall conform to Section 523.02 - Materials.

- 523.12 – 523.19 **Vacant**

ELASTOMERIC BEARINGS

- 523.20 **Description** - Two types of bearings are applicable for the following Sections: Laminated Elastomeric Bearings, which shall consist of layers of elastomer laminated to steel plates; and Plain Elastomeric Bearings, which shall consist of a single layer of elastomer.

523.21 **Materials** - Materials shall conform to Section 523.02 - Materials.

If the elastomer material is specified by its shear modulus on the Plans, the measured shear modulus value shall lie within the specified range. When the elastomer material is specified by shear modulus, the Contractor shall supply a consistent value of hardness for the purposes of defining limits for the tests of Table A and B in Section 711.11.

Laminated Elastomeric bearings shall have a Shore A Durometer hardness of 50 or 60. Plain Elastomeric bearings shall have a Shore A Durometer hardness of between 50 and 70.

Shear modulus tests shall be carried out using the apparatus and procedure described in Annex A of the ASTM D4014 specifications.

523.22 **Fabrication** - All components of Laminated Elastomeric Bearings shall be molded as an integral unit. Plain Elastomeric Bearings may be molded individually, cut from previously molded slabs, or extruded and cut to length. Cut edges shall have an ANSI 250 mils finish. Steel laminates shall be abrasive blast cleaned to an SSPC-SP-6 and protected from contamination. The Fabricator must be on the Departments Qualified Supplier List.

Elastomeric Bearings shall be fabricated in accordance with AASHTO M 251.

523.23 **Testing** - The following testing shall be performed prior to delivery of the bearings:

1. **Ambient Temperature Tests on the Elastomer** - (This test is required for each elastomer formulation)

The bond to the reinforcement shall develop a minimum peel strength of 40 lb/inch. Peel strength tests shall be performed in accordance with ASTM D429, Method B.

2. **Low-Temperature Test on the Elastomer** - (This test is required for each elastomer formulation)

Low-temperature tests shall be performed in accordance with the requirements of Section 711.11; the compound shall satisfy all criteria for its grade. The manufacturer may choose to provide certificates from low-temperature crystallization tests performed on identical material, within the last year, for Grade 3 to Grade 5 material.

3. **Visual Inspection of the Finished Bearing** - Each laminated bearing shall be inspected for compliance with dimensional tolerances and for overall quality of manufacture. In steel reinforced bearings, the edges of the steel shall be protected everywhere from corrosion.

4. **Short-Duration Compression Tests on Bearings** - Each laminated bearing shall be loaded in compression to 150% of the Bearing Design Load. The load shall be maintained for 5 minutes and released. The same load shall be reapplied and maintained for a second period of 5 minutes.

The bearing shall be examined visually during the second loading. If the load drops below the required value during either application, the test shall be performed again.

The bearing shall be rejected if:

- The bulging pattern suggests laminate parallelism outside of the specified tolerance,
- A layer thickness is outside the specified tolerances,
- A poor laminate bond exists, or
- Three or more separate surface cracks greater than 0.08" wide and 0.08" deep exists.

5. **Long-Duration Compression Tests on Bearings** - (This test is required on 10% of each type and size of laminated bearing furnished)

The long-term compression test shall be performed as specified in item 4 above, "Short-Duration Compression Tests on Bearings," except that the second load shall be maintained for 15 hours. The bearing shall be visually examined at the end of the tests while still under the load. If any patterns or cracks specified in Section 4, above, occur, all bearings from that lot shall be rejected, unless the manufacture elects to test each bearing of the lot. If the additional testing does not reveal any rejectable defects as noted in item 4, above, the bearings will be accepted.

6. **Shear Modulus Tests on Material from Bearings** - (This test is required for each elastomer formulation)

The shear modulus of the elastomer in the finished bearing shall be evaluated by testing a specimen cut from it using the apparatus and procedure described in Annex A of the ASTM D4014 specifications, amended where necessary in Tables A or B; or at the discretion of the Fabrication Engineer, a comparable nondestructive stiffness test may be conducted on a pair of finished bearings. The shear modulus shall fall within the specified range. If the test is conducted on the finished bearings, the material shear modulus shall be computed from the measured shear stiffness of the bearings, taking due account of the influence on shear stiffness of bearing geometry and compressive load.

Shear modulus tests performed on a sample of the same material as was used to fabricate the bearings will be acceptable. Shear modulus testing shall be performed using the apparatus and procedure described in ASTM D4014, Annex A.

523.24 – 523.29 **Vacant**

POT or DISC BEARINGS

523.30 **Design** - Pot or Disc bearings shall be designed for the loads and movements given on the Plans. Configurations and dimensions shall conform to AASHTO/NSBA G 9.1, Steel Bridge Bearing Design and Detailing Guidelines. Configurations and dimensions other than those given on the Plans or AASHTO/NSBA G 9.1 may be accepted subject to the approval of the Fabrication Engineer. Design calculations to substantiate all the requirements stated in this specification shall be submitted as part of the Working Drawings and shall be stamped and signed by a Professional Engineer licensed in the State of Maine.

Except where indicated on the Plans, the design shall also include the connections between the bearings and the superstructure, and the bearings and the substructure, along with adequate provisions for hold-downs equal to the tensile strength of the anchor rods.

The bearings shall be designed to accommodate a rotation of not less than 0.015 radians.

The static coefficient of friction between the PTFE and the stainless steel surface, for each size and type of bearing, shall not exceed 0.20 at the average unit bearing pressure for the minimum vertical load indicated on the Plans.

The bearings shall be designed for a horizontal force at least equal to 10% of the vertical capacity of the bearing.

No more than two bearings, with guide bars, per bearing line, shall be considered to be carrying the total maximum lateral horizontal load as indicated on the Plans.

Bearing friction shall not be considered when the horizontal load capacity of guided or fixed bearings is calculated.

The PTFE sliding surface for pot or disc bearings shall be designed to meet the following:

1. The average unit pressure shall be 3,500 psi, -5%, +0%, for the maximum vertical load indicated on the Plans.
2. Unfilled PTFE shall have a minimum thickness of $\frac{1}{8}$ " with half of its thickness recessed into the piston.
3. Filled PTFE shall be a minimum of $\frac{1}{16}$ " thick and shall be bonded to the surface of the piston and to the guide bar.
4. The maximum thickness of the PTFE, filled or unfilled, shall be $\frac{3}{32}$ ", except, if recessed it shall be $\frac{3}{16}$ ".

The stainless steel sliding surface shall be designed to meet the following:

1. The stainless steel shall cover the PTFE in all operating positions such that the stainless steel will have a minimum of 1" edge clearance beyond the PTFE.
2. The thickness shall be not less than 0.040" or greater than 0.090".
3. When a center guided key is utilized, a recess shall be machined in the sole plate and the vertical sliding surfaces of the recess shall be covered with stainless steel.

The guide bars shall be designed to meet the following:

1. The guide bars shall be designed for the maximum horizontal load, as indicated on the Plans, but not less than 10% of the vertical capacity of the bearing.
2. The guided member shall be within the guide bars at all operating positions.
3. The overall width of the guide bar and the PTFE sliding surfaces shall be $\frac{1}{8}$ " less than the clear width of the keyway in the guided member.
4. A PTFE sheet, 1/16" minimum thickness, shall be bonded to the sliding contact surfaces of the guide bars. The sheets shall be filled PTFE.

Pot Bearings

- A. The elastomeric discs shall be designed to meet the following:
 1. The average unit pressure shall be 3,500 psi, -0%, +10%, for the maximum vertical load indicated on the Plans.
 2. The average unit pressure shall not be less than 700 psi for the minimum vertical load.
 3. When utilizing flat brass sealing rings, the upper edge of the discs shall be recessed to receive the brass rings.
 4. A PTFE sheet, filled or unfilled, 1/16" minimum thickness and the same diameter as the design diameter of the disc, shall be placed below the discs.

The pot shall be designed to meet the following:

1. The depth of the cavity shall be equal to or greater than: Twice the design rotation plus 0.1" plus the thickness of the elastomeric disc and the PTFE sheet.
2. The inside diameter shall be the same as the design diameter of the elastomeric disc.

3. The pot shall be mounted, to provide a tight fit, in a $\frac{1}{8}$ " minimum depth recess in the steel masonry plate or distribution plate and shall be capable of being removed for inspection and repairs.
- B. The piston shall be designed to meet the following:
1. The outside diameter shall be 0.03" less than the inside diameter of the pot.
 2. The minimum thickness shall be not less than 0.08 times the design diameter.
 3. When utilizing round brass sealing rings, the lower outside edge shall be beveled to accept and retain the brass ring and to permit full design rotation.
 4. Laterally restrained pot bearings shall have a keyway in the sole plate. The top surface of the piston shall have a keyway slot and a cold finished steel guide bar press fitted into it and welded at the ends.
 5. A PTFE sheet, filled or unfilled, 1/16" minimum thickness and the same diameter as the bottom surface of the piston, shall be bonded to the bottom surface of the piston.
- C. The elastomer sealing rings shall be brass and shall be designed to meet the following:
1. Flat brass sealing rings, if utilized, shall:
 - a. Have a width of $\frac{3}{8}$ " minimum, with bearings up to a 1,000 kip capacity and a $\frac{1}{2}$ " width, with bearings over a 1,000 kip capacity.
 - b. Have a minimum thickness of 0.050".
 - c. Have two rings with a bearing capacity up to 1,000 kip, three rings with a bearing capacity over 1,000 kip, but less than 3,000 kip, and four rings with a bearing capacity of over 3,000 kip.
 - d. Have the ends cut at 45° with a minimum gap in the installed position of 0.050" and shall fit the inside diameter of the pot snugly.
 - e. Have the ring gaps staggered 180° apart.
 2. Round brass sealing rings, if utilized, shall:
 - a. Be of one piece with the ends brazed to make a solid ring.
 - b. Have the outside of the ring fit snug in the inside diameter of the pot.

Disc Bearings

- A. The elastomeric discs shall be made from a compound based of polyether urethane using only virgin materials.
- B. The disc shall be designed such that:
 - 1. Its instantaneous deflection under total load does not exceed 10% of the thickness of the unstressed disc and the additional deflection due to creep does not exceed 8% of the unstressed disc.
 - 2. The components of the bearing do not lift off each other at any location.
 - 3. The average compressive stress on the disc does not exceed 5.0 ksi. If the outer surface of the disc is not vertical, the smallest plan area shall be used for computing stress.

523.31 **Materials** - Materials shall conform to Section 523.02 - Materials, and the following:

- Sealing rings shall be brass.
- Flat rings shall conform to the requirements of ASTM B36, half hard.
- Round sealing rings shall conform to the requirements of Federal Specification QQB626, Composition 22, half hard.

Elastomeric Disc hardness shall be:

- Shore A Durometer scale, between 50 and 60, for Pot Bearings
- Shore D Durometer scale, between 45 and 65, for Disc Bearings

523.32 **Fabrication** - Bonding of PTFE sheets to the piston shall be under factory-controlled conditions and in accordance with written instructions of the manufacturer of the adhesive. After completion of the bonding operation, the PTFE surface shall be smooth and free from bubbles. PTFE surfaces shall not be polished, but shall be wiped clean using a solvent appropriate for the material.

The stainless steel sliding surfaces shall be seal welded around the entire perimeter. The surfaces shall be smooth and flat and the back of the stainless steel shall remain in intimate contact with the sole plate.

Pots shall be machined from a solid plate or fabricated by welding a cut shape to a plate. Fabricated pots shall be 100% ultrasonically tested at the inside weld and magnetic particle tested at the exterior weld.

The elastomeric discs in pot bearings shall be manufactured from no more than three pieces.

Each bearing shall be assembled at the plant and, following assembly, shall be sealed at the joint between the piston and the pot with a continuous ¼", minimum, bead of a flexible silicone rubber sealing compound approved by the Fabrication Engineer.

Each bearing shall have permanent match marks to indicate the neutral 45°F position of the bearing. Each bearing shall also be marked for identification by die stamping on all steel parts (edge of sole plate, piston, masonry plate, and top edge of pot).

Each bearing shall be shipped and stored in moisture-proof and dust-proof covers until they are to be erected.

- 523.33 **Fabrication Tolerances** - Tolerances shall comply with Section 523.06 - Fabrication Tolerances, and as noted below.

Brass sealing rings shall have finished surfaces of less than 63 mils (ANSI B 46.1).

- 523.34 **Testing and Certification** - The manufacturer of the pot or disc bearings shall furnish test facilities for testing and inspection of the completed bearings. The Fabrication Engineer, or an authorized representative, shall be allowed free access to the manufacturer's plant and test facility. The Fabrication Engineer will select two completed bearings for testing. The test shall be arranged so that the static coefficient of friction on the first movement can be determined. The test shall first be conducted at an average bearing pressure of 3,500 psi on the PTFE surface with the test load applied continuously for not less than 12 hours nor more than 14 hours prior to measuring the friction. The first movement static coefficient of friction shall then be determined. The above test shall then be repeated for the minimum vertical load indicated on the Plans for the bearings selected. The results shall not exceed that specified for the design.

A proof load test shall also be performed on each test bearing by applying a load equal to 150% of the maximum vertical load indicated on the Plans for the bearings selected for a period of 1 hour. The test bearings shall show no sign of failure or other defects while under load or subsequently upon disassembly and inspection.

Before testing, the testing equipment and procedure shall be submitted to the Fabrication Engineer for review.

- 523.35 – 523.39 **Vacant**

- 523.40 – 523.49 **Reserved - Spherical Bearings**

- 523.50 **Method of Measurement** - Bearings will be measured for payment by each unit, tested and accepted. Bearing installation will be measured for payment by each unit in place and accepted.

- 523.51 **Basis of Payment** - Bearings will be paid for at the Contract unit price each, which price shall be full compensation for the design, fabrication, testing, and delivery. Bearing installation will be paid for at the Contract unit price each which price shall be full compensation for installation, including all materials, equipment, labor and incidentals necessary for installing the bearings in accordance with the Plans and this specification. Removal of the existing bearings, if present, including all materials, equipment, labor and incidentals

necessary for jacking the superstructure, removal of the existing bearings and preparation of the bridge seat in accordance with the Plans and this Specification, shall be considered incidental to bearing installation.

Payment will be made under:

Pay Item		Pay Unit
523.52	Bearing Installation	Each
523.5301	Steel Bearings, Fixed, Sliding Plate	Each
523.5302	Steel Bearings, Expansion, Sliding Plate	Each
523.5303	Steel Bearings, Fixed, Rocker	Each
523.5304	Steel Bearings, Expansion, Rocker	Each
523.5401	Laminated Elastomeric Bearings, Fixed	Each
523.5402	Laminated Elastomeric Bearings, Expansion	Each
523.5403	Plain Elastomeric Bearings	Each
523.5551	Pot or Disc Bearings, Fixed	Each
523.5552	Pot or Disc Bearings, Expansion	Each
523.5601	Spherical Bearings	Each

SECTION 524 - TEMPORARY STRUCTURAL SUPPORTS

524.01 **Description** - This work shall consist of the designing, fabricating, erecting, maintaining, and dismantling of temporary structural support(s) as called for on the Contract Plans, all in conformity with these specifications. Temporary structural supports proposed by the Contractor to facilitate the work shall also conform to these specifications.

524.02 **Materials** - Materials used may be either sawn timber or steel, or a combination of both, at the Contractor's option, and, whether new or used, shall be sound and of adequate cross section for the intended loads. Blocking needed below the temporary supports to accommodate differences in elevation, and/or pads required to distribute loads to the soil may additionally incorporate plain and reinforced concrete.

524.03 **Design** - Temporary structural support(s) shall be designed to support all vertical loading including live load and impact, differential settlement forces, horizontal and longitudinal forces, and shall account for any temporary unbalanced loading due to jacking forces and other loading during load transfer. Sufficient redundancy shall be designed into the support structure so that failure of one member will not cause the collapse of the entire system and the supported structure.

Temporary supports which are adjacent to traveled ways or which support structures carrying traffic, shall additionally be designed to resist any vibration or impact forces due to traffic and shall incorporate sufficient protection against impact by errant vehicles.

Temporary support(s) shall be designed by a licensed Professional Engineer and all plans, computations, and working drawings shall be signed by that Engineer, and shall be submitted to the Resident for approval. The design of the Temporary Structural Support(s) shall be submitted to the Resident at least 3 weeks prior to the start of Work.

524.031 **Protective Shield Design** - The provisions of Section 524.03 – Design shall apply to this Section with the following modifications:

- The proposed methods of protective shielding, including connections and fasteners, shall be in accordance with the following criteria:
- The protective shield shall be designed for safely supporting all construction and dead loads, but not less than 100 lb per square foot with a load duration of 7 Days.
- Protective shield shall be stiff enough to limit deflection to ½" under maximum loads and to be tightly sealed at all joints.
- The protective shield shall be placed on the tops of the bottom flanges of steel girders, with edges and laps made tight to protect the motorists underneath from dust, debris, water, slurry and falling objects.
- The Protective shield shall be designed to safely support all anticipated loads from pieces of concrete falling from the existing deck during saw cutting or initial handling operations while the existing deck is being removed, and to protect against tools falling onto traffic below.

524.032 **Approach Roadway Support** - Design The provisions of Section 524.03 – Design shall apply to this Section with the following modifications:

- The temporary structure and approaches shall achieve acceptable minimum factors of safety.
- Minimum factors of safety for slope stability are 1.3 for approach embankment slopes and 1.5 for embankment slopes that contain or support structures.
- The minimum factor of safety for sliding and overturning is 1.3.

524.04 **Erection and Removal** - The erection of temporary support(s) shall be in strict conformance with the approved design and details and shall use only the materials approved for use. No loads shall be placed on the temporary support(s) until the Contractor's Professional Engineer has provided written certification to the Resident that the system was erected in conformance with the approved plans and design details.

The consent of the Department regarding design, construction or use of temporary supports shall not be construed, in any way, as relieving the Contractor of its responsibility to provide supports that are adequately designed and constructed to carry the loads that will be placed upon them. The work shall be entirely at the Contractor's risk.

Upon completing the work requiring the use of the temporary structural supports, the temporary support structures shall be removed and the area under and around them shall be restored to its original condition.

524.041 **Protective Shield Erection and Removal** - The provisions of Section 524.04 – Erection and Removal shall apply to this Section with the following modifications:

- No portion of the protective shield installed over a roadway shall Project below a horizontal plane Projecting out at the lowest point of the superstructure. During demolition operations and constructing/placing the new deck, the protective shield shall be covered with sheet plastic made tight at edges and laps to prevent water used in the saw cutting operation or placement of concrete from falling onto the facilities under the bridge.
- The protective shield on existing and new structures shall extend horizontally a minimum of 3 ft beyond the fascia lines and vertically to a point 1 ft minimum above the top of rail or parapet. Shielding shall extend 10 ft beyond the edge of pavement on the roadway below or as approved by the Resident.
- Shielding shall be approved and installed prior to the start of any demolition work and shall remain in position during all demolition work. Shielding shall also be approved and installed prior to the start of any deck forming for the new bridge and shall remain in position during all deck work. The protective shielding shall be relocated or removed only as directed by the Resident.

524.05 **Method of Measurement** - Temporary structural supports will be measured as the number of individual units called for on the Plans, satisfactorily designed, erected, maintained, and dismantled. Temporary Structural Support, Approaches and Temporary Structural Support, Protective Shield shall be measured as one lump sum satisfactorily designed, erected, maintained, and dismantled.

Temporary supports used by the Contractor for their convenience will not be measured for payment. Installation and reinstallation of Temporary Structural Supports between construction phases, if required, will not be measured

separately, but will be considered incidental to the Temporary Structural Support Pay Item.

Any work associated with support, bracing, or otherwise stabilizing any structures disturbed or partially removed as part of the Work or with removal and reinstallation of existing highway appurtenances (e.g. guardrails, sign supports, etc.) to facilitate the erection of Temporary Structural Supports will not be measured for payment, but will be considered incidental to the Temporary Structural Support Pay Item.

524.06 **Basis of Payment** - Temporary Structural Supports will be paid for at the Contract unit price, which price shall be full compensation for all materials, equipment, labor and incidentals necessary for the design, erection, maintenance, and dismantling of such supports in accordance with the Plans and these Specifications or as approved by the Resident. This work includes but is not necessarily limited to:

- Working Drawings;
- design;
- transportation and stacking;
- installation;
- removal,
- onsite storage,
- and reinstallation as required;
- and periodic removal of concrete rubble and other materials necessary to perform the work.

Payment will be made under:

Pay Item		Pay Unit
524.30	Temporary Structural Support	Each
524.301	Temporary Structural Support, Approaches	Lump Sum
524.40	Temporary Structural Support, Protective Shield	Lump Sum

SECTION 525 - GRANITE MASONRY

525.01 **Description** - This work shall consist of furnishing and placing granite pier facing in accordance with these specifications and as shown on the Plans.

525.02 **Materials** - The granite shall be obtained from a quarry approved by the Department and be free from materials which, by weathering, would cause discoloration or deterioration. The granite for the entire Project shall be uniform in color and free from seams, cracks and other structural defects.

Caulking of joints shall be accomplished with a two-component, epoxy-resin system designed for the intended use. A quartzite aggregate shall be added in accordance with the manufacturer's recommendations. The material shall be

moisture insensitive, of low modulus of elasticity, and of a gel-like non-sag viscosity. Color shall be gray. The materials shall be subject to the approval of the Resident.

Anchors shall be of either ASTM A36 steel, galvanized in accordance with AASHTO M 111 (ASTM A123), or ASTM A276 Type 304 stainless steel, $\frac{3}{4}$ " diameter, as indicated on the Plans. Other types of anchors may be used with prior approval of the Resident.

Joint mortar shall comply with Section 705.02 - Joint Mortar, except that it shall contain an additive to insure water-tightness. The additive shall not contain a retarding agent or hydrated lime and shall be approved by the Resident.

- 525.03 **General** - Granite masonry shall have all stones dressed and cut to exact dimensions and laid up in joint mortar, with joints $1\frac{1}{2}$ " $\pm$ $\frac{1}{8}$ " in thickness.

A complete setting plan shall be submitted to the Department for approval, before ordering any stone.

The arrangement and the length of the stones shall be approved by the Department.

- 525.04 **Stones** - The finish on exposed surfaces of the stones shall be free from tool marks. Irregular Projections shall be limited to a maximum of 3" for any one stone measured from the pitch line. Irregular depressions shall be limited to a maximum of 1" for any one stone measured from the pitch line.

Stones shall have their edges pitched to a true line with tops and bottom parallel and cut to lie on their natural beds. The top and bottom beds shall be the full size of the stone, and hollow beds shall not be permitted. The beds of stone shall be sawn or fine finished, full depth. The vertical face joints shall be sawn or fine finished for a depth of not less than 4", with the balance not to fall away more than 4".

The top layer of granite shall have a $1\frac{1}{2}$ " wide chisel draft line along the top face adjacent to concrete.

All stones shall be so finished that no holes or portions of holes shall show on surfaces that will be exposed in the finished work.

The depth of the stone shall be not less than 8" and not more than 12", measured from the back face of the stone to the pitch line. The Contractor shall use extreme care when placing the concrete within the boundaries of the stone facing to avoid causing air pockets due to overhanging stones. Stone heights shall be a minimum of 15".

- 525.05 **Anchors** - Holes for anchors shall be drilled in the stones before they are placed.

There shall be a minimum of 2 anchors at a maximum spacing of 48" in the top and bottom beds of each piece and grooves shall be cut from the anchor holes to the back of the stones.

Stones greater than 48" in height shall have additional anchors located in the back face of the pieces such that there will be a maximum spacing, both vertical and horizontal, of 48" between anchors.

Anchors in the top and bottom beds of each stone shall be located such that an anchor will be not greater than 18" from each end of the piece. Anchors in the back face of each stone shall be located such that an anchor will be not greater than 18" from each end of the piece.

525.06 **Mortar** - Joint mortar shall be machine mixed for not less than 1½ minutes after all ingredients are in the mixer. Mortar shall be used within 30 minutes after mixing and the retempering of mortar will not be permitted. The mixing and placing of mortar shall be discontinued when the atmospheric temperature is below 40°F in the shade, and dropping, and shall not be resumed until the atmospheric temperature is as high as 35°F in the shade, and rising, unless otherwise authorized by the Resident.

525.07 **Setting Stones** - Stones shall be thoroughly cleaned before being set and the bed to receive the stones shall be well cleaned. The thickness of all joints and beds shall be uniform throughout. Spalls shall not be used as pinnars in mortar beds or joints. When any stone is disturbed or mortar joint broken, the stone shall be taken up, and after all mortar has been cleaned from the stone, bed and joints, the stone shall be reset in fresh mortar. All stones shall be well bedded with the face joints properly raked before the mortar has set.

The masonry shall be kept wet during the pointing, and in hot or dry weather shall be protected from the sun and kept wet for a period of 3 Days after completion of setting, unless otherwise permitted or directed. Face surfaces of stone shall not be smeared with mortar and after pointing has been completed and set, the masonry shall be thoroughly cleaned to the satisfaction of the Resident. Stones shall not be set when the stones contain frost or during freezing weather, unless otherwise permitted.

Concrete backing shall be of the class shown on the Plans. The concrete shall be so worked and compacted that all spaces around stones are completely filled and an adequate bond with the stone is secured. Construction joints in the concrete, required by intermittent placing, shall be located not less than 6" below the top bed of any course of the stone facing. The stones shall be secured and the concrete so placed, as approved by the Resident, to prevent movement of the stones during placement of the concrete.

525.08 **Joints** - All joints shall be raked 1½" deep and caulked with an approved two-component epoxy-resin system. All caulking shall be done in such a manner as to produce a tight, durable and impervious seal at all joints. All caulking shall be accomplished as soon as possible to avoid exposure at joints to salt water.

The two-component epoxy-resin system shall be proportioned, mixed, and applied in accordance with the manufacturer's recommendations.

The joint below the bottom layer of granite shall be 1" ±½" in thickness.

525.09 **Method of Measurement** - Granite masonry will be measured for payment by the number of square feet of exposed granite masonry, including joints, in the completed work and measured from the pitch lines as shown on the plans.

525.10 **Basis of Payment** - Granite masonry will be paid for at the Contract unit price per square foot complete in place and accepted. This price shall include all materials, equipment, labor and incidentals necessary to complete the work. The cost of the anchors, completed and in place, shall be included in the Contract unit price of this item.

Payment will be made under:

Pay Item		Pay Unit
525.30	Granite Masonry	Square Foot

SECTION 526 - CONCRETE BARRIER

526.01 **Description** - This work shall consist of the furnishing, constructing, erecting, setting, resetting, and removal of concrete barrier and associated elements in accordance with these specifications, the Standard Details, and the lines and grades shown on the Plans or established by the Resident.

The types of concrete barrier are designated as follows:

- **Portable Concrete Barrier Type I** - Double faced removable barrier in accordance with the Standard Details.
- **Permanent Concrete Barrier Type II** - Double faced barrier as shown on the Plans.
- **Permanent Concrete Barrier Type IIIa** - Single faced barrier 32" high in accordance with the Standard Details or as shown on the Plans.
- **Permanent Concrete Barrier Type IIIb** - Single faced barrier 42" high in accordance with the Standard Details or as shown on the Plans.
- **Permanent Concrete Transition Barrier** - Barrier of various heights joining steel bridge rail to steel guardrail in accordance with the Standard Details or as shown on the Plans.
- **Permanent Texas Classic Rail** - Barrier Traffic rail or sidewalk rail, in accordance with the Standard Details or as shown on the Plans.

526.02 **Materials**

- a. **Concrete** - Concrete for barriers, both permanent and portable, shall have a design strength of 5,000 psi.

For cast-in-place barrier - The concrete shall be Class LP, in accordance with Standard Specification Section 502 - Structural Concrete.

For precast barrier - The concrete shall meet the requirements of Standard Specification 534 - Precast Structural Concrete, except the stripping strength for precast barriers is 4,000 psi. Concrete shall be Class P1.

- b. **Reinforcing Steel** - Reinforcing steel shall meet the requirements of Section 503 - Reinforcing Steel.
- c. **Structural Steel** - Plates and barrier connections shall meet the requirements specified in Standard Specification 504 - Structural Steel and shall be hot dip galvanized after fabrication in accordance with Standard Specification 506 - Shop Applied Protective Coating – Steel
- d. **Bolts** - Bolts shall meet the requirements specified in Section 713.02 - High Strength Bolts.
- e. **Connecting Pins for Portable Concrete Barrier** - Portable concrete barriers must be connected using a 1" diameter pin. The connecting pin must be smooth, not deformed, i.e., reinforcing bar may not be used, and shall meet the strength requirements of ASTM A449 steel. Materials with greater strength may be used with the approval of the Department.
- f. **Anchor Pins for Portable Concrete Barrier** - Anchoring to concrete or asphalt will be required when specified on the Plans. When required, portable concrete barriers must be anchored using a 1½" diameter anchor pin. The anchor pin must be smooth, not deformed, i.e., reinforcing bar may not be used, and shall meet the strength requirements of ASTM A36 steel. Materials with greater strength may be used with the approval of the Department.
- g. **Device Crashworthiness** - MaineDOT is transitioning to MASH2016 criteria for Portable Concrete Barrier on the following schedule:
 - **New Portable Concrete Barrier** - shall be crash tested and/or evaluated to MASH2016 criteria.
 - **Current Portable Concrete Barrier** - in useful serviceable condition that is successfully tested to NCHRP Report 350 or MASH2009 criteria may be utilized through December 31, 2029.

526.03 **Construction Requirements**

Cast-in-place barriers - shall be fabricated in accordance with Standard Specification Section 502 - Structural Concrete. Precast barriers shall be fabricated in accordance with Standard Specification 534 - Precast Structural Concrete.

Concrete finish - for permanent barrier shall be rubbed as defined in Standard Specification Section 502 - Structural Concrete, 502.13 D2 or an approved equal.

Portable concrete barrier shall be generally free from fins and porous areas and shall present a neat and uniform appearance.

Permanent barrier shall have a protective coating applied in accordance with Standard Specification Section 515 - Protective Coating for Concrete Surfaces.

Reflective delineators for concrete median barrier shall meet the requirements of Special Provision 645 - Highway Signing.

Preformed Joint Filler shall meet the requirements specified in Subsection 705.01 - Preformed Expansion Joint Filler.

Permissible dimensional tolerances for all concrete barriers shall be as follows:

- a. Cross-sectional dimensions shall not vary from design dimensions by more than $\frac{1}{4}$ ". The vertical centerline shall not be out of plumb by more than $\frac{1}{4}$ ".
- b. Longitudinal dimensions shall not vary from the design dimensions by more than $\frac{1}{4}$ " per 10 ft of barrier section and shall not exceed $\frac{3}{4}$ " per section.
- c. Location of anchoring holes shall not vary by more than $\frac{1}{2}$ " from the dimensions shown in the concrete barrier details on the Plans.
- d. Surface straightness shall not vary more than $\frac{1}{4}$ " under a 10 ft straightedge.
- e. The barrier shall have no significant cracking. Significant cracking is defined as fractures or cracks passing through the section, or any continuous crack extending for a length of 12" or more, regardless of position in the section.

526.04 **Method of Measurement** - Permanent Concrete Barrier Type II, IIIa, IIIb, Texas Classic Rail, and Precast Median Barrier will be measured for payment by lump sum, complete in place.

Portable concrete barrier, both anchored and unanchored will be measured for payment by lump sum. Lump sum measurement will include verification of the installation and removal of all portable concrete at the completion of the Contractor's operations.

The Contractor shall replace sections of portable concrete barrier, including anchored barrier damaged by the traveling public when directed by the Resident. Replacement sections will be measured for payment in accordance with Standard Specification 109.7 - Equitable Adjustments to Compensation and Time.

Transition barrier will be measured by each, complete in place.

526.05 **Basis of Payment** - The accepted quantities of Concrete Barrier Type II, IIIa, IIIb, Texas Classic Rail, and Precast Median Barrier will be paid for at the Contract lump sum price for the type specified, complete in place.

The accepted quantities of Portable Concrete Barrier Type I, both anchored and unanchored will be paid for at the Contract lump sum price. Such payment shall be full compensation for furnishing all materials, assembling, moving, resetting, transporting, temporarily storing, removing barrier, furnishing new parts as necessary, and all incidentals necessary to complete the work.

Portable barrier shall become the property of the Contractor upon completion of the use of the barrier on the Project and shall be removed from the Project site by the Contractor.

Transition barrier will be paid for at the Contract price each, complete in place.

The accepted quantity of all types of concrete barrier, whether portable or permanent, will be paid for at the lump sum or per each price, as applicable, which payment shall be full compensation for all materials, including reinforcing steel, protective coating, reflective delineators, steel plates and hardware, equipment, labor and incidentals required, as necessary, to complete the work.

Payment will be made under:

Pay Item		Pay Unit
526.301	Portable Concrete Barrier, Type I	Lump Sum
526.304	Portable Concrete Barrier, Anchored Type I	Lump Sum
526.312	Permanent Concrete Barrier Type II	Lump Sum
526.321	Permanent Concrete Barrier Type IIIa	Lump Sum
526.323	Texas Classic Rail	Lump Sum
526.331	Permanent Concrete Barrier Type IIIb	Lump Sum
526.34	Permanent Concrete Transition Barrier	Each

SECTION 527 - ENERGY ABSORBING UNIT (Work Zone Crash Cushion)

527.01 **Description** - The Contractor shall furnish and install Work Zone Crash Cushions as specified in Special Provision 652 or as directed by the Resident.

527.02 **Materials** - MaineDOT is transitioning to MASH2016 criteria for Work Zone Traffic Control Devices on the following schedule:

- Portable Crash Cushions will be crash tested and/or evaluated to MASH2016 criteria by January 1, 2030. Current Category 3 devices in useful serviceable condition that are successfully tested to NCHRP Report 350 or MASH2009 criteria may be utilized through December 31, 2029.

- Work Zone Crash Cushions shall be selected from the Department's Qualified Products List of Crash Cushions/Impact Attenuators or approved equal.

527.03 **Construction Requirements** - Work Zone Crash Cushions shall be provided and installed in accordance with the manufacturer's recommendations for the specific application and the posted speed limit.

Work Zone Crash Cushions, which are damaged or destroyed, shall be repaired or replaced promptly. The Contractor shall have on hand one complete set of replacements.

527.04 **Method of Measurement** - The Department will measure Work Zone Crash Cushions by the Unit, complete in place and accepted. A cluster of Portable Crash Barrels or a cluster of Energite III sand barrels is considered a Unit. Each N-E-A-T or Adiem II is considered a Unit.

527.05 **Basis of Payment** - The Department will pay for the accepted quantity of Work Zone Crash Cushions at the Contract unit price for each Unit, which price shall be full compensation for furnishing and placing the Work Zone Crash Cushion, including all incidentals and for resetting as many times as required.

Replacements for the Work Zone Crash Cushions damaged beyond functionality by collisions will be paid for as new Work Zone Crash Cushions, and the removal of the impacted devices and debris will be considered incidental to the replacement units. Replacement Work Zone Crash Cushions on hand, but unused, will not be paid for directly.

Payment will be made under:

Pay Item		Pay Unit
527.34	Work Zone Crash Cushions	Unit

SECTION 528 - STRUCTURAL TIMBER - Reserved

SECTION 529 - NAVIGATIONAL AIDS – Reserved

SECTION 530 - GLASS FIBER REINFORCED POLYMER REINFORCEMENT BARS

530.01 **Description** - This work shall consist of furnishing and placing Glass Fiber Reinforced Polymer (GFRP) reinforcement bars, in accordance with the Plans and as specified herein.

530.02 **Materials** - GFRP reinforcement shall meet the requirements shown in the AASHTO LRFD Bridge Design Guide Specifications for GFRP-Reinforced

Concrete, including interim revisions, except as shown on the Plans and as stated herein. All GFRP reinforcement shall be deformed or sand coated.

GFRP reinforcement bars shall be one of the approved products listed on the MaineDOT Qualified Products List.

All GFRP reinforcement in the same structural component shall be supplied by the same manufacturer; there shall be no mixing of products from different manufacturers in a component unless permitted in the Contract Documents.

530.021 **Documentation** - The GFRP reinforcement manufacturer shall submit two copies of a Material Certification stating that the GFRP reinforcement incorporated into the Project meets the requirements of this specification to the Resident. The certification shall include the test values and test procedures used to determine the physical properties of the GFRP reinforcement. The certification shall bear the notarized signature of a responsible authorized representative of the GFRP reinforcement manufacturer. Each bundle of GFRP reinforcement shall be identified with the lot number affixed to each bundle by means of a durable tag.

530.03 **Schedule of Material** - When the Plans do not include GFRP reinforcement bar schedules, the Contractor shall submit order lists, shape diagrams and bar layout drawings in accordance with Subsection 105.7 to the Resident for approval. The GFRP reinforcement shall not be ordered until these lists and drawings are approved. Approval shall not relieve the Contractor of full responsibility for the satisfactory completion of the Work specified herein. When the Department allows the use of precast concrete deck panels, or any other significant changes that affect the quantity of GFRP reinforcement, the Contractor shall be responsible for revising the reinforcement bar schedule; the revised schedule shall be submitted to the Resident for approval. Substitution of different size GFRP reinforcement will not be permitted except with the written authorization of the Engineer of Record.

530.04 **Fabrication** - Forming and fabrication tolerances of GFRP reinforcement shall be in conformance with the latest edition of the "Manual of Standard Practice of the Concrete Reinforcing Steel Institute" and the "Detailing Manual of the American Concrete Institute."

530.05 **Protection of Material** - Delivery, storage, and handling of GFRP reinforcement shall be in accordance with the manufacturer's recommendations. The Contractor shall prevent bending, coating the bars with soil, oil, or other material, or other damage to the GFRP reinforcement.

All handling of GFRP reinforcement by mechanical means shall be done by equipment having padded contact areas, or using nylon webbing slings. The use of chains or wire rope slings will not be allowed, even when used with padding. All bundles of GFRP reinforcement shall be lifted with a strong back, spreader bar, multiple supports, or a platform bridge to prevent bar-to-bar abrasion from

sags in the bundles. Support points during lifting or transporting of bundled GFRP reinforcement shall be spaced at a maximum of 15 ft, or as required by the manufacturer, whichever is more restrictive. Bundled bars shall be strapped together with non-metallic or padded straps in a manner to prevent bar-to-bar abrasion due to relative movement between bars.

Individual bars shall be handled in a manner that prevents damage to the coating due to abrasion or impact, and at no time shall any bar be moved by dragging over any surface, including other reinforcement bars. Sufficient personnel shall be assigned to ensure compliance with the provisions above.

Bars loaded for transport shall be loaded and strapped down in a manner that will prevent damage from motion and vibration, to the greatest extent possible. Bundles of bent bars shall be transported strapped to wooden platforms or shall be crated. All individual bundles and layers of bundles shall be separated, and supported by dunnage.

GFRP reinforcement shall be stored on skids or other supports a minimum of 12" above the ground surface and protected at all times from damage and surface contamination. The storage supports shall be constructed of wood or other material that will not damage the surface of the GFRP reinforcement or sand coating. Bundles of bars shall be stored on supports in a single layer. Each bundle shall be placed on the supports out of contact with adjacent bundles. If it is expected that GFRP bars will be required to be stored outdoors for a period in excess of 2 months, then the GFRP reinforcement shall be protected from ultraviolet radiation. Prevent exposure of GFRP to temperatures above 120 degrees Fahrenheit.

All damaged bars shall be repaired in accordance with manufacturer recommendations and inspected and accepted by the Resident prior to placing concrete. All bars with total damage greater than 2% of the bar surface area, including previously repaired areas, will be rejected. All cuts, scratches, cracks, abrasions, or other damage, visible to the naked eye, shall be repaired. All bars damaged prior to placement within the formwork shall be repaired prior to GFRP reinforcement placement.

- 530.06 ***Placing and Fastening*** - GFRP reinforcement shall be accurately placed in the positions shown on the Plans. Support and firmly tie or otherwise secure GFRP reinforcement in place to prevent settlement, floating upward, or movement in any direction during the placing and setting of the concrete.

Field bending of GFRP reinforcement is not allowed.

Field cutting of GFRP reinforcement will only be permitted with the approval of the Resident. Field cutting shall be with a high-speed cutter, fine blade saw, diamond blade or masonry saw. The GFRP reinforcement shall not be shear cut. The ends of all field cut GFRP reinforcement shall be treated in accordance with the manufacturer's recommendations.

GFRP reinforcement supported on formwork shall rest on stays, blocks, ties, hangers, GFRP or plastic chairs, bar supports made of dielectric material, or other approved materials. Blocks used for this purpose shall be precast Portland Cement mortar blocks of approved shape and dimensions. Blocks shall not be used in cases where the blocks will be visible in the finished product.

Reinforcement bars used as support bars shall be GFRP, stainless steel, or non-metallic. The use of pebbles, stone, brick, metal pipe, wood, or metal chairs will not be allowed. Wire bar supports will not be allowed. Layers of bars may be separated by precast Portland Cement mortar blocks or other approved devices.

Bars shall be fastened together at all intersections except where spacing is less than 1 ft in either direction, in which case, fastening at alternate intersections of each bar with other bars will be permitted providing this will hold all the bars securely in position. Ties shall be soft annealed wire that has been nylon, epoxy or plastic coated. Plastic ties will also be allowed. Placing reinforcement as concrete placement progresses, without definite and secure means of holding the GFRP reinforcement in its correct position, will not be allowed.

When specified on the Plans, GFRP reinforcement shall be anchored into drilled holes. The anchoring material shall be one of the products listed on the Maine Department of Transportation's Qualified Products List and the Contractor shall submit a selected material to the Resident for approval. Installation shall be in accordance with the manufacturer's recommendations.

At each anchor location, existing reinforcement shall be located to avoid drilling through existing bars. Where interferences exist, location adjustments will be determined by the Resident. Minimum embedment lengths of reinforcement shall comply with the manufacturer's recommendations for the anchoring material selected. The embedment lengths will be verified by the Resident before installation of the reinforcement.

Termination of GFRP reinforcement shall be as shown on the Plans. Any exceptions or modifications shall be approved, in writing, by the Engineer of Record.

Immediately before placing concrete, GFRP reinforcement shall be free from all foreign material. Foreign material includes, but is not limited to, dirt, paint, oil, bitumen and dried concrete mortar. Reinforcement shall be inspected and approved by the Resident prior to concrete placement.

530.07 **Splicing** - GFRP Reinforcement shall be spliced as shown on the Plans and as specified herein. No modifications of, or additions to, the splice arrangements shown on the Plans will be allowed without the prior approval of the Resident.

Any additional splices authorized shall be staggered as much as possible. All splices shall be made in a manner that will ensure that not less than 75% of the clear concrete cover and not less than 75% of the minimum clear distance to other reinforcement will be maintained, as compared to the cover and clear distance requirements for the un-spliced reinforcement.

Lapped splices shall be made by placing the bars in contact and tying them together. Ties shall meet the requirements specified herein.

- 530.08 **Method of Measurement** - GFRP reinforcement will be measured by the linear foot based on the authorized quantity in the Contract or in the approved reinforcement bar schedule submitted by the Contractor. No adjustments to the quantity will be made except to account for changes at the direction of the Resident.

If precast concrete deck panels are used, GFRP reinforcement in precast concrete deck panels will be considered incidental to the deck concrete. No separate payment will be made.

Lap splices that are authorized at the Contractor's request will not be measured for payment.

- 530.09 **Basis of Payment** - Payment for Glass Fiber Reinforced Polymer, Fabricated and Delivered, shall be considered full compensation for detailing, furnishing, and proper storage of GFRP reinforcement.

Payment for Glass Fiber Reinforced Polymer, Placing, shall be full compensation for installation, adjustment, and supplies related to placing GFRP reinforcement.

Payment for work associated with furnishing and revising the GFRP reinforcement bar schedule, and all expenses incurred by the Contractor and their suppliers to fulfill the requirements specified will be considered incidental to related Contract items. No separate payment will be made.

Payment will not be made for any materials used to hold reinforcement in place or for extra GFRP reinforcement due to substitutions and splices made for the Contractor's convenience.

When GFRP is specified to be anchored into drilled holes, no additional payment will be made for drilling and anchoring GFRP reinforcement or cutting GFRP reinforcement.

Payment will be made under:

Pay Item		Pay Unit
530.30	GFRP, Reinforcement Bars, Fabricated & Delivered	Linear Foot
530.31	GFRP, Reinforcement Bars, Placing	Linear Foot

SECTIONS 531, 532, 533 - Vacant

SECTION 534 - PRECAST STRUCTURAL CONCRETE

- 534.01 **Description** - The Contractor shall design, manufacture, furnish, and install precast structural concrete arches, box culverts or three sided frames and

associated wingwalls, headwalls, toe walls, cut-off walls and appurtenances, in accordance with the Contract Documents.

Other structural precast concrete units shall conform to the dimensions shown on the Plans, the requirements of this Specification and with the reviewed Working Drawings.

- 534.02 **Materials** - Structural precast elements shall meet the requirements of the following Standard Specification Subsections, except as noted otherwise in this specification:

Portland Cement and Blended Hydraulic Cement	701.01
Water	701.02
Air Entraining Admixtures	701.03
Water Reducing Admixtures	701.04
High Range, Water Reducing, Admixture	701.0401
Set-retarding Admixtures	701.05
Accelerating, Chemical Admixtures	701.0501
Curing Materials	701.06
Coal Ash and Natural Pozzolans	701.10
Calcium Nitrite Solution	701.11
Silica Fume	701.12
Slag Cement	701.13
Fine Aggregate for Concrete	703.01
Coarse Aggregate for Concrete	703.02
Alkali Silica Reactive Aggregates	703.0201
Combined Aggregate Grading for Concrete	703.03
Preformed Expansion Joint Filler	705.01
Reinforcing Steel	709.01
Welded Steel Wire Fabric	709.02

Materials for concrete shall conform to Table 1 below. Concrete mix designs shall be submitted for review and approval by the Fabrication Engineer prior to use. The Class of concrete shall be P1, unless specified different.

TABLE 1

Concrete CLASS	Compressive Strength (psi)	Entrained Air (%)		W/C Ratio	Calcium Nitrite Solution (gal/cy)	Notes
	LSL	LSL	USL	USL	LSL	
P1	5,000	5.0	8.0	0.40	3.0	1,2,3,4
P2	5,000	5.0	8.0	0.40	5.5	1,2,3,4
P3	4,600	5.0	8.0	0.42	N/A*	1,2,3,4
* 3 gal/cy if steel used Note #1 When required, permeability testing for all concrete mixes will be done at 56 Days. Note #2 Compressive Strength testing for all concrete mixes will be done at 28 Days. Note #3 Table limits shall be followed unless otherwise stated in the Contract Note #4 Coarse Aggregate for concrete shall conform to Grading A, AA or SP-1-7.						

For calculating water cementitious ratios, 1 U.S. gallon of water shall be considered to weigh 8.34 lb.

New concrete mix designs and mix designs not previously approved by the Fabrication Engineer shall be qualified by trial batches prepared in accord with AASHTO T 126 (ASTM C192). The test results shall demonstrate that the concrete meets the requirements of the Contract Documents.

Only one mat of steel is required for concrete member thickness of 7" or less; two mats of steel, one at each face, are required for concrete member thickness greater than 7".

Grout materials, rapid setting concrete patching materials, and geotextiles shall be one of the products listed on the Department's Qualified Products List (QPL).

All precast members for a distinct system or Contract Pay Item, including end blocks, steps, caps, box culverts, arch sections, wall units, or other elements, shall be manufactured from the same material sources of aggregates, brand and type of cement and color pigment.

Bedding and backfill material for structural precast arch, box culvert, or three sided frame and associated precast elements shall conform to the requirements of Standard Specification 703.19 - Granular Borrow, Material for Underwater Backfill.

534.03 **Drawings** - Prepare shop detail, erection and other necessary Working Drawings in accordance with Standard Specification Section 105.7 - Working Drawings. The Department will review the drawings in accordance with the applicable requirements of Section 105.7 - Working Drawings. Changes and revisions to the reviewed Working Drawings shall require further review by the Fabrication Engineer. Working Drawings shall include the following minimum details:

1. Fully dimensioned views showing the geometry of the units, including all Projections, recesses, notches, openings, block outs, keyways and chamfers.
2. Details and bending schedules of reinforcing steel including the size, spacing, and location. Reinforcing provided under lifting devices shall be shown in detail.
3. Details and locations of all items to be embedded.
4. Total weight of each unit.

Concrete mix designs shall be part of the Working Drawing submittal. Include aggregate specific gravity, absorption, percent fracture, fineness modulus and gradation as part of the mix design. Provide the mix design calculations demonstrating how the batch weights, water-cement ratio and admixture dosage rate were determined.

534.04 **Design Requirements** - The following specification is only required for precast structural concrete arches, box culverts, or three sided frames and associated wingwalls, headwalls, toe walls, cut-off walls and appurtenances.

The Contractor shall design in accordance with the AASHTO LRFD Bridge Design Specifications, latest edition. The HL-93 live load specified in the AASHTO LRFD Bridge Design Specifications shall be used for all limit states, except for Strength I. The live load used for the Strength I limit state shall be the Maine Modified live load, which consists of the standard HL-93 Live Load with a 25% increase in the Design Truck only. (Wheel loads based on the Design Truck shall be increased 25%). Additionally, if the governing load rating factor based on the HL-93 live load is equal to or less than 1.10 and the span is 14 ft, or greater, then a load rating based on the Maine legal truck (Configuration #6) shall also be checked to insure the rating factor is equal to, or greater than, 1.0.

The live load deflection check, per AASHTO LRFD Bridge Design Specifications, for the top slab of box culverts and frames with clear spans of 15 ft, or greater, and cover depths of 4 ft, or less, is mandatory. The live load deflection check shall be documented in the design computations submittal.

Design calculations that consist of computer program generated output shall be supplemented with at least one hand calculation and graphics demonstrating the design methodology used. The hand calculation shall document, at a minimum, the Strength I load case flexural design check of the top slab positive

moment reinforcing steel. Design calculations shall provide thorough documentation of the sources of equations used and material properties.

The design shall be load rated in accordance with the AASHTO Manual for Bridge Evaluation, latest edition, by the LRFR method and in accordance with the Department Load Rating Guide.

The Contractor shall submit design calculations and load rating, if applicable, for the precast structure to the Department for review. A Professional Engineer, licensed in accordance with State of Maine laws, shall sign and seal all design calculations and drawings.

The Contractor shall submit the following items for review by the Department, at least 45 Working Days prior to production:

- A. The name and location of the manufacturer
- B. Method of manufacture and material certificates
- C. Description of method of handling, storing, transporting, and erecting the units
- D. Design computations (bound and indexed)
- E. Load rating computations and completed load rating form (bound and indexed)

534.05 ***Facilities for Inspection*** - The Contractor shall provide a private office at the fabrication plant for the Department's inspection personnel, or Quality Assurance Inspectors (QAI), in accordance with Standard Specification Section 535.05 - Facilities for Inspection.

Failure to comply with the above requirements will be considered denial of access to the Work for the purpose of inspection. The Department will reject all Work done when access for inspection is denied.

534.0501 ***Fabrication Facility*** - The precast units shall be manufactured at a facility that has a minimum of 5 years of experience in producing similar type products. The plant shall meet the requirements of AASHTO M 157 or hold an active certification with Precast/Prestressed Concrete Institute (PCI) or the National Precast Concrete Association (NPCA). Facilities certified by NPCA or PCI shall provide the Fabrication Engineer with a copy of their annual audit to include deficiency reports and corrective actions.

The Contractor shall calibrate all production equipment per Table 2 below, unless there is a reason to believe calibration should be performed sooner.

TABLE 2

Production Equipment	Minimum Frequency of Calibration (every)
Water Gauge(s)	90 Days
Admixture Dispenser(s)	90 Days
Batch Plant Scale(s)	6 months
Concrete Cylinder Compression Testing Machine	1 year

Use proving rings, load cells and solid standard weights, as applicable. The calibration shall be performed by a testing laboratory acceptable to the Department, using calibration equipment the accuracy of which is traceable to a National Institute of Standards and Technology (NIST) standard. Provide calibration certifications to the QAI prior to beginning fabrication.

534.06 **Notice of Beginning Work** - The Contractor shall notify the Department of the planned start of production date of the precast units a minimum of 2 weeks prior to beginning production for in-Maine work and a minimum of 3 weeks prior to beginning production for out-of-Maine work. If the production schedule changes, notify the Fabrication Engineer no less than 3 Working Days prior to the initial production start-up date. Any Work done without the QAI present will be rejected. Advise the Fabrication Engineer of the production schedule and any changes to it. If Work is suspended on a Project, the Fabrication Engineer will require 72 hours of notice prior to the resumption of Work.

534.07 **Quality Control** - Quality Control (QC) is the responsibility of the Contractor. The Quality Control Inspection (QCI) shall inspect all aspects of the work.

QC staff shall be separate from production and shall not perform any production work.

Provide a copy of the Quality System Manual (QSM) to the Fabrication Engineer for review and approval.

Inspect all aspects of the Work in accordance with the Contractor's QSM. Reject materials and workmanship that do not meet Contract requirements.

Record measurements and test results on the appropriate forms from APPENDIX C of PCI Manual for Quality Control for Plants and Production of Structural

Precast Concrete Products (MNL 116), or an equivalent form prepared by the user. Provide copies of measurements and test results to the QAI as follows:

Type of Report	When Provided to QAI*
Aggregate gradations-fine aggregate and coarse aggregate	Prior to beginning work and at least once a week thereafter
Material certifications /calibration certifications	Prior to beginning work (anticipate adequate time for review by QAI)
Pre-placement inspection report	Prior to the concrete placement
Concrete batch slips	The morning of the next work Day
Results of concrete testing	The morning of the next work Day
Concrete temperature records	Provide with compressive strength testing
Nonconformance reports/repair procedures	Within 24 hours of discovery
Results of compressive strength testing (for design strength)	Prior to stopping curing / Prior to final acceptance
Post-placement inspection report	Prior to final acceptance
* The Contractor and QAI may, by mutual agreement, modify any part of the schedule; however, failure to provide the documentation when required by the Fabrication Engineer will result in the product being deemed unacceptable. The Contractor may perform testing in addition to the minimum required. The results of all testing shall be made available to the Department.	

- 534.08 **Quality Assurance** - Quality Assurance (QA) and acceptance is the prerogative of the Department.

The Department will conduct QA in accordance with Standard Specification Subsection 106.5. Testing deemed necessary by the Department that is in addition to the minimum testing requirements, will be scheduled to minimize interference with the production schedule. The QAI will perform acceptance sampling and testing and will witness or review documentation, workmanship and testing to assure the Work is being performed in accordance with the Contract Documents.

- 534.09 **Nonconforming Work** - The Contractor shall generate a nonconformance report (NCR) for materials and/or workmanship that is nonconforming. The NCR shall describe the nonconformance and the proposed corrective action. Copies of the NCR shall be provided to the Department's QAI and the Fabrication Engineer for review. Nonconforming material and/or workmanship shall be corrected or replaced.

If an item fabricated under this Specification does not meet the Contract requirements but is deemed suitable for use by the Department, it may be

accepted in accordance with Section 106.8 - Non-Conforming Work, of the Standard Specifications.

The QAI has the authority to reject materials and products that do not meet the Contract requirements, including Work rejected due to denial of access or the lack of adequate notice of the beginning of production. The acceptance of material or workmanship by the QAI will not prevent subsequent rejection, if the Work is later found to be unacceptable.

- 534.10 **Forms** - Construct forms in accordance with the Working Drawings. Forms shall be sufficiently rigid and accurate to maintain the member's dimensions. The forms shall be well constructed, substantial and unyielding, securely braced, and sufficiently tight to prevent leakage of mortar. Reject forms that do not maintain the dimensions shown on the Working Drawings.

Corners within the forms shall be fitted with consistent width chamfer strips of $\frac{5}{8}" \pm \frac{1}{8}"$ mitered at their intersections; all exposed corners shall be chamfered.

Seal wooden forms to prevent absorption of water. Apply and cure the sealer in accordance with the manufacturer's product data sheet.

Apply a non-staining bond-breaking compound to the forms in accordance with the manufacturer's product data sheet. Solvent clean reinforcing steel and welded steel wire fabric contaminated with the bond-breaking compound. Forms shall be clean and free of foreign material prior to placing concrete.

- 534.11 **Reinforcing Steel and Welded Steel Wire Fabric** - Reinforcing steel shall be fabricated, handled, and placed in accordance with Standard Specification Section 503, and the reviewed Working Drawings.

The concrete cover over the outside circumferential reinforcement shall be 2", minimum, and the concrete cover over the inside reinforcement shall be 1½", minimum. The clear distance of the end of circumferential wires shall not be less than 1", or more than 2" from the end of the units. Use sufficient supports and spacers to maintain the minimum concrete cover. The supports and spacers shall be made of a dielectric material or other material approved by the Fabrication Engineer.

Welded steel wire fabric shall meet the spacing requirements and contain sufficient longitudinal wires extending through the unit to maintain the shape and position of the reinforcement. Longitudinal distribution reinforcement may be welded steel wire fabric or deformed steel bars which meet the spacing requirements. The ends of the longitudinal distribution reinforcement shall not be more than 3", from the ends of the units.

Do not use more than three layers of reinforcing to form a single mat. If reinforcing steel is cut to install lifting devices, install additional reinforcing adjacent to the cut steel, as shown on the Working Drawings.

Tension splices in the reinforcement will not be permitted. For splices other than tension splices, the overlap shall be a minimum of 12" for welded steel wire fabric and as specified in Standard Specification Section 503 for deformed steel bars. The center-to-center wire spacing in wire fabric sheets shall not be less than 2", or more than 4", for the circumferential wires, and shall not be more than 8" for the longitudinal wires. The center-to-center spacing of the longitudinal distribution steel for either line of reinforcing in the top slab shall not be more than 15".

- 534.12 **Inserts** - Recess metal inserts and form ties a minimum of 1", unless noted otherwise in the Contract. The QAI is not responsible for verifying the location of inserts or other hardware installed for the convenience of the Contractor.
- 534.13 **Concrete Placement** - Do not batch or place concrete until all the form(s) for any continuous placement have been inspected and accepted by the QCI, and the QAI concurs.

Test concrete in accordance with Standard Specification Section 534.14.

Test the first two loads of concrete for temperature, air entrainment and slump flow for Self-Consolidating Concrete (SCC). If the first load is unacceptable, test the second load as the first. Continue this process until two consecutive loads are acceptable. After two consecutive loads are acceptable, the frequency of testing shall be at the discretion of the QAI.

If there is a change in the dosage rate of any admixture or a change of more than 5°F in mix temperature, then test the concrete for temperature, air entrainment and slump flow for SCC.

Test every load of 1 cy, or less, from a stationary mixer or 2 cy, or less, from a transit mixer for temperature, air entrainment and slump flow for SCC, prior to placing the concrete in the forms.

Perform all testing in the presence of the QAI. The QAI will designate the loads to be tested. Make cylinders used to determine stripping strength during the last 1/3 of the placement.

Place the concrete as nearly as possible to its final location. Control the depth of each lift in order to minimize entrapped air voids. The maximum depth of an unconsolidated lift shall be 18". Vibrate the concrete with internal or internal and external vibrators. Do not use external vibrators, only. Insert internal vibrators vertically and penetrate the lower layer of concrete by at least 4". Insert the vibrators in the concrete to assure that the radii of action of the vibrators overlap. Hold the vibrators in position from 5 to 15 seconds; vibration time shall be reduced by 50% when placing SCC. Do not use vibrators to move concrete horizontally. Each lift of concrete shall have sufficient plasticity to be consolidated with subsequent lifts.

Do not re-temper the concrete with water after discharging has begun. The Contractor may add High Range, Water Reducing, admixture to the concrete

after batching if that practice conforms to the manufacturer's product data sheet. Discard concrete that becomes unworkable.

Do not use water or water-based products to aid in finishing fresh concrete.

After the concrete has been placed and finished and before the forms are covered, remove all concrete from Projecting reinforcing steel.

534.1301 **Curing** - The units shall be cured by one of the following methods:

1. **Curing by Moisture Retention** - Cure the concrete in accordance with the latest edition of MNL 116, Section 4.9. Moist cure the concrete until it has reached design strength.

Do not use membrane-forming curing compounds without the approval of the Fabrication Engineer. If membrane-forming curing compounds are authorized, follow the requirements of MNL 116 and the curing compound manufacturer's published recommendations.

2. **Accelerated Curing of Concrete** - Cure the concrete in accordance with MNL 116, Section 4.9, except as modified herein.

Initial set shall be determined in accordance with ASTM C403. A strength gain of 500 psi indicates initial set. The maximum allowable concrete temperature shall be 160°F. Concrete temperature shall be measured during curing with recording thermometers. In order to qualify for accelerated cure, the concrete temperature shall attain a minimum temperature of 120°F; that temperature shall be maintained for a minimum of 8 hours and the concrete shall achieve a minimum of 80% of design strength.

The accelerated curing cycle shall be considered complete when the method of supplying heat is stopped and/or the concrete temperature drops below 120°F. Two cylinders shall be tested immediately upon completion of the accelerated cure cycle. Products that have not achieved all of the above criteria shall be moist cured until the concrete has achieved design strength.

If the precast units have achieved 80% of design strength during the accelerated curing cycle, no further curing will be required.

The forms shall remain in place until the concrete attains a minimum compressive strength of 3,000 psi.

534.14 **Acceptance and Quality Control Testing of Concrete** - Acceptance of structural precast units, for each Day's production, will be determined by the

Department, based on compliance with this specification and satisfactory concrete testing results.

At least once per week, the QAI will make three concrete cylinders (six cylinders when the Contract includes permeability requirements) for use by the Department; cylinders shall be standard cured in accordance with AASHTO R 100. The QAI will perform entrained air content and slump flow testing, determine water-cement ratio and determine temperature of the sampled concrete at the time of cylinder casting. All testing equipment required by the QAI to perform this testing shall be in accordance with Standard Specification Section 502.041 - Testing Equipment. In addition, the Contractor shall provide a slump cone meeting the requirements of AASHTO T 119. Providing and maintaining testing and curing equipment shall be considered incidental to the work and no additional payment will be made.

Quality Control test cylinders shall be made and tested in accordance with the following standards:

• AASHTO T 22 (ASTM C39)	Test Method for Compressive Strength of Cylindrical Concrete Specimens
• AASHTO R 100 (ASTM C31)	Practice for Making and Curing Concrete Test Specimens in Field
• AASHTO R 60 (ASTM C172)	Practice for Sampling Freshly Mixed Concrete
• AASHTO T 152 (ASTM C231)	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
• AASHTO T 196 (ASTM C173)	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
• ASTM C1064	Test Method for Temperature of Freshly mixed Portland Cement Concrete
• ASTM C1611	Standard Test Method for Slump Flow of Self-Consolidating Concrete

Tested concrete shall conform to the following:

- A. Temperature shall be from 40°F to 85°F.
- B. Slump flow shall be homogenous with no sign of segregation.
- C. Visual stability index (VSI) of SCC shall not exceed 1; if a mortar paste halo is present it shall not exceed an average of 0.25".

The Contractor shall cast a minimum of 8 concrete test cylinders for each continuous concrete placement, for QC purposes: 2 cylinders shall be standard cured in accordance with AASHTO R 100 to be tested for 28 Day strength; and a minimum of 6 cylinders shall be field cured under the same conditions as the units and tested for stripping and design strength. Unit identification, entrained air content, water-cement ratio, slump flow and temperature of the sampled

concrete shall be recorded at the time of cylinder casting. The Contractor shall perform all testing in the presence of the QAI. The QAI will designate the loads to be tested.

If the Contractor fails to make enough cylinders to demonstrate that the product meets the Contract requirements, the product will be considered unacceptable.

The compressive strength of the concrete will be determined by averaging the compressive strength of two test cylinders made from the same sample. For determining design strength, the average of two cylinders shall meet or exceed the design strength, and the difference in strength between the two shall be no more than 10% of the higher strength cylinder.

Perform compressive strength testing to determine stripping and design strength in the presence of the QAI. Cylinder tests not witnessed by the QAI will not be acceptable.

All QC Inspectors performing concrete testing shall hold a current ACI Field Testing Technician Grade I Certification, or other equivalent certification.

- 534.15 ***Manufacture of Precast Units*** - The units shall be free of fractures. The ends of the units shall be normal to the walls and centerline of the unit, within the limits of variation provided, except where beveled ends are specified. The surfaces of the units shall be a smooth steel form or troweled surface finish, unless a form liner is specified. The ends and interior of the assembled structure shall make a continuous line of units with a smooth interior surface.

Defects which may cause rejection of precast units include, but are not limited to, the following:

- A. Any discontinuity (crack, rock pocket, etc.) of the concrete which could allow moisture to reach the reinforcing steel.
- B. Rock pockets or honeycomb over 6 square inches in area or over 1" deep.
- C. Edge or corner breakage exceeding 12" in length or 1" in depth.
- D. Any other defect that clearly and substantially impacts the quality, durability, or maintainability of the structure, as determined by the Fabrication Engineer.

The manufacturer of the units shall sequentially number and shop fit each adjacent unit to ensure that they fit together in the field. This fit up shall be witnessed by the QAI. Any non-fitting units shall be corrected or replaced at no cost to the Department.

The manufacturer of the units shall keep accurate records of aggregate gradations, concrete batching, testing, curing, and inspection activities to verify that forms, reinforcing and unit dimensions conform to these requirements. Copies of reports shall be furnished to the Department.

534.16 **Tolerances** - Dimensional tolerances shall be in conformance with the following:

- A. The internal dimensions shall not vary by more than 1% from the design dimensions or 1½", whichever is less, with the exception of the cross diagonal dimension which shall not vary by more than ½" from the design dimension.
- B. The haunch dimensions shall not vary by more than ¾" from the design dimension.
- C. The dimension of the legs shall not vary by more than ¼" from the dimension shown on the reviewed Working Drawings.
- D. The slab and wall thickness shall not be less than the design thickness by more than ¼". A thickness greater than the design thickness shall not be cause for rejection.
- E. Variations in laying lengths of two opposite surfaces shall not be more than ⅝" in any unit, except where beveled ends for laying of curves are specified.
- F. The under-run in length of any unit shall not be more than ½".

534.17 **Finishing Concrete** - Products shall be finished to meet the Standard Grade finish as described in the MNL-116. Units, or portions of units, that will be exposed to view in their final location shall receive a rubbed precast finish. See the requirements of each finish type below.

1. **Rubbed Precast Finish** - The Contractor may propose an alternate procedure to achieve a rubbed precast finish for review by the Fabrication Engineer. If an alternate procedure is not submitted, the following procedure shall be followed.

After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be thoroughly saturated with water. Sufficient time shall have elapsed before wetting down to allow the mortar used in ordinary finish to become thoroughly set. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone, using a small amount of mortar on its face. The mortar shall be composed of cement and fine sand mixed in proportions as used in the concrete being finished. Rubbing shall continue until all form marks, Projections and irregularities have been removed, all voids filled and a uniform surface has been obtained. A thin layer of paste produced by this rubbing shall be left on the surfaces.

After all concrete above the surface being treated has been cast, the final finish shall be obtained by a second rubbing with a fine carborundum stone using only water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform color. The paste produced by this second rubbing shall be carefully spread with a moist whitewash

brush to form a very thin uniform coating upon the surface of the concrete.

After the final rubbing is completed and the surface has dried, it shall be rubbed lightly with clean, dry, burlap to remove excess loose powder and shall be left free from all unsound patches, paste, powder and objectionable marks. This finish shall result in a surface of smooth texture and uniform color.

Marking - The date of manufacture, production lot number, and type of unit shall be clearly and indelibly inscribed on a rear, unexposed portion of each unit.

- 534.18 **Repairing Defects** - Defects requiring repair will be considered either non-structural or structural.

Non-Structural Defects - Exposed surfaces shall be of uniform appearance; only minor repairs to remove and blend fins, patch minor spalls and to repair small, entrapped air pockets, shall be permitted. Repair honeycombing, ragged or irregular edges and other non-structural or cosmetic defects using a patching material from the Department Qualified Products List (QPL). The repair, including preparation of the repair area, mixing and application and curing of the patching material, shall be in accordance with the manufacturer's product data sheet. Corners not exposed in the final product may be ground smooth with no further repair necessary, if the depth of the defect does not exceed ½". Remove form ties and other hardware to a depth of not less than 1" from the face of the concrete and patch the holes using a patching material from the Department QPL.

Structural Defects - Repair structural defects only with the approval of the Fabrication Engineer. Submit a nonconformance report (NCR) to the Fabrication Engineer with a proposed repair procedure. Do not perform structural repairs without an NCR that has been reviewed by the Fabrication Engineer. Structural defects include, but are not limited to, exposed reinforcing steel, cracks in bearing areas, through cracks and cracks 0.013" in width that extend more than 12" in length in any direction. Give the QAI adequate notice prior to beginning any structural repairs.

- 534.19 **Handling, Storage and Transportation** - Handle, store and transport units in a manner as to eliminate the danger of chipping, cracks, fracture, and excessive bending stresses. Any units found damaged upon delivery, or damaged after delivery, shall be subject to rejection.

Do not place precast units in an upright position until a compressive strength of at least 4,000 psi is attained. Precast units may be handled and moved, but not transported, until the 28 Day design strength has been attained.

Support stored precast units above the ground on dunnage in a manner to prevent twisting or distortion. Protect the units from discoloration and damage.

Set precast units on ½" thick neoprene pads during shipment to prevent damage to the unit legs. The Contractor shall repair any damage to precast units resulting from shipping or handling; this shall be accomplished by saw cutting a minimum of ½" deep around the perimeter of the damaged area, removing any loose concrete out to the saw cut perimeter and installing a polymer-modified cementitious patching material, from the Department's QPL, per the manufacturer's product data sheet.

- 534.20 ***Installation of Precast Units*** - When footings are required, install the precast units on concrete footings that have reached a minimum compressive strength of 3,000 psi. Construct the completed footing surface to the lines and grades shown on the Plans. When checked with a 10 ft straightedge, the surface shall not vary more than ¼" in 10 ft. The footing keyway shall be filled with a Department-approved non-shrink flowable cementitious grout with a minimum design compressive strength of 5,000 psi at 28 Days, unless otherwise specified in the Contract.

Three sided frame and box culvert joints shall be sealed with a Department-approved flexible joint sealant in accordance with ASTM C990. Joints shall be closed tight. Culvert units shall be equipped with joint closure mechanisms to draw units together and close joints to the required opening.

Completely fill the exterior face of joints between precast units with a material from the Department QPL and cover with a minimum 12" wide joint wrap. Additionally, for box culverts and three sided frames, cover the entire top surface with waterproofing membrane; waterproofing membrane shall extend 1 ft from the top down the sides of the units. The surfaces shall be free of dirt and deleterious materials before applying the filler material and joint wrap. Install the external wrap in one continuous piece over each unit joint, taking care to keep the joint wrap in place during backfilling.

Seal the back of joints between the end unit and attached elements with a non-woven geotextile. Install and tighten the bolts fastening the connection plate(s) between the elements that are designed to be fastened together as designated by the manufacturer.

Fill holes that were cast in the units for handling with either Portland Cement mortar or with precast plugs secured with Portland Cement mortar or other approved adhesive.

Place and compact the bedding material as shown on the Plans prior to lifting and setting the culvert units. Backfilling of the structure shall be done in accordance with the manufacturer's instructions and the Contract Documents. Uniformly distribute backfill material in layers of not more than 8" in depth, loose measure, and thoroughly compact each layer using approved compactors before successive layers are placed. Compact the Granular Borrow bedding and backfill in accordance with Section 203.12 - Construction of Earth Embankment with Moisture and Density Control, except that the minimum required compaction

shall be 92% of maximum density, as determined by AASHTO T 180, Method C or D. Place and compact the backfill without disturbance or displacement of the structure, keeping the fill at approximately the same elevation on both sides of the structure. Whenever a compaction test fails, the Contractor shall not place additional backfill over the area until the lift is re-compacted and a passing test achieved.

Use hand-operated compactors within 5 ft of the precast structure as well as over the top until it is covered with at least 12" of backfill. Take appropriate precautions to protect the top of the culvert from damage during backfilling and/or paving operations. Any damage to the top of the precast structure shall be repaired, or units replaced, at no cost to the Department.

534.21 **Method of Measurement** - Precast Structural Concrete Arches, including three-sided frames, and Precast Concrete Box Culverts will be measured as one lump sum, complete, in place and accepted.

534.22 **Basis of Payment** - The accepted Precast Structural Concrete Arches, including three-sided frames, or Precast Concrete Box Culverts will be paid for at the respective Contract lump sum price. The lump sum price shall include associated wingwalls, headwalls, toe walls, cut-off walls and appurtenances, and shall be full compensation for all labor, equipment, materials, professional services, and incidentals necessary for designing, manufacturing, furnishing and installing the precast concrete elements and accessories. Falsework, reinforcing steel, welded steel wire fabric, joint wrap, geotextile, repair material, grout, cast-in-place concrete fill or grout fill for anchorage of precast wings and/or other appurtenances will not be measured and paid for separately, but will be incidental to the lump sum pay item. Cast-in-place concrete, reinforcing steel in cast-in-place elements and waterproofing membrane will be measured and paid for separately, under the provided Contract Pay Items. Pay adjustments for quality level will not be made for precast concrete.

Excavation for precast structural concrete structures, including excavation below culverts for bedding and backfilling, will be measured and paid for as provide in Section 206 - Structural Excavation.

When the minimum cover material extends above the subgrade line, the removal of the cover material necessary to complete the work will not be paid for directly, but shall be considered incidental to the precast structural concrete lump sum pay item.

Payment will be made under:

Pay Item		Pay Unit
534.70	Precast Structural Concrete Arch	Lump Sum
534.71	Precast Concrete Box Culvert	Lump Sum

SECTION 535 - PRECAST, PRESTRESSED CONCRETE SUPERSTRUCTURE

- 535.01 **Description** - This work shall consist of casting and erecting precast/prestressed concrete products and related material. Materials, work, inspection and documentation not specifically addressed by this Specification shall be done in accordance with the applicable sections of the Precast/Prestressed Concrete Institute (PCI), Manual for Quality Control for Plants and Production of Structural Precast Concrete Products (MNL 116), including Commentary.

ALL REQUIREMENTS IN THIS SPECIFICATION ARE THE RESPONSIBILITY OF THE CONTRACTOR, UNLESS NOTED OTHERWISE.

- 535.02 **Materials** - Materials for precast/prestressed concrete products shall meet the requirements of the following Subsections of the Standard Specifications:

Portland Cement and Blended Hydraulic Cement	701.01
Water	701.02
Air-Entraining Admixtures	701.03
Water Reducing Admixtures	701.04
High Range, Water Reducing, Admixture (HRWR)	701.0401
Set-Retarding Admixtures	701.05
Accelerating, Chemical Admixtures	701.0501
Coal Ash and Natural Pozzolans	701.10
Calcium Nitrite Solution	701.11
Silica Fume	701.12
Slag Cement	701.13
Fine Aggregate for Concrete	703.01
Coarse Aggregate for Concrete (Class A, AA, or SP-1-7)	703.02
Combined Aggregate Grading for Concrete	703.03
Reinforcing Steel	709.01
Welded Steel Wire Fabric	709.02
Steel Strand	709.03

Provide a Materials Certification from the manufacturer of the prestressing strand. The certification shall include a representative load elongation curve for each coil. The manufacturer shall identify each coil of strand. Do not remove the identification from the coil. Partial coils may be used with the approval of the Fabrication Engineer. Failure to maintain traceability of a coil will be cause for rejection. Provide Certified Mill Test Reports for the reinforcing steel, welded wire fabric and fusion bonded epoxy coating.

- 535.03 **Working Drawings** - Prepare shop detail, erection and other necessary Working Drawings in accordance with Section 105.7 - Working Drawings. The Department will review the drawings in accordance with the applicable requirements of Section 105.7 - Working Drawings. Changes and revisions to the reviewed Working Drawings will require further review by the Fabrication Engineer.

Concrete mix designs shall be part of the Working Drawing submittal. Include aggregate specific gravity, absorption, percent fracture, fineness modulus and gradation as part of the mix design. Provide the mix design calculations demonstrating how the batch weights, water-cement ratio and admixture dosage rate were determined.

535.04 **Plant** - The plant shall be a PCI Certified facility.

535.05 **Facilities for Inspection** - Provide a private office at the fabrication plant for the Department's inspection personnel, or Quality Assurance Inspectors (QAI's). The office shall be in close proximity to the Work. The office shall be climate controlled to maintain the temperature between 68°F and 75°F and have the exit(s) closed by a door(s) equipped with a lock and 2 keys which shall be furnished to the QAI's.

The QAI's office shall meet the following minimum:

Description	Quantity
Office area (minimum ft ²)	100
Drafting table surface (ft ²)	35
Drafting stools-each	1
Office desk	1
Ergonomic swivel chairs	1
Folding chairs	2
High-speed internet connection (ports) or wireless	1
Fluorescent lighting of 100 foot-candles minimum for all work areas	2
110 Volt 60 cycle electric wall outlets	3
Wall closet	1
Waste basket with trash bags	1
Broom	1
Dustpan	1
Water cooler	1
Cleaning materials-floor, surfaces, windows	for duration of the Project

The Contractor will be responsible for disposing of trash and supplying commercially bottled water for the water cooler.

The QAI will have the option to reject any furniture or supplies provided to the QAI's office, based on general poor condition.

Provide parking space for the QAI(s) in close proximity to the entrance to the QAI's office. Maintain the pathway between the parking area and the QAI's office so that it is free of obstacles, debris, snow and ice.

The facilities and all furnishings shall remain the property of the Contractor upon completion of the Work. Payment for the facilities, heating, lighting, internet

connection and monthly internet charges and all furnishings shall be incidental to the Contract.

Failure to comply with the above requirements will be considered denial of access to the Work for the purpose of inspection. The Department will reject all Work done when access for inspection is denied.

535.06 **Notice of Beginning Work** - Give the Department a minimum of 2 weeks notice for in-Maine work and 3 weeks notice for out-of-Maine work, prior to beginning production. If the production schedule changes, notify the Fabrication Engineer no less than 3 Working Days prior to the initial start-up date. Any Work done without the QAI present will be rejected. Advise the Fabrication Engineer of the production schedule and any changes to it. If Work is suspended on a Project, the Fabrication Engineer will require 72 hours notice prior to the resumption of Work.

535.07 **Quality Control** - Quality Control (QC) is the responsibility of the Contractor. Provide a copy of the Quality System Manual (QSM) to the Fabrication Engineer, if requested.

Calibrate all production equipment in accordance with MNL 116, except that stressing jacks shall be calibrated every 6 months. Provide calibration certifications to the QAI prior to beginning fabrication. Calibrate scales, admixture dispensers and water gauges at the frequency specified in MNL 116. Use proving rings, load cells and solid standard weights, as applicable. The calibration shall be performed by a testing laboratory acceptable to the Department using calibration equipment the accuracy of which is traceable to a National Institute of Standards and Technology (NIST) standard.

Quality Control Inspectors (QCI's) shall have a valid PCI Quality Control Certification Level I, Level II or Level III. Personnel performing concrete testing shall hold a current ACI Field Testing Technician Grade I Certification, or equivalent.

Inspect all aspects of the Work in accordance with the Contractor's QSM. Reject materials and workmanship that do not meet Contract requirements.

Record measurements and test results on the appropriate forms from APPENDIX E of MNL 116, or an equivalent form prepared by the user. Provide copies of measurements and test results to the QAI as follows:

Type of Report	When Provided to QAI*
Aggregate gradations-fine aggregate and coarse aggregate	Prior to beginning work and at least once a week thereafter
Material certifications / stressing calculations / calibration certifications	Prior to beginning work (anticipate adequate time for review by QAI)
Tensioning report	The same work Day
Pre-placement inspection report	Prior to the concrete placement
Concrete batch slips	The morning of the next work Day
Results of concrete testing	The morning of the next work Day
Results of compressive strength testing (for release)	The same work Day
Concrete temperature records	Provide with compressive strength testing (for release)
Nonconformance reports/repair procedures	Within 24 hours of discovery
Results of compressive strength testing (for design strength)	Prior to stopping curing
Post-placement inspection report	Within 48 hours of achieving design strength
* The Contractor and QAI may, by mutual agreement, modify any part of the schedule; however, failure to provide the documentation when required by the Fabrication Engineer will result in the product being deemed unacceptable. The Contractor may perform testing in addition to the minimum required. The results of all testing shall be made available to the Department.	

535.08 **Quality Assurance** - Quality Assurance (QA) is the prerogative of the Department.

The QAI will perform acceptance sampling and testing and will witness or review documentation, workmanship and testing to assure the Work is being performed in accordance with the Contract Documents.

The QAI has the authority to reject materials and products that do not meet the Contract requirements, including Work rejected due to denial of access or the lack of adequate notice of the beginning of production. The acceptance of material or workmanship by the QAI will not preclude subsequent rejection, if found unacceptable by the Department, at a later date.

535.09 **Nonconforming Work** - Correct or replace nonconforming material and/or workmanship. Generate a nonconformance report (NCR) describing the

nonconformance and the proposed corrective action; provide a copy to the QAI and forward a copy to the Fabrication Engineer for review.

In the event that an item does not meet the Contract requirements but is deemed suitable for use by the Department, said item may be accepted in accordance with Section 106.8, Non-Conforming Work, of the Standard Specifications.

- 535.10 **Forms and Casting Beds** - Construct forms in accordance with the Working Drawings. The forms shall be well constructed, carefully aligned and sufficiently tight to prevent leakage of mortar. Reject forms that do not maintain the dimensions shown on the Working Drawings. Inspect the bulkheads after each cast and repair or replace worn or damaged pieces.

Seal wooden forms to prevent absorption of water. Apply and cure the sealer in accordance with the manufacturer's product data sheet.

Remove all paint, adherent material, foreign matter and debris prior to placing concrete.

Apply a non-staining bond-breaking compound to the forms in accordance with the manufacturer's product data sheet. Solvent clean reinforcing steel and strand contaminated with the bond-breaking compound.

- 535.11 **Reinforcing Steel** - Fabricate, package, handle, store, place, splice and repair reinforcing steel in accordance with Section 503 of the Standard Specifications.

Accurately locate and securely anchor the reinforcing steel to prevent displacement during concrete placement. Install and secure all reinforcing steel prior to beginning the concrete placement.

The concrete cover shown on the reviewed Working Drawings shall be the minimum allowable cover. Use sufficient bar supports and spacers to maintain the minimum concrete cover. The bar supports and spacers shall be made of a dielectric material or other material approved by the Fabrication Engineer.

- 535.12 **Voids and Inserts** - Voids shall be non-absorbent. The out-to-out dimensions of the voids shall be within 2% of Plan dimensions. Repair damaged voids in a manner acceptable to the Fabrication Engineer. Store, handle and place voids in a manner that prevents damage.

Accurately locate and securely anchor, securely cap and vent the voids in the form. Any portion of a void that is displaced beyond the allowable dimensional tolerances shall be cause for rejection of the slab or beam.

Open the void drains immediately upon removing the product from the form.

Recess inserts 1", unless noted otherwise on the Plans.

The Department is not responsible for verifying the location of inserts or other hardware installed for the convenience of the Contractor.

- 535.13 **Concrete** - New concrete mix designs and mix designs not previously approved by the Fabrication Engineer shall be qualified by trial batches prepared in

accordance with AASHTO T 126 (ASTM C192). The test results shall demonstrate that the concrete meets the requirements of the Plans and this Specification. If accelerated curing is to be used in production, the test specimens shall be similarly cured.

The concrete mix design shall meet the following requirements:

Minimum cement content	660 lb/cy
Water-cement ratio*	0.40 (maximum)
Air entrainment	5% to 8%
Allowable Slump Flow for Self-Consolidating Concrete (SCC)	20" to 30"
Visual Stability Index (VSI) for SCC	VSI of 0 or 1, per ASTM C1611. If a mortar paste halo is present, it shall not exceed 0.25".
Corrosion inhibitor**	3 gal/cy (unless otherwise specified)
Silica Fume (when used)	5% to 10% of cement content by weight
Coal Ash (when used)	40% of cementitious material (maximum)
Slag Cement (when used)	50% of cementitious material (maximum)
* For the purpose of calculating water cement ratios, 1 U.S. gallon of water shall be considered to weigh 8.34 lb. ** The water in the corrosion inhibitor solution shall be included when calculating the water-cement ratio.	

The concrete mix design shall be proportioned so that the concrete achieves transfer strength within 24 hours of the completion of the placement if the release strength is 6,000 psi, or less. If two consecutive placements fail to meet the above requirements, no further placements shall take place until corrective action is taken by the Contractor.

- 535.14 **Concrete Placement** - Do not batch or place concrete until all the form(s) for any continuous placement have been inspected and accepted by the QCI, and the QAI concurs.

Test concrete in accordance with the following Standards:

- AASHTO T 22 (ASTM C39) Test Method for Compressive Strength of Cylindrical Concrete Specimens
- AASHTO R 100
- AASHTO T 141 (ASTM C172) Practice for Sampling Freshly Mixed Concrete
- AASHTO T 152 (ASTM C231) Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- AASHTO T 196 (ASTM C173) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

- ASTM C1064 Test Method for Temperature of Freshly mixed Portland Cement Concrete
- ASTM C1611 Standard Test Method for Slump Flow of Self-Consolidating Concrete

Test the first two loads of concrete for temperature, air entrainment and slump flow for SCC. If the first load is unacceptable, test the second load as the first. Continue this process until two consecutive loads are acceptable. After two consecutive loads are acceptable, the frequency of testing shall be at the discretion of the QAI.

If there is a change in the dosage rate of any admixture or a change of more than 5°F in mix temperature, then test the concrete for temperature, air entrainment and slump flow for SCC.

Test every load of 1 cy, or less, from a stationary mixer or 2 cy, or less, from a transit mixer for temperature, air entrainment and slump flow for SCC, prior to placing the concrete in the forms.

Perform all testing in the presence of the QAI. The QAI will designate the loads to be tested. Make cylinders used to determine release strength during the last one-third of the placement.

Place the concrete as nearly as possible to its final location. Control the depth of each lift in order to minimize entrapped air voids. The maximum depth of an unconsolidated lift shall be 18". Vibrate the concrete with internal or internal and external vibrators. Do not use external vibrators, only. Insert internal vibrators vertically and penetrate the lower layer of concrete by at least 4". Insert the vibrators in the concrete to assure that the radii of action of the vibrators overlaps. Hold the vibrators in position from 5 to 15 seconds; vibration time shall be reduced by 50% when placing SCC. Do not use vibrators to move concrete horizontally. Each lift of concrete shall have sufficient plasticity to be consolidated with subsequent lifts.

Do not re-temper the concrete with water after discharging has begun. The Contractor may add HRWR to the concrete after batching, if that practice conforms to the manufacturer's product data sheet. Discard concrete that becomes unworkable.

Do not use water or water-based products to aid in finishing fresh concrete.

After the concrete has been placed and finished, and before the forms are covered, remove all concrete from Projecting reinforcing steel.

Measure and record the concrete cover at each void location after void hold-downs have been removed. The QAI will indicate the number and location of the measurements.

535.15 **Acceptance and Quality Control Testing of Concrete** - Acceptance of structural precast/prestressed units, for each Day's production, will be

determined by the Department, based on compliance with this specification and satisfactory concrete testing results. At least once per week, the QAI will make three concrete cylinders (6 cylinders when the Contract includes permeability requirements) for use by the Department; cylinders shall be standard cured in accordance with AASHTO R 100. The QAI will perform entrained air content and slump flow testing, determine water-cement ratio and determine temperature of the sampled concrete at the time of cylinder casting. All testing equipment required by the QAI to perform this testing shall be provided in accordance with Standard Specification Section 502.041 - Testing Equipment. In addition, the Contractor shall provide a slump cone meeting the requirements of AASHTO T 119. Providing and maintaining testing and curing equipment shall be considered incidental to the work and no additional payment will be made.

Quality Control concrete test cylinders shall be made for each Day's cast and each form bed used. Cylinders tested to determine strand release strength and design strength shall be field cured in accordance with AASHTO R 100. 28 Day cylinders shall be standard cured. Record unit identification, entrained air content, water-cement ratio, slump flow and temperature of the sampled concrete at the time of cylinder casting.

If the Contractor fails to make enough cylinders to demonstrate that the product meets the Contract requirements, the product will be considered nonconforming work.

The compressive strength of the concrete will be determined by averaging the compressive strength of two test cylinders made from the same sample. For the purpose of detensioning prestressed products, neither of the test cylinders shall have a compressive strength less than the minimum required transfer strength. For the purpose of determining design strength, the average of two cylinders shall meet or exceed the design strength, and the difference in strength between the two shall be no more than 10% of the higher strength cylinder.

Perform compressive strength testing to determine transfer and design strength in the presence of the QAI. Cylinder tests not witnessed by the QAI will not be acceptable.

- 535.16 ***Curing by Moisture Retention*** - Cure the concrete in accordance with MNL 116, Section 4.9. Moist cure the concrete until it has reached design strength.

Do not use membrane- forming curing compounds without the approval of the Fabrication Engineer. If membrane-forming curing compounds are authorized, follow the requirements of MNL 116 and the curing compound manufacturer's published recommendations.

- 535.17 ***Accelerated Curing of Concrete (Optional)*** - Cure the concrete in accordance with MNL 116, Section 4.9, except as modified herein.

After initial set, the temperature gain of the concrete shall not exceed 40°F per hour. Initial set shall be determined in accordance with ASTM C403 - Standard

Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance; a strength gain of 500 psi indicates initial set. The maximum allowable concrete temperature shall be 160°F. Concrete temperature shall be measured near each end of the casting bed and at intervals not to exceed 100 ft. In order to qualify for accelerated cure, the concrete temperature shall attain a minimum temperature of 120°F; that temperature shall be maintained for a minimum of 8 hours and the concrete shall achieve a minimum of 80% of design strength.

Detension precast/prestressed products immediately after the completion of the curing cycle while the products are warm and moist. The accelerated curing cycle shall be considered complete when the method of supplying heat is stopped and/or the concrete temperature drops below 120°F. Two cylinders shall be tested immediately upon completion of the accelerated cure cycle. Products that have not achieved all of the above criteria shall be moist cured until the concrete has achieved design strength.

If the precast/prestressed concrete products have achieved 80% of design strength during the accelerated curing cycle, no further curing will be required.

- 535.18 ***Prestressing*** - Tension the strands in accordance with MNL 116 and this Specification.

Provide stressing calculations to the QAI prior to tensioning strands. Do not tension the strands until the QAI has reviewed the calculations. Apply initial force and final force to the strands in the presence of the QAI. The QCI shall be present to monitor and document the application of initial force, final force and the elongation of the strands.

Tension strands in an orderly sequence to avoid snags and entanglements. When strands from two, or more, coils are used, identify the locations of the different strand lots. Calculate the elongation and adjusted gauge pressure readings for each modulus of elasticity and cross sectional area of the strands.

Prior to tensioning, cycle the hydraulic jacking devices until the hydraulic fluid reaches normal operating temperature.

After initial tensioning, establish a permanent and clearly visible reference mark on the strand to determine strand elongation after final tensioning. Measure the strand elongation to the nearest 1/16".

If the strands have been tensioned for more than 48 hours without concrete being placed in the forms, test a minimum of 10% of the strands, but not less than two strands in each row and not less than two strands in draped strand arrays, by applying the theoretical force used during the final tensioning to each of the strands. If additional elongation is gained, subtract the amount gained from the theoretical elongation. If the result of the theoretical elongation minus the gain in elongation is less than the minimum allowable elongation for any of the strands tested, apply the final force to all strands. Do not measure total

elongation from the original reference mark. Accept properly tensioned strand based on the force applied to the strands.

Measure and record the chuck-to-chuck distance on self-stressing beds after tensioning the first set-up and at any time the number of strands or strand array changes. Confirm that the measurement used in the stressing calculations is the same as the field measurement.

- 535.19 **Detensioning** - Detension the strands in accordance with MNL 116 and this Specification. Use a carburizing flame. Heat a minimum length of 6" of the strand slowly so that only one wire is released at a time. Cut both ends and any intermediate points simultaneously. Failure to maintain symmetry of cutting or causing sudden shock to the product will make it subject to rejection. Detension the strands in the presence of the QAI and QCI.

Measure any strand slippage on all precast/prestressed concrete products. Mark all strands prior to detensioning. Measure a minimum of four strands per row. The QAI will choose the strands to be measured.

- 535.20 **Finishing Concrete and Repairing Defects** - Precast/prestressed concrete products fabricated under this Section shall meet Standard Grade finish requirements as defined in MNL 116, except that the Contractor shall rub fascia units in accordance with Standard Specification Section 534.17 - Rubbed Precast Finish. Abrasive blast fascia surfaces prior to finishing.

Repair honeycombing, ragged or irregular edges and other non-structural or cosmetic defects using a patching material from the Department Qualified Products List (QPL). The repair, including preparation of the repair area, mixing and application and curing of the patching material, shall be in accordance with the manufacturer's product data sheet. Corners that are not exposed in the final product may be ground smooth with no further repair necessary if the depth of the defect does not exceed ½". Remove form ties and other hardware to a depth of not less than 1" from the face of the concrete and patch the holes using a patching material from the Department QPL.

Repair structural defects only with the approval of the Fabrication Engineer. Submit a nonconformance report (NCR) to the Fabrication Engineer with a proposed repair procedure. Do not perform structural repairs without an NCR that has been reviewed by the Fabrication Engineer. Structural defects include, but are not be limited to, exposed reinforcing steel or strand, cracks in bearing areas, through cracks and cracks 0.013" in width that extend more than 12" in length in any direction. Give the QAI adequate notice prior to beginning any structural repairs.

Make chamfers and drip notches smooth and uniform. Sandblast keyways to remove mortar paste prior to shipping. Recess strand ends 1" and patch the holes with a patching material from the Department QPL. Coat the entire ends of the precast/prestressed concrete units with a bituminous protective coating

unless otherwise specified on the Plans or as directed by the Fabrication Engineer.

535.21 **Precast/prestressed Deck Panels** - Produce precast/prestressed deck panels in accordance with the Plans and Specifications. Cure the deck panels in accordance with Sections 535.16 or 535.17.

535.22 **Tolerances** - Product dimensional tolerances shall be in conformance with the latest edition of PCI MNL-135, Tolerance Manual for Precast and Prestressed Concrete Construction, as applicable to the particular product (e.g., slab, I-girder, box beam), the Plans, and this Specification. Use Box Beam fabrication tolerances for voided or solid slab beams and use Double Tee tolerances for NEXT beams. In case of dispute, the Fabrication Engineer shall determine the allowable tolerance.

535.23 **Transportation and Storage** - Handle and store material using lifting devices. Handle and transport precast/prestressed units so that the reactions with respect to the unit shall be approximately the same during transportation and storage as in its final position. Do not transport units until the 28 Day design strength has been attained.

Support stored precast/prestressed units above the ground on dunnage in a manner to prevent twisting or distortion. Protect the units from discoloration and damage.

Repair or replace precast/prestressed concrete units damaged by improper storing, hoisting or handling.

535.24 **Installation of Slabs, Beams and Girders** - Finish bearing areas to the elevations shown on the Plans and in accordance with Section 523 - Bearings, as applicable.

Lift the units using the lifting devices cast into them. Support I-Girders at the abutments and piers to prevent overturning. Place beams and slabs in their final location in a manner that assures that the keyways are spaced properly and the post-tensioning ducts are in alignment. Use compressible gaskets around duct openings within keyways to prevent blocking of the duct with grout.

Prior to grouting, initially post-tension slabs or beams to 5,000 lb force, per strand. Make a permanent and clearly visible reference mark on each strand after it has been initially post-tensioned in order to determine strand elongation after final post-tensioning.

Immediately prior to grouting, clean the keyways between slab or box units and soak the keyways with water in order to prevent absorption of water from the grout. Seal the bottom of the keyways to prevent the loss of grout.

Fill longitudinal keyways between slabs or beams with a non-shrink, flowable, cementitious grout with a minimum design compressive strength of 6,000 psi at 28 Days. The grout shall be a material for keyways from the Department QPL.

Mix, place and cure the grout in accordance with the manufacturer's product data sheet. The Contractor may propose the use of an alternate grout material supplied from a Department approved ready mixed concrete batch plant. Ready mixed grout shall achieve a design compressive strength of 6,000 psi at 28 Days, have an entrained air content of between 5.0 and 8.0%, be non-shrink, flowable, and contain a non-shrink additive listed on the Department QPL for expansive cements. The proposed grout mix design shall be submitted to the Department for approval.

Do not perform final post-tensioning of slabs or beams less than 24 hours after completion of the grouting operation. Final post-tension precast/prestressed concrete slabs or beams to 41,000 lb force per strand, unless otherwise specified on the Plans. Provide a jacking device that has been calibrated in accordance with MNL 116. Provide calibration documentation, a calibration curve and stressing calculations to the Resident, allowing adequate time for review. Do not post-tension slabs or beams until the documentation has been reviewed by the Department. Post-tension the slabs or beams in the presence of the Resident. No vehicular traffic, including the Contractor's equipment, shall be allowed on the bridge until post-tensioning is complete.

Saw cut or abrasive cut the post-tensioning strand of slabs or beams no closer than 1¼" from the wedges after tensioning is complete. Coat the strand ends and wedges with a corrosion inhibiting grease and cap the ends with a watertight cover.

Pack and neatly finish the post-tensioning recesses of slabs or beams with a grout made of the same brand and type of cement used to cast the slabs or beams. Clean the post-tensioning recesses prior to packing the grout.

- 535.25 ***Installation of Precast/Prestressed Deck Panels*** - Erect deck panels as shown on the Plans or reviewed Working Drawings, as applicable. Adjust the bottom-of-slab elevation using threaded jacking devices cast into the panels, or by other means approved by the Resident.

Fill the voids between the top of the beam and the bottom of the panels, as shown on the Plans, reviewed Working Drawings or Standard Details, as applicable, with a non-shrink, flowable, cementitious grout with a minimum design compressive strength of 6,000 psi at 28 Days. The grout shall be a material for keyways from the Department QPL. Mix, place and cure the grout in accordance with the manufacturer's published product data sheet. Provide vent holes at 3 ft intervals to avoid air locks. The Contractor may propose the use of an alternate grout material supplied from a Department approved ready mixed concrete batch plant. Ready mixed grout shall achieve a design compressive strength of 6,000 psi at 28 Days, have an entrained air content of between 5.0 and 8.0%, be non shrink, flowable, and contain a non shrink additive listed on the Department QPL for expansive cements. The proposed grout mix design shall be submitted to the Department for approval.

Prevent concrete leakage between the deck panels using caulking, backer rod or other methods approved by the Resident.

Remove all visible contaminants from the deck panels and protruding reinforcing steel by abrasive blast cleaning or high pressure (minimum of 8,000 psi) water cleaning, prior to placing the deck concrete.

535.26 **Method of Measurement** - Prestressed structural concrete items will be measured by the lump sum, except that precast deck panels will be measured as part of the structural concrete slab Pay Item(s).

535.27 **Basis of Payment** - Acceptable work done under Precast, Prestressed Concrete Superstructure will be paid for at the Contract lump sum price for the respective Pay Item; all work associated with precast deck panels will be considered incidental to the structural concrete slab Pay Item(s). Payment will be full compensation for furnishing all materials, labor and equipment in the precast/prestressed work, including concrete, strand, reinforcing steel, anchor dowels and related items. Related items will include, but not be limited to: Working Drawings, preformed pads, transportation, erecting the units, drilling and grouting of anchor dowels, grouting of keyways, panels and ducts, tensioning and post-tensioning operations, and required concrete admixtures.

Payment will be made under:

Pay Item		Pay Unit
535.60	Prestressed Structural Concrete Slab	Lump Sum
535.61	Prestressed Structural Concrete I-Girders	Lump Sum
535.62	Prestressed Structural Concrete Box Beams	Lump Sum
535.622	Prestressed Structural Concrete NEXT Beam	Lump Sum

DIVISION 600 - MISCELLANEOUS CONSTRUCTION

SECTION 601 - GABIONS AND MATTRESSES

601.01 **Description** - This work shall consist of furnishing, assembling, filling with stones and lacing wire mesh baskets, hereafter called gabions or mattresses, constructed in accordance with these specifications and placed in conformity with the lines, grades and dimensions shown on the plans or established.

601.02 **Materials** - Materials shall conform to the requirements specified in the following Sections of Division 700 - Materials.

Gabion	711.02
Stones for Gabions	711.03
Mattresses	711.07
Stones for Mattresses	711.08

601.03 **Fabrication** - Gabions and mattresses shall be manufactured so that their sides, ends, lid, and diaphragm(s) can be assembled to form rectangular units of the specified dimensions.

Gabions shall be of a single unit construction. The front, base, back and lid shall be woven into a single unit. The ends and diaphragm(s) shall be factory connected to the base.

The base, sides, and two ends of mattresses shall be of a single unit construction woven into a single unit. Diaphragm(s) shall be factory connected to the base. The lid may be a separate unit.

Perimeter edges of the mesh forming the gabion or mattress shall be securely fastened so that joints have at least the same strength as the wire mesh itself.

The wire mesh shall be fabricated to be non-raveling. Non-raveling is defined as the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire in a section of mesh is cut and the section of mesh then subjected to the load test described in the materials specification.

The gabion length shall be 1½, 2, 3, or 4 times its horizontal width. The horizontal width shall not be less than 36". However, all gabions furnished by the manufacturer shall be of uniform width. Where the gabion length exceeds 1½ times its horizontal width, the gabion shall be equally divided into cells by diaphragm(s) of the same mesh and gauge as the gabion body.

Mattresses shall be at least 6 ft by 6 ft and equally divided by transverse diaphragms.

601.04 **Assembling** - Gabions and mattresses shall be supplied folded flat, tied in pairs and packed in bundles. Single units shall be removed from the bundle; unfolded flat on the ground and all kinks and bends flattened.

The units shall be assembled individually by erecting the front side, back side, ends, and diaphragm(s), assuring that all creases are in the correct position and the tops of all sides level.

The four corners of each unit shall be laced first, followed by the edges of internal diaphragm(s) to the sides.

The lacing procedures for lacing corners and units together shall consist of cutting a length of lacing wire approximately 1½ times the distance to be laced, not to exceed 5 ft, securing the wire terminal at the corner by looping and twisting, then proceeding to lace with alternating single and double loops at approximately 5" intervals and securely fasten the other wire terminal.

The mattresses shall not be assembled in their final location, except as required for lacing adjacent units together. This is to maintain a uniform bedding surface for installation as described in Section 601.051.

At the option of the Contractor, approved locking wire fasteners may be used in lieu of lacing wire provided they are used in every mesh opening along the joint, each ring is formed such that the ends interlock and the fasteners be of stainless steel construction with a minimum thickness of 0.125", meeting the requirements of ASTM A213, Type 302.

601.05 Installation of Gabions - The assembled gabion units shall be placed in the proper location. All adjoining empty gabions shall be placed along the perimeter of the gabion contact surfaces to obtain a monolithic structure.

Once the gabion units are laced together, they shall be stretched to effective alignment. This operation shall be carried out after several empty gabion units have been positioned. The first gabion in the line shall be partially filled to provide the necessary anchorage prior to stretching. Stretching shall be carried out using a means of stretching of at least 1 ton capacity.

While under tension, the gabion shall be carefully controlled against any possible unraveling.

Whenever gabion structures require more than one tier, the upper empty gabion tier, while under tension, shall be laced to the top of the lower one.

601.051 Installation of Mattresses - If the mattress is to be placed in the dry, the assembled unit shall be placed in the proper location after it is assembled as described in Section 601.04. Several empty units shall be laced together along the contact surfaces to obtain a monolithic structure. Care shall be taken to maintain a uniform surface on the bedding material.

If the mattresses are to be placed underwater, they may be laced together, filled in the dry, and then placed in final position.

If the mattresses are polyvinyl chloride coated, they shall not be dragged, but shall be placed in a manner so as not to damage the coating.

- 601.052 **Filter Fabric** - A filter fabric in accordance with Section 722.02 - Drainage Geotextile, shall be placed on the subgrade, backslope, and sides of the excavation. If earthfill is to be placed over the gabions, filter fabric shall be placed top of the gabions before earthfill placement.

- 601.06 **Filling** - Gabions and mattresses shall be filled in strict accordance with the manufacturer's recommendations, one copy of these recommendations will be supplied to the Resident. Care shall be taken when placing stones inside gabions and mattresses in an effort to prevent distortion and ensure proper alignment.

Care shall be taken when placing fill material to assure that the sheathing on coated units will not be broken or damaged.

Gabions shall be filled in layers, 1 ft at a time. Two connecting wires shall be placed between each layer in all cells along all exposed faces of the gabion structure. All connecting wires shall be looped around two mesh openings and the wire terminals shall be securely twisted to prevent their loosening.

The cells in any row shall be filled in stages so that local deformation will be avoided. At no time shall any cell be filled to a depth exceeding 1 ft more than the adjoining cell.

Along all exposed gabion faces, the outer layer of stone shall be carefully placed and packed by hand to ensure proper alignment and a neat, compact, square appearance. No sharp edges of stone shall protrude through the wire mesh. The last layer of stone shall be leveled with the top of the gabion or mattress to allow proper closing of the lid and provide an even surface for the next course.

Gabions and mattresses shall be well packed and full without excessive bulging.

- 601.061 **Filling of Hand Filled Gabions** - The assembled gabion units shall be placed in the proper location. A form shall then be placed along the front face and any side face not adjacent to an already placed gabion, and anchored to formwork on the back face to provide a rigid frame rectangle before filling with stone.

The forms shall be sufficiently braced and tied to prevent distortion while the stones are being placed.

On all exposed gabion faces, the outer layer of stone shall be carefully placed and packed by hand to ensure proper alignment and a neat, compact, square appearance. No sharp edges of stone shall protrude through the wire mesh.

Care shall be taken when placing fill material to assure that the sheathing on coated units will not be broken or damaged.

Gabions shall be filled by hand in 1 ft layers. Two connecting wires shall be placed between each layer in all cells along all exposed faces of the gabion structure. All connecting wires shall be looped around two mesh openings and the wire terminals shall be securely twisted to prevent their loosening.

The cells in any row shall be filled in stages so that local deformation will be avoided. At no time shall any cell be filled to a depth exceeding 1 ft more than the adjoining cell.

The last layer of stone shall be leveled with the top of the gabion or mattress to allow proper closing of the lid and provide an even surface for the next course.

At no time will any stones be placed by machine.

Complete gabions shall have a maximum deviation from the designated shape of 1" in 3 ft. Gabions not meeting this tolerance will be emptied, adjustments made, and refilled.

601.07 **Lid Closing** - The lids shall be stretched tightly over the filling, using crowbars or lid closing tools, until the lid meets the perimeter edges of the front and end panels. The lid shall then be tightly laced along all edges, ends, and diaphragms in the same manner as described above for assembly.

601.08 **Cutting and Folding Mesh** - Where shown on the drawings or when otherwise directed, the mesh shall be cut, folded, and wired together to suit existing site conditions. The mesh must be cleanly cut and the surplus mesh cut out completely or folded back and neatly wired to an adjacent face. The cut edges of the mesh shall be securely laced together with lacing wire in the manner as described above for assembling.

601.09 **Method of Measurement** - Gabions and mattresses will be measured for payment by the cubic yard to the neat line dimensions shown on the plans.

601.10 **Basis of Payment** - Payment for gabions and mattresses will be made at the Contract unit price per cubic yard in place. Payment will be full compensation for excavating to place gabions and backfill material, for preparing and fine grading the foundations area, for furnishing and placing backfill material under and behind the gabions and for furnishing and placing all necessary gabion units including wire mesh baskets, lacing wire, rock fill and all labor and equipment necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
601.21	Gabions, Galvanized	Cubic Yard
601.211	Gabions, Galvanized and Hand Filled	Cubic Yard
601.22	Gabions, PVC Coated	Cubic Yard
601.221	Gabions, PVC Coated and Hand Filled	Cubic Yard

601.23	Mattresses, Galvanized: _____	Cubic Yard
601.24	Mattresses, PVC Coated: _____	Cubic Yard

SECTION 602 - PIPE LINING - Reserved

SECTION 603 - PIPE CULVERTS AND STORM DRAINS

- 603.01 **Description** - This work shall consist of constructing or reconstructing pipe culverts and storm drains, in accordance with these specifications, the Standard Detail plans and in reasonably close conformity with the lines and grades shown on the plans or established.

The word "pipe" in these specifications shall include both round pipe and pipe arches.

- 603.02 **Materials** - Meet Sections:

Joint Mortar	705.02
Flexible Gaskets	705.03
Flexible Culvert Polyvinylchloride (PVC) Pipe	706.08
Polypropylene Pipe	706.10
Corrugated Steel, Metallic Coated Pipe	707.02
Corrugated Aluminum Alloy Pipe & Pipe Arches	707.06
Polymer Precoated, Galvanized Corrugated Steel Pipe & Pipe Arches	707.07
Aluminum Coated (Type 2) Corrugated Steel Pipe	707.10
Zinc-Coated (Galvanized) Corrugated Steel Pipe	707.11
Rigid Culvert	
Reinforced Concrete Pipe	706.02
Corrugated Polyethylene Pipe	706.06

Flexible culverts with a diameter of 48" or more shall have the ends cut to a partial bevel as called for on the plans. The cut ends of galvanized steel pipe shall be regalvanized or painted with a zinc aluminum paint conforming to Federal Specification TT-P-1561A or an approved equal.

Helical corrugated pipe shall be re-rolled to form angular corrugations on the ends.

The corrugated bands for connecting pipe with 2⅔" by ½" corrugations shall be not less than 10½" wide.

Rigid culverts, designated to have the ends shaped to a partial bevel, shall be either cast or cut to the required shape and dimensions. In either case, the edges of the pipe shall be even and true with no exposed reinforcing.

Reinforced Concrete Pipe (RCP) with inside diameters of 10 ft (120") or greater shall be designed, fabricated and accepted in accordance with Section 534 - Precast Structural Concrete.

All Pipes or Culverts with inside diameters of 10 ft (120") or greater shall be designed using the current version of the AASHTO LRFD Bridge Design Specifications with Maine Modified HL-93 for Strength 1.

603.03 **Construction Requirements**

603.031 **General** - Culvert pipe and pipe arches shall be furnished under the following options unless otherwise specified.

Option I - The Contractor shall furnish any of the following type of pipe under Option I:

- Corrugated Steel, Metallic (zinc or aluminum) Coated Pipe
- Reinforced Concrete Pipe
- Corrugated Polyethylene Pipe
- Any of the metal pipes allowed under Option III.

Option III - The Contractor shall furnish any of the following types of pipe under Option III. (Corrugated pipe used under this option shall be adequate to equal the flow capacity of comparable smoothlined pipe):

- Corrugated Aluminum Alloy Pipe
- Polyvinylchloride (PVC) Pipe
- Polymer-Precoated Galvanized Corrugated Steel Pipe
- Reinforced Concrete Pipe
- Corrugated Polyethylene Pipe
- Polypropylene Pipe

Within any single run of culvert pipe, including extensions of existing culverts, the type of pipe shall be the same unless otherwise specified or as directed by the Resident. In a closed drainage system, a run of culvert pipe shall be considered from catch basin to catch basin. In an open drainage system, a run of culvert shall be considered from inlet to outlet.

Option III polyvinylchloride (PVC) pipe shall only be used in closed drainage systems, between catch basins.

603.0311 **Corrugated Polyethylene and Polypropylene Pipe for Option III** - If inspection by the Resident reveals an unsatisfactory installation, the Resident may direct the Contractor to test installed Smooth Lined Corrugated Polyethylene and Polypropylene Pipe for Option III to ensure the vertical deflection does not exceed the maximum allowable deflection. Maximum allowable

deflection shall be 5% of the sum of the nominal inside diameter minus a 1.5% undersize tolerance.

Deflection tests shall not be performed until at least 30 Days after completion of installation and compaction of backfill. The pipe shall be cleaned and inspected for offsets and obstructions before testing.

For all pipes 24" and smaller, a mandrel shall be pulled through the pipe by hand to ensure the maximum allowable deflections have not been exceeded. The mandrel shall be certified by the Department prior to use. If the mandrel fails to pass through the pipe, the pipe will be deemed overdeflected.

For pipes greater than 24", deflections shall be determined by a method submitted and approved by the Department. If a mandrel is selected, the minimum diameter and length and other requirements shall conform to the dimensions and requirements stated below. If other methods are used the measurements shall meet the minimum mandrel diameter requirements.

Any overdeflected pipe shall be uncovered and if not damaged as determined by the Department shall be allowed for reinstallation. Damaged pipe shall not be reinstalled and shall be removed from the work site.

The mandrel shall be a rigid non-adjustable, odd numbered-leg (9 legs minimum) mandrel having an effective length not less than its nominal diameter and having a minimum diameter at any point along the full length as follows:

Nominal Size inches	Minimum Mandrel Diameter inches
12	11.23
15	14.04
18	16.84
24	22.46
30	28.07
36	33.69
42	39.30
48	44.92
60	56.15

When deflection testing reveals over deflected pipe, all costs incurred by the Contractor including mandrel and

deflection testing, reinstallation of pipe and delays shall be the responsibility of the Contractor. When deflection testing reveals satisfactory pipe, all costs for deflection testing will be paid for by the Department.

603.032 **Excavation** - Trenches shall be excavated in accordance with the requirements of Section 206 - Structural Excavation and wide enough to allow joining the culvert and compacting the bedding and backfill material under and around the culvert. Unless otherwise designated, trench walls shall be as nearly vertical as possible and the trench width no greater than necessary for installation of the culvert.

603.04 **Bedding** - Culverts, less than 42" in diameter, shall be bedded on a firm foundation of uniform density. After placing the culvert pipe, backfill material shall be placed along the bottom of the trench, thoroughly tamped against the lower portion of the pipe with special care taken not to move the bedded pipe.

For culverts 42" in diameter and larger, the bottom of the trench shall be compacted to uniform density and shaped to fit a template with reasonable closeness for at least 10% of the culvert's total height.

On all bedding, when bell and spigot pipe is used, the portion of trench at the joints shall be shaped to fit the bell.

603.05 **Laying Culvert** - The Contractor shall not install nor backfill culverts between December 15th and April 1st without written permission. Installing shall begin at the downstream end of the culvert line. Bell or groove ends of rigid culverts shall be placed facing upstream.

Elliptically shaped culverts shall be placed with the major axis within 5° of vertical. Elliptically reinforced concrete pipe shall be placed with the vertical axis, indicated by the manufacturer, within 5° of vertical.

603.06 **Joining Culverts** - The method of joining rigid culvert sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even. Joints shall be made with Portland Cement mortar, Portland Cement grout, rubber ring gaskets, or flexible plastic gaskets.

The pipe ends shall be thoroughly cleaned before the joint is made. Mortared joints shall be made with an excess of mortar to form a bead around the outside of the culvert and finished smooth inside. For grouted joints, molds or runners shall be used to retain the poured grout.

Joints with rubber ring gasket or flexible plastic gasket shall be made in accordance with the manufacturer's recommended procedures.

When Portland Cement mixtures are used, the completed joints shall be covered to protect against drying.

Flexible culvert section and metal end sections shall be firmly jointed by coupling bands. These bands shall meet the same applicable requirements as the flexible culvert being joined.

603.07 **Shop Strutting** - All flexible circular culvert pipe 48" in diameter and larger shall be elongated along the vertical diameter in accordance with one of the following two methods:

- a) The pipe shall be elongated by the manufacturer after fabrication by increasing the diameter along the vertical axis approximately 3% with a corresponding decrease along the horizontal axis. The elongation shall be obtained by installing rods and tightening the rods, uniformly from end to end of the pipe, obtaining approximately one quarter of the required elongation each time throughout the length of the pipe.

The rods shall be $\frac{5}{8}$ " diameter threaded 7" at both ends with washers and nuts. The length of the rods shall be the diameter of the pipe plus 8". The rods shall be placed on the horizontal axis of the pipe at 2 ft spacing and located halfway between the circumferential riveting. A block of soft wood 2" by 4" by 12" long, shall be placed over the rods at each end to provide contact against the outside of the pipe. The long dimension of the blocks shall be parallel with the horizontal axis of the pipe. The rods shall be left in the pipe until the fill is completed and compacted, unless for some unusual condition their removal is ordered. The rods shall be removed by cutting from the inside adjacent to the pipe.

- b) The pipe shall be elongated by the manufacturer by increasing the diameter along the vertical axis approximately 5% with a corresponding decrease along the horizontal axis by applying sufficient pressure to the sides of the pipe after fabrication to produce the specified distortion. The elongation shall be maintained by drilling holes in the ends of the pipe sections and placing and tightening horizontal wires. After the pipe sections have been installed with coupling bands, the wires shall be removed.

Helically corrugated culvert sections shall be match marked before being elongated by the manufacturer or before the $\frac{5}{8}$ " diameter rods are installed.

603.08 **Backfilling Culverts and Storm Drains** - After the pipe is installed, it will be inspected before any backfill material is placed. All pipe found to be out of alignment, unduly settled or damaged to the extent that full performance is impaired, shall be taken up and re-laid or replaced.

Trenches shall be backfilled in accordance with Section 206.03 and as follows. The backfill material shall be thoroughly rammed under the haunches of the pipe with power or pneumatic operated hand tampers. The remainder of the backfill shall be thoroughly compacted with power tampers or vibratory compactors or other approved equipment or combination of equipment.

When the top of the pipe is exposed above the top of the trench, the embankment material around the pipe shall be placed and compacted on each side of the pipe in the aforementioned manner described for backfilling trenches, for a width of 5 ft measured from the outside diameter of the pipe. Only that portion of the embankment on each side and top of the pipe, for a minimum distance of 15" measured from the outside diameter of the pipe, must be of material conforming to the requirements described for backfilling in Section 206.03. Backfill material beyond these limits may contain stones larger than 3" but no greater than the thickness of the layer being placed. The embankment construction around the pipe shall continue up to an elevation 15" above the top of the pipe. Beyond these limits, the embankment shall be placed and compacted in accordance with the embankment construction requirements specified for the work except where the induced trench method is called for on the plans.

When construction equipment is used or traffic is maintained the Contractor shall provide a minimum cover of 3 ft over all pipes, if possible. Whenever this cover extends above the subgrade the Contractor shall temporarily place earth, which shall be removed when necessary to complete the work in accordance with the plans, or as directed. Any deviation from this practice shall have prior approval.

603.09 ***Induced Trench*** - Under this method, for designated rigid pipes only, the embankment shall be completed as specified above, to a height above the culvert equal to the vertical outside diameter of the pipe plus 1 ft. A trench, equal in width to the outside horizontal diameter of the pipe, shall then be excavated to within 1 ft of the top of the pipe. Trench walls shall be as nearly vertical as possible. Hay bales shall be used to fill the lower $\frac{1}{4}$ to $\frac{1}{3}$ of the trench. Construction of the embankment above shall then proceed in a normal manner. The trench shall be loosely filled with highly compressible soil.

603.10 ***Removing and Relaying Culverts*** - The pipe shall be carefully removed from its existing location, transported to and installed in the new location in accordance with these specifications for the particular type of pipe involved. Pipe damaged by the Contractor shall be replaced with pipe of similar type by the Contractor without additional compensation.

New metal bands or joint material shall be supplied and installed when necessary.

603.11 ***Method of Measurement*** - Culvert and storm drain pipe of the different types and sizes, both new and re-laid, will be measured by the length in linear feet along the invert, laid as directed, complete in place, and accepted. Pipe laid in excess of the authorized length will not be included.

When the ends of a pipe are sloped or skewed, the amount to be included for payment shall be the length along the invert of the pipe.

When elbows, tees, wyes, or other special fittings are required, each fitting shall be included for payment as 3 additional linear feet of the largest pipeline involved.

Inlet grate units will be measured by each unit installed, complete in place, and accepted.

Concrete pipe ties shall be measured per Group (2 ties per Group).

603.12 **Basis of Payment** - The accepted quantities of pipe for culverts and storm drains will be paid for at the Contract unit price per linear foot, for the types and sizes specified, complete in place.

No payment will be made for pipe ordered without written approval of the Resident when such pipe is not required to be installed for completion of the work.

Excavation for culverts and storm drains, including excavation below the pipe, for induced trench and for bedding and backfilling will be considered incidental, except as provided in Section 206 - Structural Excavation.

Whenever minimum cover material extends above the subgrade, removal of the cover material necessary to complete the work will not be paid for directly but shall be considered part of the work specified herein.

Coupling bands and joint material will not be paid for separately but shall be considered included in the unit bid price for the type of pipe being used or re-laid.

Existing culverts to be re-laid, salvaged, or wasted shall be removed and disposed of as directed. The excavation for removal of these culverts that is not paid for under other items or incidental to other items shall be paid for as Common Excavation.

Inlet grate units will be paid for at the Contract unit price each for the size specified, complete in place.

The accepted quantity of concrete pipe ties will be paid for at the Contract unit price per Group. Such payment will be full compensation for furnishing, installing, and all other necessary incidentals for satisfactory completion of the work. Any grout or mortar necessary to repair chipping shall be incidental to the installation of the pipe ties.

Payment will be made under (Table continues on next pages):

Pay Item		Pay Unit
603.15	12" Culvert Pipe Option I	Linear Foot
603.16	15" Culvert Pipe Option I	Linear Foot
603.17	18" Culvert Pipe Option I	Linear Foot
603.18	21" Culvert Pipe Option I	Linear Foot
603.19	24" Culvert Pipe Option I	Linear Foot
603.20	30" Culvert Pipe Option I	Linear Foot

603.21	36" Culvert Pipe Option I	Linear Foot
603.159	12" Culvert Pipe Option III	Linear Foot
603.169	15" Culvert Pipe Option III	Linear Foot
603.179	18" Culvert Pipe Option III	Linear Foot
603.189	21" Culvert Pipe Option III	Linear Foot
603.199	24" Culvert Pipe Option III	Linear Foot
603.2009	27" Culvert Pipe Option III	Linear Foot
603.209	30" Culvert Pipe Option III	Linear Foot
603.2019	33" Culvert Pipe Option III	Linear Foot
603.219	36" Culvert Pipe Option III	Linear Foot
603.229	42" Culvert Pipe Option III	Linear Foot
603.239	48" Culvert Pipe Option III	Linear Foot
603.249	54" Culvert Pipe Option III	Linear Foot
603.259	60" Culvert Pipe Option III	Linear Foot
603.269	66" Culvert Pipe Option III	Linear Foot
603.279	72" Culvert Pipe Option III	Linear Foot
603.289	84" Culvert Pipe Option III	Linear Foot
603.30	21" span by 15" rise Pipe Arch Option III	Linear Foot
603.31	24" span by 18" rise Pipe Arch Option III	Linear Foot
603.32	28" span by 20" rise Pipe Arch Option III	Linear Foot
603.33	35" span by 24" rise Pipe Arch Option III	Linear Foot
603.34	42" span by 29" rise Pipe Arch Option III	Linear Foot
603.35	49" span by 33" rise Pipe Arch Option III	Linear Foot
603.36	57" span by 38" rise Pipe Arch Option III	Linear Foot
603.37	64" span by 43" rise Pipe Arch Option III	Linear Foot
603.38	66" span by 51" rise Pipe Arch Option III	Linear Foot
603.39	73" span by 55" rise Pipe Arch Option III	Linear Foot
603.40	81" span by 59" rise Pipe Arch Option III	Linear Foot
603.41	24" Reinforced Conc. Pipe Class IV	Linear Foot
603.42	30" Reinforced Conc. Pipe Class IV	Linear Foot
603.43	36" Reinforced Conc. Pipe Class IV	Linear Foot
603.44	42" Reinforced Conc. Pipe Class IV	Linear Foot
603.45	48" Reinforced Conc. Pipe Class IV	Linear Foot
603.46	54" Reinforced Conc. Pipe Class IV	Linear Foot
603.47	60" Reinforced Conc. Pipe Class IV	Linear Foot
603.48	66" Reinforced Conc. Pipe Class IV	Linear Foot
603.49	72" Reinforced Conc. Pipe Class IV	Linear Foot
603.55	Concrete Pipe Ties	Group
603.73	Remove and Relay Metal Pipe: _____	Linear Foot
603.7315	Remove and Relay 15" Metal Pipe	Linear Foot
603.7318	Remove and Relay 18" Metal Pipe	Linear Foot
603.7324	Remove and Relay 24" Metal Pipe	Linear Foot
603.733	Remove and Relay 30" Metal Pipe	Linear Foot

603.7336	Remove and Relay 36" Metal Pipe	Linear Foot
603.7348	Remove and Relay 48" Metal Pipe	Linear Foot
603.7372	Remove and Relay 72" Metal Pipe	Linear Foot
603.74	Remove and Relay Concrete Pipe: _____	Linear Foot
603.7415	Remove and Relay 15" Concrete Pipe	Linear Foot
603.7418	Remove and Relay 18" Concrete Pipe	Linear Foot
603.7421	Remove and Relay 21" Concrete Pipe	Linear Foot
603.7424	Remove and Relay 24" Concrete Pipe	Linear Foot
603.743	Remove and Relay 30" Concrete Pipe	Linear Foot
603.7436	Remove and Relay 36" Concrete Pipe	Linear Foot
603.7442	Remove and Relay 42" Concrete Pipe	Linear Foot
603.7448	Remove and Relay 48" Concrete Pipe	Linear Foot
603.7454	Remove and Relay 54" Concrete Pipe	Linear Foot
603.746	Remove and Relay 60" Concrete Pipe	Linear Foot
603.7472	Remove and Relay 72" Concrete Pipe	Linear Foot
603.75	6" Inlet Grate Unit	Each
603.76	12" Inlet Grate Unit	Each
603.77	15" Inlet Grate Unit	Each
603.78	18" Inlet Grate Unit	Each
603.79	21" Inlet Grate Unit	Each
603.80	24" Inlet Grate Unit	Each
603.81	30" Inlet Grate Unit	Each
603.82	36" Inlet Grate Unit	Each

SECTION 604 - MANHOLES, INLETS, AND CATCH BASINS

604.01 **Description** - Construct manholes, inlets, and catch basins.

604.02 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Portland Cement and Blended Hydraulic Cement	701.01
Clay or Shale Brick	704.01
Concrete Masonry Blocks	704.03
Joint Mortar	705.02
Reinforcing Steel	709.01
Stone Curbing and Edging	712.04
Precast Concrete Units	712.06
Catch Basin and Manhole Frames, Grates and Covers, Drainage, Sewer, Utility, and related castings	712.07
Corrugated Metal Units	712.08
Catch Basin and Manhole Steps	712.09

Except as otherwise provided on the plans, concrete for these structures shall meet the requirements of Section 502 - Structural Concrete.

Catch basin grates shall be either the type of grate shown on the Standard Details or an approved equal. The corners shall be notched by the Contractor at the Project site by grinding the corner to fit the cast iron frames.

- 604.03 **Construction Requirements** - Concrete catch basins and manholes shall be constructed of precast units, except that concrete blocks may be used around inlet and outlet pipes. Joints for precast concrete units shall be of Portland Cement mortar, rubber gaskets, flexible plastic rings, mastic joint filler or other approved types to form a watertight joint. Joints for concrete blocks shall be of Portland Cement mortar, not more than ½" wide, completely filled and neatly tooled on the inside of the structure.

Metal catch basins shall be corrugated metal pipe units mounted on a Portland Cement concrete foundation.

Catch basins and manholes shall be placed to the required grade on a compacted foundation of uniform density. Inlet and outlet pipe elevations may vary from the elevations shown on the plans depending upon field conditions.

Pipe sections entering catch basins shall be firmly connected to the structure wall with no part of the pipe Projecting more than 6" inside the wall. When a section of culvert is cut, the end shall be finished in a skillful manner.

Metal frames and traps, when called for, shall be set in a bed of clay bricks or shale bricks and mortar, or otherwise secured as shown on the plans. Castings shall be set to the correct elevation before the next final course of paving material has been placed.

Upon completion, each catch basin and manhole shall be cleaned of all accumulation of silt, debris, or foreign matter and shall be kept clean until final acceptance of the work.

- 604.04 **Altering, Adjusting, and Rebuilding Catch Basins and Manholes** - Existing catch basins and manholes shall be dismantled sufficiently to allow altering, adjusting, or rebuilding in accordance with the applicable requirements as shown on the Standard Detail plans for complete catch basins and manholes. When existing frames, covers, and grates are used, they shall be thoroughly cleaned of existing mortar before placing to the new grade.
- a. **Altering Catch Basin** - The existing top assembly shall be removed and replaced with a new Type A or Type B frame and special grate set to the required grade using approved clay brick and mortar.
 - b. **Adjusting Catch Basins and Manholes** - The existing top assembly shall be removed, thoroughly cleaned, and reset to the new grade using approved clay brick and mortar. The Department will allow the use of metal ring inserts set into the manhole top frame or composite risers placed beneath the manhole frame to adjust manhole slope and grade for paving Projects. The use of metal ring inserts shall be in accordance with

604.04d. Ring Insert Requirements. The use of composite risers shall be in accordance with 604.04e. Composite Riser Requirements.

- c. **Rebuilding Catch Basins and Manholes** - The existing top assembly, cone section, and barrel section shall be removed down to the outlet flow line grade to the extent required, as determined by the Resident, and shall be rebuilt and a new frame and grate furnished and installed at the required line and grade directed. Concrete blocks may be used to rebuild the barrel section, if necessary, due to existing conditions.

The Department will allow the use of metal ring inserts set into the manhole top frame or composite risers placed beneath the manhole frame to adjust manhole slope and grade for paving Projects. The use of metal ring inserts shall be in accordance with 604.04d. Ring Insert Requirements. The use of composite risers shall be in accordance with 604.04e. Composite Riser Requirements.

- d. **Ring Insert Requirements** - Ring inserts to adjust manhole top frame slope and grade will be allowed in accordance with the following requirements:

- 1. **Materials**

- i. All ring inserts must be made of iron. Multiple ring inserts will not be allowed. The single ring insert may be any height up to a maximum of 2" tall.
- ii. Ring inserts shall not be welded to the manhole frame to prevent brittle failure of the cast iron frame.
- iii. Ring inserts shall be fastened to the manhole frame using liquid steel-filled epoxy such as Loctite Fixmaster Steel Liquid or equivalent. The epoxy shall be installed in accordance with the manufacturer's recommendations.

- 2. **Where Ring Inserts May/May Not Be Used**

- i. The Department will allow the use of a single manhole ring insert to raise manholes on state and state-aid highways.
- ii. Manhole ring inserts may not be used along state and state-aid highway sections where the speed limit is 40 mph or more. The standard brick and mortar or flat composite risers beneath the manhole frame must be used at these locations.

- 3. **Construction Requirements for the Use of Iron Manhole Ring Inserts**

- i. Wherever iron ring inserts are used to raise manhole top elevations, the rings shall be fastened to the existing manhole frame using liquid steel-filled epoxy. The liquid steel-filled epoxy shall be placed evenly around the entire manhole frame before

placing the ring insert. Unbonded ring inserts will not be allowed. If the manufacturer's recommended construction practices result in loose or unacceptable manhole cover restraint, standard brick and mortar or flat composite risers beneath the manhole frame must be used at these locations.

- e. **Composite Riser Requirements** - Flat or beveled, doughnut-shaped, composite risers placed beneath the manhole frame to adjust slope and grade are allowed. The composite riser shall be fastened to both the top of the concrete cone and bottom of the manhole frame with the manufacturer's recommended epoxy. Composite risers may be used at all locations on state and state-aid highways under any legal speed limit without restriction.

All salvaged material not reused, including grates, and frames, and curb inlets will remain the property of the present owner unless otherwise specified.

Each catch basin and manhole altered, adjusted, or reconstructed, shall be cleaned of all accumulated silt, debris, and other foreign matter before final acceptance of the work.

Resetting the curb inlet will be included in the adjusting or rebuilding catch basin items.

604.05 **Method of Measurement** - Catch basins, manholes, and accessories of the respective types will be measured by the number of units, measured as follows, complete, and accepted in place.

- a. **Complete Structures** - Each catch basin and manhole having a depth up to 8 ft from the top of the grate or cover to the top of the floor, measured to the nearest foot, will be one unit. $\frac{1}{8}$ of a unit will be added for each additional foot over 8 ft measured to the nearest foot. Depth measurements in excess of the dimensions authorized will not be included.
- b. **Existing Structures** - Existing catch basins and manholes to be altered, adjusted or rebuilt will be one unit each. Existing catch basins and manholes that are cleaned will be one unit each.
- c. **Trap** - Each trap included in the completed structure will be one unit each.
- d. **Step** - Each step included in the completed structure will be one unit each.
- e. **Grate** - Each grate changed under item 604.167 will be measured by each unit, complete in place and accepted.

604.06 **Basis of Payment** - The accepted quantities of catch basins, manholes, altered grates, traps, and steps, will be paid for at the Contract unit price each of the respective types complete in place. Payment for rebuilding, adjusting or altering

catch basins and manholes shall include furnishing all materials including new blocks, bricks, mortar, metal tops, covers, and curb inlets when required. Frames, grates, and covers for new or rebuilt catch basins or manholes shall be considered part of the structure and no separate payment will be made. Payment for cleaning existing catch basins and manholes will be paid for at the Contract unit price each. There will be no payment for cleaning new, altered, adjusted, or rebuilt catch basins and manholes. Payment will be full compensation for supplying all equipment and labor to clean the basins and manholes and to dispose of the waste.

Excavation and backfill will be considered incidental, except as provided in Section 206 - Structural Excavation.

Payment will be made under (Table continues on next page):

Pay Item		Pay Unit
604.072	Catch Basin Type A1-C	Each
604.082	Catch Basin Type A2-C	Each
604.09	Catch Basin Type B1	Each
604.092	Catch Basin Type B1-C	Each
604.096	60" Catch Basin Type B1-C	Each
604.097	72" Catch Basin Type B1-C	Each
604.10	Catch Basin Type B2	Each
604.102	Catch Basin Type B2-C	Each
604.11	Catch Basin Type C1	Each
604.12	Catch Basin Type C2	Each
604.13	24" Catch Basin Type E	Each
604.14	30" Catch Basin Type E	Each
604.15	Manhole	Each
604.16	Altering Catch Basin to Manhole	Each
604.161	Altering Catch Basin	Each
604.164	Rebuilding Catch Basin	Each
604.166	Rebuilding Manhole	Each
604.167	Change Catch Basin Grate to Cascade Grate	Each
604.17	Altering Manhole to Catch Basin	Each
604.18	Adjusting Manhole or Catch Basin to Grade	Each
604.182	Cleaning Existing Catch Basin and Manhole	Each
604.19	8" Trap	Each
604.20	12" Trap	Each
604.21	15" Trap	Each
604.22	18" Trap	Each
604.23	Step	Each
604.242	Catch Basin Type F3	Each
604.243	Catch Basin Type F3-C	Each
604.244	Catch Basin Type F4	Each

604.245	Catch Basin Type F4-C	Each
604.246	Catch Basin Type F5	Each
604.247	Catch Basin Type F5-C	Each
604.248	Catch Basin Type F6	Each
604.249	Catch Basin Type F6-C	Each
604.25	Catch Basin Type A5	Each
604.252	Catch Basin Type A5-C	Each
604.26	Catch Basin Type B5	Each
604.262	Catch Basin Type B5-C	Each

SECTION 605 - UNDERDRAINS

605.01 **Description** - This work shall consist of the construction of underdrain, using pipe and filter material and pipe outlets in accordance with these specifications and the standard detail plans and in reasonably close conformity with the lines and grades shown on the plans or established.

605.02 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Granular Borrow	703.19
Underdrain Backfill Material	703.22

Underdrain Pipe

Corrugated Polyethylene Pipe	706.06
Polyvinylchloride (PVC) Perforated Pipe	706.09
Corrugated Steel, Metallic Coated Pipe for Underdrain	707.05
Corrugated Aluminum Alloy Pipe for Underdrain	707.08

Underdrain Outlet Pipe

Corrugated Polyethylene Pipe	706.06
Corrugated Steel, Metallic Coated Pipe for Underdrain	707.02
Corrugated Aluminum Alloy Pipe	707.06

Connections for polyethylene pipe shall be made with external wrap-around split couplings, screw-on type couplings, external snap-on couplings, or bell and spigot and ring gasket. External wrap-around split couplings shall be secured with heavy duty splicing tape or plastic or wire ties placed on each side of the coupling. External snap-on couplings shall comply with the appropriate section of AASHTO Specifications.

Connections for other plastic underdrain pipe shall be made with bell and spigot and ring gasket.

Connections for metallic underdrain pipe shall be made with corrugated metal bands secured with bolts. Dimpled bands shall not be used.

Other types of connectors for underdrain may be used upon approval by the Resident.

605.021 **Fittings** - The material for elbows, tees and wyes for Underdrain pipe shall be at least as thick as the largest size pipe being connected.

605.03 **General** - Underdrain pipe for Underdrain, Type B shall, at the Contractor's option, consist of any one of the following types:

- Corrugated Aluminum Alloy Pipe for Underdrain
- Corrugated Polyethylene Pipe for Underdrain (Smoothlined)
- Metallic Coated (Zinc or Aluminum Coated) Corrugated Steel Pipe for Underdrain
- Polyvinylchloride (PVC) Perforated Pipe

At the Contractor's option, underdrain pipe for Underdrain Type C shall consist of any one of the following types:

- Corrugated Aluminum Alloy Pipe for Underdrain
- Corrugated Polyethylene Pipe (Smoothlined)
- Metallic Coated (Zinc or Aluminum Coated) Corrugated Steel Pipe for Under-drain
- Polyvinylchloride (PVC) Perforated Pipe

605.04 **Underdrain Construction**

- a. **Underdrain, Type B** - The trench shall be excavated to the required width and depth and a bed of the specified granular material, 3" in depth, prepared in the trench. Six inch perforated pipe shall be laid on this bed with the perforations as shown on the Standard Detail plans.

After the pipe has been firmly bedded and joints securely connected, it will be inspected before any backfill is placed. The remaining backfill shall be granular material meeting the same requirements as that used for bedding the pipe.

For underdrain placed under areas of proposed pavement, the material shall be placed in 8" layers, loose measure and thoroughly compacted except that the initial layer of backfill around the pipe may be placed in a layer not exceeding 12". For underdrains placed under areas not proposed to be paved, the initial layer of backfill shall not exceed 12" and the remaining material may be placed in one lift to the elevation of the subgrade and compacted with heavy rubber tired or vibratory compaction equipment to the satisfaction of the Resident.

The upstream end of all completed underdrain pipe shall be sealed with cement mortar or other acceptable material. Care shall be taken that soil does not enter the pipe. Pipe contaminated before backfilling shall be removed, cleaned, and re-laid.

- b. **Underdrain Type C** - The trench shall be excavated to the width and depth as determined by the size and depth of the pipe to be installed.

The perforated pipe shall be laid to line and grade centered on the bottom of the trench with the perforations as shown on the Standard Detail plans.

After the pipe has been firmly bedded and all joints securely connected, it will be inspected before any backfill is placed. The backfill shall be placed in accordance with Section 603.08 and as shown on the Standard Detail plans using the materials specified.

When Underdrain Type B or Underdrain Type C is constructed, backfill material beyond the underdrain trench lateral limits designated on the plans shall be material conforming to the requirements of Granular Borrow, Underwater Backfill. Material within the underdrain trench limits shall conform to the requirements of the type underdrain being constructed. The Contractor shall take precautions to prevent the underdrain backfill material from becoming contaminated with clay, silts, organic matter, or other foreign matter. Methods of placing backfill material shall be limited to the use of equipment that will place material directly into the trench. Pushing material into the trench will not be allowed.

When underdrain is to be constructed in embankment fill, the excavation for the trench shall be done after the embankment has been completed to subgrade elevation.

- 605.05 **Underdrain Outlets** - Trenches for underdrain outlets shall be excavated to the required width and depth. These outlets shall be of the same size and wall thickness used in the underdrain, except that the perforations may be omitted.

The pipe shall be laid in the trench with all ends firmly joined by the applicable methods and means. After inspection and approval of the pipe installation, the trench shall be backfilled with suitable material in layers and compacted as provided for in Section 603.08.

- 605.06 **Method of Measurement** - Underdrain and underdrain outlets will be measured by the length in linear feet along the centerline of underdrains and underdrain outlets of the types and sizes completed and accepted.

When elbows, tees, wyes, or other special fittings are required in underdrain, each fitting shall be included for payment as 3 additional linear feet of the largest pipe size involved.

- 605.07 **Basis of Payment** - The accepted quantities of underdrains and underdrain outlets will be paid for at the Contract unit price per linear foot of each type and size specified complete in place. Outlet pipe for Underdrain, Type C will be paid for under Section 603 - Pipe Culverts and Storm Drains.

Within and beyond the trench limits, backfill, couplings and bands and other related items will not be paid for separately, but shall be considered included in the unit bid price for the type of underdrain being installed.

Excavation will be considered incidental, except as provided in Section 206 - Structural Excavation. No allowance for payment will be made for excavating or material excavated beyond the horizontal dimensions shown for Underdrain, Type B or Underdrain, Type C.

Payment will be made under:

Pay Item		Pay Unit
605.09	6" Underdrain Type B	Linear Foot
605.10	6" Underdrain Outlet	Linear Foot
605.11	12" Underdrain Type C	Linear Foot
605.12	15" Underdrain Type C	Linear Foot
605.13	18" Underdrain Type C	Linear Foot
605.14	21" Underdrain Type C	Linear Foot
605.15	24" Underdrain Type C	Linear Foot
605.17	30" Underdrain Type C	Linear Foot
605.18	36" Underdrain Type C	Linear Foot

SECTION 606 - GUARDRAIL

606.01 **Description** - This work shall consist of furnishing and installing guardrail components in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or as established. Guardrail is designated as:

- 31" W-Beam Guardrail - Mid-Way Splice
- Galvanized Steel W-Beam, 8" wood or composite offset blocks, galvanized steel posts
- Thrie Beam
- Galvanized Steel Thrie Beam, 8" wood or composite offset blocks, galvanized steel posts

Median guardrail shall consist of two beams of the above types, mounted on single posts.

Bridge mounted guardrail shall consist of furnishing all labor, materials, and equipment necessary to install guardrail as shown on the plans. This work shall also include drilling for and installation of offset blocks if specified, and incidental hardware necessary for satisfactory completion of the work.

Remove and Reset and Remove, Modify, and Reset guardrail shall consist of removing the existing designated guardrail and resetting in a new location as shown on the plans or directed by the Resident. Remove, Modify, and Reset

guardrail and Modify guardrail include the following guardrail modifications: Removing plate washers at all posts, except at anchorage assemblies as noted on the Standard Details, adding offset blocks, and other modifications as listed in the Construction Notes or General Notes. Modifications shall conform to the guardrail Standard Details.

Bridge Connection shall consist of the installation and attachment of beam guardrail to the existing bridge. This work shall consist of constructing a concrete end post or modifying an existing end post as required, furnishing, and installing a terminal connector, necessary hardware, and incidentals required to complete the work as shown on the plans. Bridge Transition shall consist of a bridge connection and furnishing and installing guardrail components as shown in the Standard Details.

606.02 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Timber Preservative	708.05
Metal Beam Rail	710.04
Guardrail Posts	710.07
Guardrail Hardware	710.08

Guardrail components shall meet the applicable standards of "A Guide to Standardized Highway Barrier Hardware" prepared and approved by the AASHTO-AGC-ARTBA Joint Cooperative Committee, Task Force 13 Report.

Posts for underdrain delineators shall be "U" channel steel, 8 ft long, 2½ lb/ft minimum and have ⅜" round holes, 1" center to center for a minimum distance of 2 ft from the top of the post.

Reflectorized Flexible Guardrail Markers shall be mounted on all guardrails. A marker shall be mounted onto guardrail posts at the flared guardrail terminal end point and tangent point, both at the leading and trailing ends of each run of guardrail. The marker's flexible posts shall be gray with either silver-white or yellow reflectors (to match the edge line striping) at the tangents, red at leading ends, and green at trailing ends. Whenever the guardrail terminal is not flared, markers will only be required at the terminal end point. These shall be red or green as appropriate. Markers shall be installed on the protected side of guardrail posts unless otherwise approved by the Resident. Reflectorized flexible guardrail markers shall be from the Department's Qualified Products List of Delineators. The marker shall be gray, flexible, durable, and of a non-discoloring material to which 3" by 9" reflectors shall be applied, and capable of recovering from repeated impacts and meeting MASH 16 requirements. Reflective material shall meet the requirements of Section 719.01 for ASTM D4956 Type III reflective sheeting. The marker shall be secured to the guardrail post with two fasteners, as shown in the Standard Details.

Reflectorized beam guardrail reflectors shall be mounted on all "w" beam guardrail and shall be either the "butterfly" type or linear delineation system

panels. “Butterfly” or linear delineation panels shall be installed at approximately 62.5 ft intervals on tangents (after every tenth post) and 31.25 ft on curves (after every fifth post), and shall be centered on the guardrail beam. On Divided highways, the left-hand delineators shall be yellow and the right-hand delineators shall be silver/ white. On two-way directional highways, the right-hand side will have silver / white reflectors and no reflectorized delineator used on the left. Delineators shall have reflective sheeting that meets or exceeds the requirements of Section 719.01.

“Butterfly” reflectors shall be fabricated from high-impact, ultraviolet & weather resistant thermoplastic. Aluminum, galvanized metal or other materials shall not be used. Reflective sheeting will be applied to only one side of the delineator facing the direction of traffic and shall be centered vertically on the guardrail beam as shown in the Standard Detail 606(7).

Linear delineation system panels shall be 1.5" wide by approximately 11" nominal length, with a minimum of 5 raised lateral ridges spaced at approximately 2.25". The height of each ridge shall be 0.34" with a 45° profile and a 0.28" radius at the top. Sheeting shall be laminated to thin gauge aluminum with a pre-applied adhesive tape on the back. Panels shall not be installed over seams or bolt heads and shall be centered horizontally on the guardrail beam; linear delineation panels shall be attached to only one guardrail beam. The guardrail beam surface shall be cleaned and prepared according to the manufacturer’s instructions. Air temperature and guardrail surface temperature must be a minimum of 50°F (10°C) with rising temperature at the time of installation.

Exact locations of the either the “butterfly” type or the linear delineation panels shall be approved by the Resident prior to installation.

Single wood post shall be of cedar, white oak, or tamarack, well-seasoned, straight, and sound and have been cut from live trees. The outer and inner bark shall be removed, and all knots trimmed flush with the surface of the post. Posts shall be uniform taper and free of kinks and bends.

Single steel post shall conform to the requirements of Section 710.07 b.

Single steel pipe post shall be galvanized, seamless steel pipe conforming to the requirements of ASTM A120, Schedule No. 40, Standard Weight.

Acceptable multiple mailbox assemblies shall be listed on the Department’s Qualified Products List and shall be MASH 16 tested and approved.

Flared and Tangent w-beam guardrail terminals and guardrail offset blocks shall be from the Department’s Qualified Products List. Flared terminals shall be installed with a 4 ft offset as shown in the Manufacturer’s installation instructions.

Anchorage assemblies used to anchor trailing ends, radius guardrail, or other ends not exposed to traffic shall meet the applicable standards of “A Guide to

Standardized Highway Barrier Hardware” prepared and approved by the AASHTO-AGC-ARTBA Joint Cooperative Committee, Task Force 13 Report, Drawing SEW02a.

Existing materials damaged or lost during adjusting, removing and resetting, or removing, modifying, and resetting, shall be replaced by the Contractor without additional compensation. Existing guardrail posts and guardrail beams found to be unfit for reuse shall be replaced when directed by the Resident.

- 606.03 **Posts** - Posts for guardrail shall be set plumb in holes or they may be driven if suitable driving equipment is used to prevent battering and distorting the post. When posts are driven through pavement, the damaged area around the post shall be repaired with approved bituminous patching. Damage to lighting and signal conduit and conductors shall be repaired by the Contractor.

When set in holes, posts shall be on a stable foundation and the space around the posts, backfilled in layers with suitable material, thoroughly tamped.

The reflectorized flexible guardrail markers shall be set plumb with the reflective surface facing the oncoming traffic. Markers shall be installed on the protected side of guardrail posts. Markers, which become bent or otherwise damaged, shall be removed and replaced with new markers.

Single wood posts shall be set plumb in holes and backfilled in layers with suitable material, thoroughly tamped. The Resident will designate the elevation and shape of the top. The posts, that are not pressure treated, shall be painted two coats of good quality oil base exterior house paint.

Single steel posts shall be set plumb in holes as specified for single wood posts or they may be driven if suitable driving equipment is used to prevent battering and distorting the post.

Additional bolt holes required in existing posts shall be drilled or punched, but the size of the holes shall not exceed the dimensions given in the Standard Details. Metal around the holes shall be thoroughly cleaned and painted with two coats of approved aluminum rust resistant paint. Holes shall not be burned.

- 606.04 **Rails** - Brackets and fittings shall be placed and fastened as shown on the plans. Rail beams shall be erected and aligned to provide a smooth, continuous barrier. Beams shall be lapped with the exposed end away from approaching traffic.

End assemblies shall be installed as shown on the plans and shall be securely attached to the rail section and end post.

All bolts shall be of sufficient length to extend beyond the nuts but not more than 1/2". Nuts shall be drawn tight.

Additional bolt holes required in existing beams shall be drilled or punched, but the size of the holes shall not exceed the dimensions given in the Standard Details. Metal around the holes shall be thoroughly cleaned and painted with two coats of approved aluminum rust resistant paint. Holes shall not be burned.

606.041 – 606.044 **Vacant**

606.045 **Offset Blocks** - The same offset block material is to be provided for the entire Project unless otherwise specified.

606.05 **Shoulder Widening** - At designated locations the existing shoulder of the roadway shall be widened as shown on the plans. All grading, paving, seeding, and other necessary work shall be in accordance with the Specifications for the type work being done.

606.06 **Mail Box Post** – Single wood post shall be installed at the designated location for the support of the mailbox. The multiple mailbox assemblies shall be installed at the designated location in accordance with the Standard Details and as recommended by the Manufacturer. Attachment of the mailbox to the post will be the responsibility of the home or business owner.

606.07 **Abraded Surfaces** - All galvanized surfaces of new guardrail and posts, which have been abraded so that the base metal is exposed, and the threaded portions of all fittings and fasteners and cut ends of bolts shall be cleaned and painted with two coats of approved rust resistant paint.

606.08 **Method of Measurement** - Guardrail will be measured by the linear foot from center to center of end posts along the gradient of the rail except where end connections are made to masonry or steel structures, in which case measurement will be as shown on the plans. When connected to radius rail, measurement will be to the end of the last tangent beam.

Guardrail terminal, reflectorized flexible guardrail marker, terminal end, anchorage assembly, bridge transition, bridge connection, multiple mailbox post, and single post will be measured by each unit of the kind specified and installed.

Widened shoulder will be measured as a unit of grading within the limits shown on the plans.

Excavation in solid rock for placement of posts will be paid under force account unless otherwise indicated in the Bid Documents.

Reflectorized beam guardrail reflectors (“butterfly” type or linear delineation system panels) when identified by pay item, will be measured for payment by each.

606.09 **Basis of Payment** - The accepted quantities of guardrail will be paid for at the Contract unit price per linear foot for the type specified, complete in place. Reflectorized beam guardrail (“butterfly” type) delineators will not be paid for directly but will be considered incidental to guardrail items. Reflectorized flexible guardrail marker, terminal end, anchorage assembly, bridge transition, bridge connection, multiple mailbox post, and single post will be paid for at the Contract unit price each for the kind specified complete in place.

Guardrail terminals will be paid for at the Contract price each, complete in place which price shall be full payment for furnishing and installing all components including the terminal section, posts, offset blocks, "w" beam, cable foundation posts, plates and for all incidentals necessary to complete the installation within the limits as shown on the Standard Details or the Manufacturer's installation instructions. Pay limits for a flared terminal will be 37½ ft. Pay limits for a tangent terminal will be 50 ft. Each guardrail terminal will be clearly marked with the Manufacturer's name and model number to facilitate any future needed repair. Such payment shall also be full compensation for furnishing all material, excavating, backfilling holes, assembling, and all incidentals necessary to complete the work, except that for excavation for posts or anchorages in solid ledge rock, Payment will be made under 109.7.5 - Force Account. Type III Retroreflective Adhesive Sheeting shall be applied to the approach buffer end sections and sized to substantially cover the end section. On all roadways, the ends shall be marked with alternating black and retroreflective yellow stripes. The stripes shall be 3" wide and sloped down at an angle of 45° toward the side on which traffic is to pass the end section. Guardrail terminals shall also include a set of installation drawings supplied to the Resident.

Anchorage to bridge end posts will be part of the bridge work. Connections thereto will be considered included in the unit bid price for guardrail.

Guardrail to be placed on a radius of curvature of 150 ft or less will be paid for under the designated radius pay item for the type guardrail being placed.

Widened shoulder will be paid for at the Contract unit price each complete in place and will be full compensation for furnishing and placing, grading and compaction of aggregate subbase and any required fill material.

Adjust guardrail will be paid for at the Contract unit price per linear foot and will be full compensation for adjusting to grade. Payment shall also include adjusting guardrail terminals where required.

Modify guardrail will be paid for at the Contract unit price per linear foot and will be full compensation for furnishing and installing offset blocks, additional posts, and other specified modifications; removing, modifying, installing, and adjusting to grade existing posts and beams; removing plate washers and backup plates, and all incidentals necessary to complete the work. Payment shall also include removing and resetting guardrail terminals where required.

Remove and Reset guardrail will be paid for at the Contract unit price per linear foot and will be full compensation for removing, transporting, storing, reassembling all parts, necessary cutting, furnishing new parts when necessary, reinstalling at the new location, and all other incidentals necessary to complete the work. Payment shall also include removing and resetting guardrail terminals when required.

Remove, Modify, and Reset guardrail will be paid for at the Contract unit price per foot and will be full compensation for the requirements listed in Modify guardrail and Remove and Reset guardrail.

Bridge Connections will be paid for at the Contract unit price each. Payment shall include, attaching the connection to the endpost including furnishing and placing concrete and reinforcing steel necessary to construct new endposts if required, furnishing and installing the terminal connector, and all miscellaneous hardware, labor, equipment, and incidentals necessary to complete the work.

Bridge Transitions will be paid for at the Contract unit price each. Payment shall include furnishing and installing the Thrie beam or "w"-beam terminal connector, doubled beam section, and transition section, where called for, posts, hardware, precast concrete transition curb, and any other necessary materials and labor, including the bridge connection as stated in the previous paragraph.

No payment will be made for guardrail removed, but not reset and all costs for such removal shall be considered incidental to the various Contract Pay Items.

Reflectorized beam guardrail reflectors ("butterfly" type and the linear delineation panels) will not be paid for directly but will be considered incidental to all new guardrail items. The Contractor shall furnish and install either the "butterfly" type or linear delineation panels, at its discretion, for new guardrail items.

Reflectorized beam guardrail reflectors (either "butterfly" type or linear delineation system panels) will be paid for under the applicable pay items for installation in conjunction with Adjust, Modify, Remove and Reset, Remove Modify and Reset guardrail items. The accepted quantity of "butterfly" type or linear delineation system panels will be paid for at the Contract unit price each for all work and materials furnished to install, complete in place, including all incidentals necessary to complete the work.

Payment will be made under (Table continues on following pages):

Pay Item		Pay Unit
606.1301	31" W-Beam Guardrail - Mid-Way Splice – Single Faced	Linear Foot
606.1302	31" W-Beam Guardrail - Mid-Way Splice – Double Faced	Linear Foot
606.1303	31" W-Beam Guardrail - Mid-Way Splice, 15 ft Radius and Less	Linear Foot
606.1304	31" W-Beam Guardrail - Mid-Way Splice, Over 15 ft Radius	Linear Foot
606.1305	31" W-Beam Guardrail - Mid-Way Splice Flared Terminal	Each
606.1306	31" W-Beam Guardrail - Mid-Way Splice Tangent Terminal	Each

606.1307	Bridge Transition (Asymmetrical) – Type IA	Each
606.1721	Bridge Transition - Type I	Each
606.1722	Bridge Transition - Type II	Each
606.1731	Bridge Connection - Type I	Each
606.1732	Bridge Connection - Type II	Each
606.178	Guardrail Beam	Linear Foot
606.25	Terminal Connector	Each
606.257	Terminal Connector - Thrie Beam	Each
606.259	Anchorage Assembly	Each
606.265	Terminal End-Single Rail - Galvanized Steel	Each
606.266	Terminal End-Single Rail - Corrosion Resistant Steel	Each
606.275	Terminal End-Double Rail - Galvanized Steel	Each
606.276	Terminal End-Double Rail - Corrosion Resistant Steel	Each
606.352	Reflectorized Beam Guardrail Delineators (“Butterfly” type)	Each
606.3521	Linear Delineation System Panel	Each
606.353	Reflectorized Flexible Guardrail Marker	Each
606.354	Remove and Reset Reflectorized Flexible Guardrail Marker	Each
606.356	Underdrain Delineator Post	Each
606.358	Guardrail, Modify	Linear Foot
606.362	Guardrail, Adjust	Linear Foot
606.365	Guardrail, Remove, Modify, and Reset	Linear Foot
606.366	Guardrail, Remove and Reset	Linear Foot
606.367	Replace Unusable Existing Guardrail Posts	Each
606.3671	Replace Unusable Offset Blocks	Each
606.47	Single Wood Post	Each
606.48	Single Galvanized Steel Post	Each
606.50	Single Steel Pipe Post	Each
606.51	Multiple Mailbox Support	Each
606.568	Guardrail, Modify - Double Rail	Linear Foot
606.63	Thrie Beam Rail Beam	Linear Foot
606.64	Guardrail Thrie Beam - Double Rail	Linear Foot
606.65	Guardrail Thrie Beam - Single Rail	Linear Foot
606.66	Terminal End Thrie Beam	Each
606.70	Transition Section - Thrie Beam	Each
606.71	Guardrail Thrie Beam - 15 ft radius and less	Linear Foot
606.72	Guardrail Thrie Beam - over 15 ft radius	Linear Foot
606.73	Guardrail Thrie Beam - Single Rail Bridge Mounted	Linear Foot
606.74	Guardrail - Single Rail Bridge Mounted	Linear Foot

606.753	Widen Shoulder for Low Volume Guardrail End	Each
606.754	Widen Shoulder for Flared Guardrail Terminal	Each
606.78	Low Volume Guardrail End	Each
606.80	Buried-in-Slope Guardrail End	Each

SECTION 607 - FENCES

607.01 **Description** - Construct fence and gates.

607.02 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 – Materials unless otherwise specified herein:

Barbed Wire	710.01
Woven Wire	710.02
Chain Link Fabric	710.03
Cedar Rail Fence	710.05
Fence Posts and Braces	710.06

Bars for barways shall be of eastern hemlock, northern white pine, Norway pine, spruce, cedar, or tamarack, equal in quality to the wood posts. The bark shall be removed and all knots hewn flush.

Metal gates shall be of galvanized steel.

Staples shall be of galvanized or aluminum coated steel.

Concrete for anchoring metal posts, metal braces and wooden gate posts shall meet the requirements of Section 502 - Structural Concrete, except air entraining will not be required. The class of concrete shall be optional.

Drive anchors shall be an approved anchorage consisting of two steel angles driven diagonally into the ground through metal clamps bolted to the post. All parts shall be galvanized.

607.03 **General** - The Contractor shall perform clearing and grubbing necessary to construct the fence to the required grade and alignment.

Posts shall be spaced as called for on the plans except that a variation of 2 ft back or ahead on line may be allowed at approved locations. The tops of posts shall be set to the required grade and alignment. Cutting off the posts may be allowed with approval.

Posts for cedar rail fence shall be set plumb in drilled or hand dug holes. After posts are placed, rails installed and the posts aligned, the post holes shall be backfilled. The completed fence shall have the tops of the posts at uniform height above ground following the gradient of the ground.

Posts for woven wire fence and barbed wire fence shall be braced with Type I or Type II bracing at designated location as hereafter specified. Type I bracing shall

include diagonal brace and one post of the designated size. Type II bracing shall include two diagonal braces and one post of the designated size.

When the plans require posts or braces to be anchored into the soil, concrete anchors or metal drive anchors shall be used. If concrete is used, temporary guys to hold the posts in position shall be installed until the concrete has set. Unless otherwise permitted, no material shall be installed on posts or strain placed on guys and bracing set in concrete until 48 hours after the concrete has been placed.

If metal drive anchors are used they shall be installed according to the manufacturer's instructions so all parts will be below the ground surface. One drive anchor shall be used on line posts; two drive anchors shall be used on bracing assemblies. Where two drive anchors are used, they shall be placed perpendicular to each other.

Backfill with earth placed in 8" layers, loose measure, and each layer thoroughly tamped.

Metal posts to be set in solid rock shall be placed in drilled holes and grouted with a cement grout composed of 1 part Portland Cement and two parts sand mixed with water.

All surplus material and other debris shall be removed and disposed of.

607.04 ***Woven Wire or Barbed Wire Fencing*** - Wood posts shall be set plumb in holes dug to full depth. Metal posts shall be set plumb by an approved post driver. Posts, which are bent or otherwise damaged, shall be removed and replaced.

- a. ***Bracing*** - At changes in horizontal alignment in excess of 30°, bracing will be required. At changes in horizontal alignment of 15° to 30°, bracing may be called for on the plans or required by the Resident. At changes in horizontal alignment angles of less than 15°, bracing will not be required except at intervals of 660 ft.

In depressions where tension in the fencing may cause lifting, the post will require bracing.

End, corner, gate, barway, and intermediate posts shall be braced and anchored as shown in the Standard Details.

If metal posts are to be placed in concrete, the concrete shall be allowed to set before the space around the base is backfilled. Backfill with satisfactory material thoroughly tamped. If directed, the Contractor shall place a minimum of 6" of gravel in the bottom of the post hole.

- b. ***Gates*** - All gates and the bracing assemblies at gates shall be constructed of metal.
- c. ***Barways*** - Barways shall be constructed of posts corresponding to the type of fence posts used. Wood crossbars shall be furnished.

- d. **Erection of Fabric or Wire** - Fabric or wire shall be stretched taut. Each strand of barbed wire shall be attached to wood posts with staples. Top and bottom strands of woven wire shall be attached to each post and alternate interior strands of woven wire fencing shall be attached to alternate posts. Staples shall not be driven into line posts to restrict the horizontal movement of wire except at corner posts, end posts and bracing where staples shall be fully driven. When attaching fencing to metal posts, approved stay fasteners shall be used.

Except as otherwise provided, splicing wire will be permitted at posts only with each horizontal strand of wire wrapped completely around the post. The wire strand shall be fastened by winding the wire about the same strand where it leads to the post. This type of fastening shall be used at each end post, corner post, and gate post and at barway posts. Other devices designed specifically to splice fencing wire may be used, subject to approval.

607.05 **Chain Link Fence, Ground Installed** - Foundations for posts for chain link fence shall be cast-in-place Portland Cement concrete placed in approved forms or shall be approved metal drive anchors. If wood forms are used, they shall be removed before backfilling. If fiber forms are used, they need not be removed.

- a. **Braces** - Fences less than 6 ft in height that are installed with a top rail shall not require any brace rails. Fences less than 6 ft in height installed without a top rail and all fences with heights of 6 ft or more shall have brace rails installed midway between the top and bottom of the fabric as shown on the plans. Braces shall be securely fastened to the posts then trussed from the line post to the base of the end, intermediate or corner post with a $\frac{3}{8}$ " diameter truss rod and tightened. At changes in horizontal alignment of less than 15°, bracing will not be required except at intervals of 330 ft. At changes in alignment of 15° to 30°, bracing may be required as called for on the plans or requested. At changes in alignment in excess of 30°, bracing will be required. One brace assembly shall be furnished with each end or gate post and two assemblies with each corner or intermediate post and at grade changes specified above.
- b. **Gates** - Where gates are required for chain link fence, they shall be constructed of metal.
- c. **Erection of Chain Link Fabric** - The grade of fence shall be approximately parallel with the grade of the ground. When directed, abrupt depressions shall be filled.

Top rails when required, shall pass through post caps and be securely fastened to end, corner, brace and gate posts. Joints in top rails shall be made with expansion sleeve couplings. On curves with a radius of less than 500 ft, the top rail shall be bent to the arc.

The fabric shall be pulled taut, the ends attached to the posts with stretcher bars, and bands or other approved devices. When required, wire fabric shall be joined by weaving a single strand of mesh wire into the ends of the rolls to form a continuous mesh.

- d. **Tension Wire** - When called for on the plans, a tension wire of 7 gauge galvanized wire shall be used in place of the top rail.

607.06 **Chain Link Fence, Barrier Mounted** - Barrier mounted fences, such as bridge snow fence or railroad security fence on a bridge or wall shall be constructed according to the details in the Plans (including the Standard Details) and meet the following material and installation requirements.

- a. **Posts and Rails** - Posts, rails, and braces shall be manufactured by one of the following methods with the steel conforming to ASTM A1011 or ASTM A1008 and A1011/A1011M:

- Furnace butt welded, continuous welded
- Cold rolled and electric resistance welded
- Seamless

Top rails shall pass through post caps and be securely fastened to end posts. Joints in top rails shall be made with expansion sleeve couplings. On curves with a radius of less than 500 ft, the top rail shall be bent to the arc.

- b. **Attachments** - Tension bars, bar bands, and rail clamps shall be steel or aluminum alloy conforming to AASHTO M 181 (ASTM F626). Steel components shall be hot-dip galvanized in accordance with AASHTO M 111 (ASTM A123), AASHTO M 232 (ASTM A153), or ASTM B695, Class 50, Type I as applicable.
- c. **Hardware** - All bolts and nuts shall be steel conforming to ASTM A307 and ASTM A563 Grade A respectively. Washers shall be hardened steel commercial Type A plain and shall meet the dimensional requirements of ANSI B18.22. All bolts, nuts, and washers shall be hot-dip galvanized in accordance with AASHTO M 111 (ASTM A123), AASHTO M 232 (ASTM A153), or ASTM B695, Class 50, Type I as applicable.
- d. **Chain Link Fabric** - The chain link fabric shall be 9 gauge steel, zinc coated conforming to AASHTO M 181 Type 1 Class D (ASTM A392), aluminum-coated conforming to AASHTO M181 Type II (ASTM A491), or 6 gauge aluminum alloy conforming to AASHTO M 181 Type III (ASTM F1183). Chain-link fabric shall be knuckled on top and bottom.

The fabric shall be pulled taut when installed. When required, wire fabric shall be joined by weaving a single strand of mesh wire into the ends of the rolls to form a continuous mesh.

- e. **Wire Ties** - Wire ties shall be standard round 9 gauge zinc or aluminum coated steel or 6 gauge aluminum alloy conforming to ASTM F626. All ties shall be wrapped around chain-link fabric twice (double-pigtailed) at both ends. Space ties at 6" on center to bottom rail and at 12" on center at all posts and other rails. Mechanical or power fastened ties are acceptable.

607.07 **Method of Measurement** - Fence will be measured by the linear foot accepted in place. Measurement will be along the gradient of the fence from outside to outside of end posts for each continuous run of fence and shall include fence at bracing assemblies but shall not include space at gates and barways. Gates, barways, and bracing assemblies will be measured by the unit of the size and type specified. Excavation in rock for placement of fence posts in drilled holes will be measured by the cubic yard determined from the actual depth of the drilled hole in the rock and a hypothetical circle diameter of 2 ft.

Barrier mounted fences shall be measured by the lump sum accepted in place.

607.07 **Basis of Payment** - The accepted quantities of fence will be paid for at the Contract unit price per linear foot of the type and size specified complete in place. Barways, gates, and bracing assemblies will be paid for at the Contract unit price for each type specified complete in place. Payment shall be full compensation for furnishing, assembling, and installing all materials, for excavating and backfilling holes, and for all incidentals necessary to complete the work except that in rock, payment for drilled holes will be made under 109.7.5 – Force Account. Excavation of earth to exposed rock shall be incidental to the several items for erection of the fence.

Payment for bracing assemblies shall include furnishing and installing the various larger size and longer length posts, diagonal bracing, ties, anchors and all incidental hardware necessary to complete the type of assembly required, all as shown in the Standard Details. At gateways, payment will be made for bracing assemblies and there will be no separate payment for the gate posts. All extra costs incurred for furnishing and installing the oversize posts at gateways shall be considered included with the various Contract items.

Clearing or removal of trees, stumps or boulders, required to install the fence shall be included in the work of the respective pay items of this section.

The accepted quantities of barrier mounted fence will be paid for at the Contract lump sum price complete in place. Payment shall be full compensation for furnishing, assembling, and installing all materials, including components like anti-climb shields.

Payment will be made under:

	Pay Item	Pay Unit
607.08	Woven Wire Fence – Wood Posts	Linear Foot
607.09	Woven Wire Fence – Metal Posts	Linear Foot
607.10	Barbed Wire Fence – Wood Posts	Linear Foot
607.11	Barbed Wire Fence – Metal Posts	Linear Foot
607.12	Barway - Wood Posts	Each
607.13	Barway - Wood Posts	Each
607.14	Walk Gateway 4 foot – Metal	Each
607.15	Drive Gateway 16 foot – Metal	Each
607.16	Chain Link Fence – 4 foot Linear	Foot
607.163	Chain Link Fence – 4 foot – PVC Coate	Linear Foot
607.165	Chain Link Fence – 4 foot – without Top Rail	Linear Foot
607.17	Chain Link Fence – 6 foot	Linear Foot
607.173	Chain Link Fence – 6 foot – PVC Coated	Linear Foot
607.175	Chain Link Fence – 6 foot – without Top Rail	Linear Foot
607.182	Chain Link Fence – 8', High Security	Lump Sum
607.183	Chain Link Snow Fence 33"	Lump Sum
607.22	Cedar Rail Fence	Linear Foot
607.23	Chain Link Fence Gate	Each
607.24	Remove and Reset Fence	Linear Foot
607.25	Remove and Reset Chain Link Fence	Linear Foot
607.30	Bracing Assembly Type I – Wood Posts	Each
607.31	Bracing Assembly Type II – Wood Posts	Each
607.32	Bracing Assembly Type I – Metal Posts	Each
607.33	Bracing Assembly Type II – Metal Posts	Each
607.34	Bracing Assembly Chain Link Fence	Each
607.35	Bracing Assembly Chain Link Fence – PVC Coated	Each

SECTION 608 - SIDEWALKS

- 608.01 **Description** - This work shall consist of furnishing all materials for and constructing sidewalks of either Hot Mix Asphalt (HMA) pavement, brick or concrete, and curb ramp detectable warning plates with truncated domes, in conformance with this specification and all other applicable Contract Documents.
- 608.02 **Materials, General** - All new Portland Cement concrete surfaces shall have protective coating applied in accordance with Section 515 - Protective Coating for Concrete Surfaces.

608.021 **Sidewalk Materials** - Materials for sidewalks shall meet the requirements specified in the following Sections of Division 700 - Materials:

Aggregate for Untreated Surface Course and Leveling Course	703.10
Brick for Paving	704.02
Preformed Expansion Joint Filler	705.01
Welded Steel Wire Fabric	709.02

Portland Cement concrete shall be Class A and meet the requirements of Section 502 - Structural Concrete.

HMA pavement shall meet the requirements of Section 403 - Hot Bituminous Pavement.

New aggregate required to build new sidewalk shall meet the requirements of Standard Specification 703.06(b) - Aggregate for Base and Subbase, Type D. New aggregate for regrading existing sidewalk shall meet the requirements of Section 703.10 - Aggregate for Untreated Surface Course and Leveling Course.

Standard compacting will be required for all sidewalk areas where 6" or more of new or disturbed aggregate is placed. Where less than 6" is placed, compaction will be achieved by use of a plate compactor, hand tamp or other means approved by the Resident.

608.022 **Detectable Warnings Materials** - Detectable warning plates shall be new cast iron, as manufactured by one of the manufacturers listed on Department's Qualified Products List of Detectable Warning Plates. Each plate shall match the width of the ramp, unless otherwise indicated in the Contract Documents, and shall have a natural finish. Prior to starting this work, the Contractor shall submit to the Department the name of the selected supplier, the manufacturer's literature describing the product, installation procedures, and routine maintenance requirements. Concrete shall meet the requirements of Section 608.021 - Sidewalk Materials, of this specification or may be a prepackaged concrete mix from the Department's Qualified Products List (QPL).

608.03 **Sidewalk Construction**

608.031 **Portland Cement Concrete Sidewalks**

- a. **Excavation** - Excavation shall be to the depth and width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown in the Contract Documents. All soft and yielding material shall be removed and replaced with acceptable material.

- b. **Forms** - Forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be true, free from warp and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.
- c. **Placing Concrete** - The foundation shall be thoroughly moistened immediately prior to placing the concrete. The proportioning, mixing and placing of the concrete shall be in accordance with the requirements of Section 502 - Structural Concrete.
- d. **Finishing** - The sidewalk surface shall receive a float finish, in accordance with Section 502 - Structural Concrete. Additionally, a light broom finish shall be applied, perpendicular to the sidewalk. No plastering of the mortar will be permitted. All outside edges of the slab and all joints shall be finished with a sidewalk edging tool, 2" in width, with a ¼" radius lip.
- e. **Joints** - Joints shall be located as shown in the Contract Documents. Slabs shall be placed alternately and the joints coated with an approved bituminous material before placing the adjacent slab.

When a concrete sidewalk is constructed adjacent to a building, retaining wall, or other fixed structure, preformed joint filler, ¼" thick, shall be used between the slab and the structure.

- f. **Curing** - Concrete shall be cured for at least 72 hours. Curing shall be by moist burlap or mats, or by application of a curing compound listed on the Department's Qualified Products List. The curing compound shall be applied continuously by approved mechanical pressure spraying or distributing equipment at a rate necessary to obtain an even, continuous membrane, meeting the manufacturer's recommendations, but at a rate of not less than 1 gal per 200 ft² of surface; at a minimum, two coats shall be applied using a pressurized sprayer, with the first coat being applied within 15 minutes after finishing is complete and the second coat being applied within 30 minutes of, and at right angles to, the first; hand-pump sprayers, rollers or brushes shall not be used. During the curing period, all traffic, both pedestrian and vehicular, shall be excluded. Vehicular traffic shall be excluded for such additional time as may be deemed necessary by the Resident.

608.032 **HMA Pavement Sidewalk**

- a. **Excavation** - Excavation shall be to the required depth and width. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown in the Contract Documents. All soft and yielding material shall be removed and replaced with acceptable material.
- b. **Base Course** - Base course material shall be placed as shown in the Contract Documents and each layer thoroughly compacted.
- c. **Placing HMA Sidewalk Material** - HMA sidewalk material shall be placed on the compacted base course in two courses to provide the required depth when rolled. Compaction shall be by a power roller having a minimum total weight of 1 ton with a minimum of 65 lb/in of width of the drive roll or by satisfactory power vibratory compaction equipment. In areas inaccessible to other equipment, hand tamping will be permitted. In any case, the HMA sidewalk material shall be uniformly compacted.

608.033 **Brick Sidewalk (Remove and Rebuild)** - This work shall consist of the following, unless otherwise indicated in the Contract Documents:

- Removal, storage, and disposal, as necessary, of existing brick;
- shaping and compacting the foundation to a firm, even surface, conforming to the section shown in the Contract Documents - all soft and yielding material shall be removed and replaced with acceptable material;
- regrading, compacting and furnishing of Aggregate for Untreated Surface Course and Leveling Course, as necessary;
- furnishing of new or re-used brick to match the existing sidewalk; furnishing and applying joint filler material (sand) and compacting with water and refilling until joint material is at the same surface as the brick;
- all necessary grading and restoration at the back edge of sidewalk;
- removal and disposal of unused materials and debris.

608.034 **Brick Sidewalk** - Excavation shall be to the required depth and width and the foundation shaped and compacted to a firm, even surface, conforming to the section shown in the Contract Documents. All soft and yielding material shall be removed and replaced with acceptable material.

- 608.035 **Construct Sidewalk** - This work shall consist of excavating the existing ground and placing and compacting new aggregate, as necessary, to build the sidewalk in the new location as shown in the Contract Documents.
- 608.036 **Regrading Sidewalk** - This work shall consist of removing the existing pavement, adding and compacting new aggregate, as necessary, and regrading the gravel base to conform to the grading limits shown in the Contract Documents.
- 608.04 **Detectable Warnings Construction** - New plates shall be set square with the curb edge and the base of the truncated domes shall be set flush with adjacent surfaces to allow for proper drainage. All concrete required for detectable warnings shall be cured in accordance with Section 608.031(f) - Curing, of this specification.
- 608.041 **Existing Concrete Curb Ramps** - Existing concrete shall be saw-cut to a dimension 4" larger than the detectable warning plates. New concrete shall be placed in the resulting opening and finished, and the new plates set into the wet concrete, according to the manufacturer's recommendations.
- 608.042 **New Concrete Curb Ramps** - New concrete shall be placed and finished for the ramp, and the new plates set into the wet concrete, according to the manufacturer's recommendations.
- 608.043 **New HMA Pavement Ramps** - HMA pavement shall be saw cut and removed to provide an opening that will allow for the dimensions of the cast iron plate surrounded by an additional 4" border on all sides of the plate. New concrete shall be placed in the resulting opening and finished, and the new plates set into the wet concrete, according to the manufacturer's recommendations.
- 608.05 **Method of Measurement** - Construct sidewalk, regrading sidewalk, concrete sidewalk, brick sidewalk (remove and rebuild), brick sidewalk and brick driveway aprons will be measured by the square yard of finished surface. HMA pavement sidewalks will be measured by the ton of HMA mixture placed. Detectable warning plates will be measured for payment by the square foot of actual plate area, only, not including the surrounding concrete.
- 608.06 **Basis of Payment** - The accepted quantities of sidewalk will be paid for at the Contract Unit Price per square yard for concrete sidewalk, brick sidewalk and brick driveway aprons, and per ton for HMA pavement sidewalk, complete and in place. Excavation will be paid for under Section 203 - Excavation and Embankment. Base and subbase material will be paid for under Section 304 - Aggregate Base and Subbase Course. HMA mixture for sidewalks will be paid for under Section 403 - Hot Bituminous Pavement. Expansion joint material, joint filler, and other related items will not be paid for separately but shall be considered incidental to related Pay Items.

For construct sidewalk, payment will be for excavation, new aggregate and necessary incidentals to bring the grade to pre-pave grade. For regrading sidewalk, payment will be for removing existing pavement, regrading existing gravel base and adding new material, as necessary.

For brick sidewalk (remove and rebuild), payment will be for all work outlined in Section 608.033 - Brick Sidewalk (Remove and Rebuild), except that any necessary excavation will be paid for under Section 203 - Excavation and Embankment, any necessary base and subbase material will be paid for under Section 304 - Aggregate Base and Subbase Course, and any specified HMA mixture will be paid for under Section 403 - Hot Bituminous Pavement.

The accepted quantity of detectable warnings will be paid for at the Contract Unit Price per square foot for all labor, materials, and equipment required to install the detectable warning plates, complete and in place. This shall include surface preparation and removal of concrete or HMA pavement, and necessary replacement concrete. For new concrete ramps, concrete shall be paid for under related sidewalk Pay Items.

Welded steel wire fabric for reinforced concrete sidewalks will not be paid for separately, but shall be included in the Contract Unit Price for reinforced concrete sidewalk.

Protective coating shall be paid for under Section 515 - Protective Coating for Concrete Surfaces.

Payment will be made under:

Pay Item		Pay Unit
608.07	Plain Concrete Sidewalk	Square Yard
608.08	Reinforced Concrete Sidewalk	Square Yard
608.10	Brick Sidewalk (Remove and Rebuild)	Square Yard
608.15	Brick Sidewalk with Bituminous Base	Square Yard
608.16	Brick Driveway Aprons with Bituminous Base	Square Yard
608.26	Curb Ramp Detectable Warning Field	Square Foot
608.45	Construct Sidewalk	Square Yard
608.46	Regrading Sidewalk	Square Yard

SECTION 609 - CURB

609.01 **Description** - Construct or reset curb, gutter, or combination curb and gutter, paved ditch, and paved flume. The types of curb are designated as follows:

- **Type 1** - Stone curbing of quarried granite stone
- **Type 2** - Concrete Curbing
- **Type 3** - Bituminous curbing
- **Type 5** - Stone edging of quarried granite stone

609.02 **Materials** - Except as provided below, the materials used shall meet the requirements of the following Sections of Division 700 - Materials:

Portland Cement and Blended Hydraulic Cement	701.01
Water	701.02
Air Entraining Chemical Admixture	701.03
Fine Aggregate for Concrete	703.01
Coarse Aggregate for Concrete	703.02
Joint Mortar	705.02
Reinforcing Steel	709.01
Stone Curbing and Edging	712.04
Epoxy Resin	712.35
Hot Mix Asphalt Curbing	712.36
Structural Precast Concrete Units (Concrete Curb)	712.061

The Contractor shall submit a concrete mix design for the Portland Cement Concrete to the Resident, for the uses specified below or in accordance with the Contract Documents.

Circular curb, terminal sections and transition sections shall be in reasonably close conformity with the shape and dimensions shown on the Plans and to the applicable material requirements herein for the type of curb specified.

Dowels shall be reinforcing steel deformed bars.

Concrete for Slipform Concrete Curb shall meet the requirements below:

- Class A, with the exception that permeability requirements shall be waived.
- Entrained air content of Slipform Concrete Curb shall be 4.0% to 7.0%.
- Concrete temperature, prior to discharge, shall not exceed 90°F.
- Proposed mix designs may contain polypropylene fibers.
- Partially discharged loads may be retempered with water provided the maximum water to cement ratio is not exceeded.

609.03 **Vertical Stone Curb, Terminal Section and Transition Sections and Portland Cement Concrete Curb, Terminal Sections and Transition Sections**

- Installation** - The curb stone shall be set on a compacted foundation so that the front top arris line conforms to the lines and grades required. The foundation shall be prepared in advance of setting the stone by grading the proper elevation and shaping to conform as closely as possible to the shape of the bottom of the stone. The required spacing between stones shall be assured by the use of an approved spacing device to provide an open joint between stones of at least ¼" and no greater than ⅝".
- Backfilling** - All remaining spaces under the curb shall be filled with approved material and thoroughly hand tamped so the stones will have a firm uniform bearing on the foundation for the entire length and width. Any remaining excavated areas surrounding the curb shall be filled to the

required grade with approved materials. This material shall be placed in layers not exceeding 8" in depth, loose measure and thoroughly tamped.

When backfill material infiltrates through the joints between the stones, small amounts of joint mortar or other approved material shall be placed in the back portion of the joint to prevent such infiltrating.

- c. **Protection** - The curb shall be protected and kept in good condition. All exposed surfaces smeared or discolored shall be cleaned and restored to a satisfactory condition or the curb stone removed and replaced.
- d. **Curb Inlets** - Curb placed adjacent to curb inlets shall be installed with steel dowels cemented into each stone with epoxy grout as shown in the Standard Details.

The epoxy grout shall be used in accordance with the manufacturer's instructions. The grout shall be forced into the hole, after which the dowel shall be coated with grout for one-half its length and inserted into the grout filled hole. The hole shall be completely filled with grout around the dowel. All tools and containers must be clean before using.

The Contractor may elect to substitute concrete to backfill Stone Curbing or Stone Edging at their option. If the concrete backfill option is elected, the Concrete Fill shall meet the requirements of 609.02. The Contractor shall submit a concrete design for the Portland Cement Concrete, with a minimum designated compressive strength of 3000 PSI meeting the requirements of Class S or Class Fill Concrete. The Contractor may elect to choose a Prepackaged Concrete Mix from the Departments Qualified Products list (QPL). Concrete backfill shall be completed in conformance with a Department supplied concrete backfill detail.

609.04 **Bituminous Curb**

- a. **Preparation of Base** - Before placing the curb, the foundation course shall be thoroughly cleaned of all foreign and objectionable material. String or chalk lines shall be positioned on the prepared base to provide guidelines. The foundation shall be uniformly painted with tack coat at a rate of 0.04 to 0.14 gal/yd².
- b. **Placing** - The curb shall be placed by an approved power operated extruding type machine using the shape mold called for. A tight bond shall be obtained between the base and the curb. The Resident may permit the placing of curbing by other than mechanical curb placing machines when short sections or sections with short radii are required. The resulting curbing shall conform in all respects to the curbing produced by the machine.
- c. When required, the curb shall be painted and coated with glass beads in accordance with Section 627 - Pavement Marking.

- d. **Acceptance** - Curb may be accepted or rejected based on appearance concerning texture, alignment, or both. All damaged curb shall be removed and replaced at the Contractor's expense.
- e. Polyester fibers shall be uniformly incorporated into the dry mix at a rate of 0.25% of the total batch weight. Certification shall be provided from the supplier with each shipment meeting the following requirements:
 - Average Length: 0.25" $\pm$ 0.005
 - Average Diameter: 0.0008" $\pm$ 0.0001
 - Specific Gravity: 1.32-1.40
 - Melting Temperature: 480°F Minimum

609.05 **Slipform Concrete Curb**

- a. **Preparation of Base** - Before placing the curb, the foundation course shall be thoroughly cleaned of all foreign and objectionable material. The Contractor shall not place Slipform Concrete Curb on a wet or frozen foundation. The foundation (HMA or concrete) may be in a Saturated Surface Dry condition, but no standing water shall be allowed. String or chalk lines shall be positioned on the prepared foundation to provide guidelines. Prior to placing the curb, the foundation shall be uniformly coated with an epoxy resin adhesive that meets the requirements of AASHTO M 235, Type I, II, III, IV or V and has been tested by AASHTO Product Evaluation & Audit Solutions. The Contractor shall submit the epoxy resin adhesive that they propose to utilize with the concrete mix design. The epoxy resin adhesive must be approved prior to placement and used in accordance with manufacturer's recommendations.
- b. **Placing Concrete** - shall be placed with an approved Slipform machine that will produce a finished product according to the design specified in the Plans. For cold weather slip forming, the outside temperature must be at least 36°F and rising. The curb shall be placed on a firm, uniform foundation, shall conform to the section profile specified in the Plans, and shall match the appropriate grade. Expansion joints shall be placed in the curb where it meets rigid structures such as but not limited to building foundations, catch basin headers or fire hydrants. Contraction joints will be placed at 10 ft intervals using sawing methods, which shall cut 1 to 3" into the concrete. Contraction joints shall be cut between 1 and 7 Days after placement of the concrete. Joints shall be constructed perpendicular to the subgrade and match other joints in roadways, sidewalks, or other structures when applicable.
- c. **Curing and Sealing** - Proper curing shall be provided using either a combination curing/sealing compound spray that meets ASTM 1315 Type 1-Class A, or a curing compound spray that meets ASTM 309 Type 1-D – Class A. Curing may also be accomplished by the methods specified in Standard Specification Section 502.14 - Curing Concrete.

If a combination curing/sealing compound spray is not used, a separate sealing compound from the MaineDOT Qualified Products List for a Type 1c sealer shall be applied after the concrete has cured.

- d. **Protection** - Slipform curb must be adequately protected after placement. The concrete shall be allowed to cure for at least 72 hours. During cold weather conditions, when temperatures drop below the required temperature of 36°F after placement, curbing shall be protected by concrete blankets or a combination of plastic sheeting and straw. After any placement of Slipform curb, regardless of weather conditions, the placed curb shall be adequately protected by traffic control devices as necessary.
- e. **Marking** - When required, the curb shall be painted and coated with glass beads in accordance with Section 627 - Pavement Marking. Curb designated to be painted shall not be sealed unless a combination curing/sealing compound is used.
- f. **Acceptance** - Curb shall be accepted or rejected based on finish, alignment, entrained air content, and compressive strength. Concrete Quality Control and Acceptance shall be done in accordance with Standard Specification Section 502, Method C. All damaged curb shall be removed and replaced at the Contractor's expense.

609.06 **Stone Edging** - The curb shall be installed, backfilled and protected in accordance with Section 609.03, except as follows:

- a. **Slope** - The edging shall be set on a slope as shown on the Plans or as directed.
- b. **Joints** - Joints shall be open and not greater than 1½" in width.

609.07 **Stone Bridge Curb**

- a. **Installation** - Each stone and the bed upon which it is to be placed shall be cleaned and thoroughly wetted with water before placing the mortar for bedding and setting the stone. The stone shall be set on a fresh bed of joint mortar and well bedded before the mortar has set so that the front top arris line conforms to the line and grade required. Whenever temporary supporting wedges or other devices are used in setting the stones, they shall be removed before the mortar in the bed has become set, and the holes left by them shall be filled with mortar. Concrete behind the stones shall not be placed until the stones have been in place at least 2 Days. Bedding and pointing mortar for joints shall be cured as required under Section 502 - Structural Concrete.
- b. **Joints** - Vertical joints shall be ½" in width plus or minus ⅛". Whenever possible, the face and top of the joint shall be pointed with joint mortar to a depth of 1½", before the bedding mortar has set. Joints which cannot be so pointed, shall be prepared for pointing by raking them to a depth of 1½"

before the mortar has set. Joints not pointed at the time the stone is laid shall be thoroughly wetted with clean water and filled with mortar. The mortar shall be well driven into the joint and finished with an approved pointing tool, flush with the pitch line of the stones.

609.08 ***Resetting Stone or Portland Cement Concrete Curb, Including Terminal Sections and Transitions***

The curb shall be installed, backfilled and protected in accordance with Section 609.03, except as follows:

- a. ***Removal of Curbing*** - The Contractor shall carefully remove and store curb specified on the Plans or designated for resetting. Curb damaged or destroyed, because of the Contractor's operations or because of their failure to store and protect it in a manner that would prevent its loss or damage, shall be replaced with curbing of equal quality at the Contractor's expense.
- b. ***Cutting and Fitting Cutting*** - or fitting necessary in order to install the curbing at the locations directed shall be done by the Contractor.

609.09 ***Method of Measurement*** - Curb, both new and reset, will be measured by the linear foot along the front face of the curb at the elevation of the finished pavement, complete in place and accepted. Curb inlets at catch basins, including doweling, will not be measured for payment but shall be considered included in the cost of the catch basin. New transition sections and terminal curb will be measured by the unit. Reset transition sections and terminal curb will be included in the measurement for resetting curb.

Concrete Slipform Curb and terminal ends will be measured by the linear foot along the front face of the curb at the elevation of the finished pavement, complete in place and accepted.

609.10 ***Basis of Payment*** - The accepted quantities of curbing will be paid for at the Contract unit price per linear foot for each kind and type of curbing as specified.

Payment for terminal curb shall include only that portion of the curbing modified for installation at ends of curb runs shown in the Standard Details. Curb adjacent to terminal ends shall be paid for at the Contract unit price per linear foot for the type of curb installed.

Vertical Curb Type 1 is required to have a radius of 60 ft or less, will be paid for as Vertical Curb Type 1 - Circular.

Curb, Type 5 required to have a radius of 30 ft or less will be paid for as Curb Type 5 - Circular.

There will be no separate payment for concrete fill, mortar, reinforcing steel, anchors, tack coat, drilling for and grouting anchors, pointing and bedding of curbing, and for cutting and fitting, but these will be considered included in the work of the related curb.

Removal of existing curb and necessary excavation for installing new or reset curbing will not be paid for directly but shall be considered to be included in the appropriate new or reset curb pay item. Base and Subbase material will be paid for under Section 304 - Aggregate Base and Subbase Course. Backing up bituminous curb is incidental to the curb items. Loam, as directed, will be paid under 615 – Loam.

Payment will be made under:

Pay Item		Pay Unit
609.11	Vertical Curb Type 1	Linear Foot
609.12	Vertical Curb Type 1 - Circular	Linear Foot
609.13	Vertical Bridge Curb Type 1	Linear Foot
609.131	Vertical Bridge Curb Type 1A	Linear Foot
609.132	Vertical Bridge Curb Type 1B	Linear Foot
609.142	Vertical Bridge Curb Type 1B - Circular	Linear Foot
609.15	Sloped Curb Type 1	Linear Foot
609.151	Sloped Curb Type 1 - Circular	Linear Foot
609.161	Concrete Slipform Curb – Vertical Type 2	Linear Foot
609.21	Concrete Slipform Curb Type 2	Linear Foot
609.219	Concrete Slipform Terminal End Type 2	Linear Foot
609.23	Terminal Curb Type 1	Each
609.234	Terminal Curb Type 1 - 4 ft	Each
609.237	Terminal Curb Type 1 - 7 ft	Each
609.2371	Terminal Curb Type 1 - 7 ft – Circular	Each
609.238	Terminal Curb Type 1 - 8 ft	Each
609.26	Curb Transition Section B Type 1	Each
609.31	Curb Type 3	Linear Foot
609.34	Curb Type 5	Linear Foot
609.35	Curb-Type 5 - Circular	Linear Foot
609.38	Reset Curb Type 1	Linear Foot
609.39	Reset Curb Type 2	Linear Foot
609.40	Reset Curb Type 5	Linear Foot

SECTION 610 - STONE FILL, RIPRAP, STONE BLANKET, AND STONE DITCH PROTECTION

610.01 **Description** - This work shall consist of excavating for and constructing a protective covering of stone. The types of protective covering of stone are designated as follows:

- a. **Stone Fill** - Machine placed embankment for fill slope
- b. **Plain Riprap** - Machine placed stones on earth bedding
- c. **Hand Laid Riprap** - Hand placed stones on earth bedding

- d. **Stone Blanket** - Machine placed stones around piers and Abutments
- e. **Heavy Riprap** - Machine placed stones on earth bedding
- f. **Stone Ditch Protection** - Machine placed ditch protection of rock

610.02 **Materials** - Materials shall meet the requirements of the following Sections of Division 700 - Materials:

Stone Fill	703.25
Plain and Hand Laid Riprap	703.26
Stone Blanket	703.27
Heavy Riprap	703.28
Stone Ditch Protection	703.29

610.03 **Construction Requirements**

610.031 **General** - Suitable material removed when excavating for the placing of riprap, stone fill, stone blanket or stone ditch protection shall be used in the formation of embankments, subgrade and for backfilling as shown on the plans or as directed.

610.032 **Placing Stones**

- a. **Stone Fill and Stone Blanket** - Material for stone fill shall be deposited to provide a compact mass. The exposed slope shall be finished to the line and grade required without special handling or handwork. Material for stone blanket shall be deposited for protection around piers or abutments as shown on the plans. The stones shall be placed individually to form a reasonably compact mass. Spaces between the larger stones shall be filled with stone or spall of suitable size to leave an even surface conforming to the contour required. Stone fill and stone blanket shall be placed on the slope in a well-knit, compact and uniform layer. The surface stones shall be chinked with smaller stone from the same source.
- b. **Riprap** - Stones for riprap shall be placed upon a slope properly graded and compacted as called for. When required, the bottom of the riprap shall be placed in a trench at the toe of the slope. Plain riprap shall be placed full depth in one operation without special handwork and shall be placed approximately true to the required slope line and grade and be uniform in appearance. Hand laid riprap shall be random rubble, hand laid stones for the full depth placed in one operation to secure interlocking of all face stones and stones placed as backing. Larger stones shall be laid at the base of the slope. The stones shall be laid in close contact with the longer axis perpendicular to the plane of the slope to stagger joints. Except when required to be grouted the openings between the stones in all riprap shall be filled with spall, or

rocks securely rammed into place. Riprap shall be placed on the slope in a well-knit, compact and uniform layer. The surface stones shall be chinked with smaller stone from the same source.

Stones for heavy riprap shall be placed to the full depth in one operation without special handwork or machine work upon a properly graded and compacted slope. Above the low water elevation, stones shall be placed to form an approximate uniform surface, free from humps or depressions, with no excessively large stones Projecting from the general surface. Loose stones or excessively large stones tending to extend above the average general surface shall be embedded, reoriented, or discarded. The openings between stones on the face of heavy riprap shall be filled with spall or small rocks, securely rammed into place.

- c. **Stone Ditch Protection** - The ditch shall be excavated below the flow line to allow placement of the rock material to the specified depth. The stone ditch protection shall be placed, full depth, in one operation without special handwork, shall be approximately true to line and grade and shall be uniform in appearance.
- d. **Inspection** - The grading of riprap, stone fill, stone blanket and stone ditch protection shall be determined by the Resident by visual inspection of the load before it is dumped into place, or, if ordered by the Resident, by dumping individual loads on a flat surface and sorting and measuring the individual rocks contained in the load. A separate, reference pile of stone with the required gradation will be placed by the Contractor at a convenient location where the Resident can see and judge by eye the suitability of the rock being placed during the duration of the Project. The Resident reserves the right to reject stone at the job site or stockpile, and in place. Stone rejected at the job site or in place shall be removed from the site at no additional cost to the Department.

610.04 **Removed**

610.05 **Method of Measurement** - Stone fill, plain riprap, hand laid riprap, stone blanket, heavy riprap and stone ditch protection will be measured by the cubic yard, complete in place, except that when placed under water the quantity may be measured by truck load count with no reduction in volume.

610.06 **Basis of Payment** - The accepted quantities of stone fill, plain riprap, hand laid riprap, stone blanket, heavy riprap and stone ditch protection and materials to fill

the voids will be paid for at the Contract unit price per cubic yard complete in place.

Costs of all required excavation below the slope line for the placement of bedding, riprap, stone fill, stone blanket, stone ditch protection and for furnishing and placing the bedding material itself, will be considered incidental to the Contract items and no separate payment will be made.

Payment will be made under:

Pay Item		Pay Unit
610.07	Stone Fill	Cubic Yard
610.08	Plain Riprap	Cubic Yard
610.09	Hand Laid Riprap	Cubic Yard
610.11	Stone Blanket	Cubic Yard
610.16	Heavy Riprap	Cubic Yard
610.18	Stone Ditch Protection	Cubic Yard

SECTION 611 - Reserved

SECTION 612 - BITUMINOUS SEALING

- 612.01 **Description** - This work shall consist of sealing bituminous mix surfaces with emulsified bituminous sealing compound of the specified color, applied at locations shown on the plans or designated.
- 612.02 **Materials** - Bituminous material for sealing shall conform to the requirements of Emulsified Bituminous Sealing Compound, Section 702.12.
- 612.03 **General** - The sealing compound shall be applied in two coats. The first coat shall be diluted by the addition of up to 50% water to a liquid consistency and applied with brooms or other approved methods at a rate of 0.25 gal to 0.50 gal of diluted sealer per square yard. The second coat shall be diluted only to the extent necessary to obtain workability and applied at a rate of 0.25 gal to 0.50 gal of diluted sealer per square yard.
- 612.04 **Method of Measurement** - Bituminous sealing will be measured by the square yard of surface sealed measured parallel to the surface.
- 612.05 **Basis of Payment** - The accepted quantities of bituminous sealing will be paid for at the Contract unit price per square yard complete in place.

Payment will be made under:

Pay Item		Pay Unit
612.06	Bituminous Sealing-Black	Square Yard

SECTION 613 - EROSION CONTROL BLANKETS

- 613.01 **Description** - This work shall consist of furnishing and installing erosion control blankets on previously prepared areas in accordance with the manufacturer instructions or as called for on the plans or otherwise authorized.

Erosion control blankets shall be installed on critical slopes, shoulder berms, esplanade strips, curb sections, in ditches and drainage ways, and other previously prepared areas or as shown.

- 613.02 **Materials** - Erosion control blanket shall conform to the requirements specified in the following Sections of Division 700 - Materials.

Erosion Control Blankets	717.061
Ground Anchors	717.063

- 613.03 **Site Preparation** - The area for erosion control blankets shall be prepared as follows:

Soil must be loose or scarified, smoothly raked and free of stones, litter, and any abrupt ground surface roughness under the blanket.

- 613.04 **Seeding** - All seed shall be sown before installing erosion control blankets. No loam will be required for Seeding, unless called for on plans or designated. Seeding, Method Number 2 will be used unless otherwise specified.

- 613.05 **Installation** - On Slopes and in ditches, blankets shall be aligned in the direction of water flow and along the contours of berms. The uphill end of blanket shall be anchored in a trench no less than 6" deep and overlapped on the adjoining ends no less than 3". Parallel strips shall be overlapped 4" on the sides. Approved anchor staples shall be placed at a maximum spacing of 3 ft on center or as required by the manufacturer, whichever is closer.

- 613.08 **Method of Measurement** - Erosion control blanket will be measured by the square yard based on the width and length of the blanket measured on the ground.

- 613.09 **Basis of Payment** - Erosion control blankets of the type specified will be paid for at the Contract unit price per square yard complete in place and accepted. Such payment shall be full compensation for furnishing and installing the blankets and initial seeding under blanket in accordance with this specification and for all required maintenance.

Payment will be made under:

Pay Item		Pay Unit
613.319	Erosion Control Blanket	Square Yard

SECTION 614 - GEOCELL SLOPE PROTECTION

- 614.01 **Description** - This work shall consist of designing, furnishing and placing a Geocell Slope Protection System, in reasonably close conformity with the lines and grades shown on the Plans, as specified herein, and as directed by the Resident. The Geocell Slope Protection System consists of subgrade preparation, non-woven erosion control geotextile, geocell material into which select infill material is placed, infill material, anchors, and surface treatment. This work includes subgrade preparation and placing and compacting Granular Borrow to the subgrade elevation.
- 614.02 **Submittals** - Submittals shall comply with MaineDOT Section 105 - General Scope of Work. All information shall be submitted to the Resident thirty (30) Days prior to the Geocell Slope Protection System installation.
- A. **Product Data** - Submit manufacturer's product data.
 - B. **Supplier Design** - Submit manufacturer's Project-specific design recommendations or engineering design for cell size, stake anchor length and stake anchor spacing. The Project specific design shall be prepared, checked, and sealed by a Professional Engineer licensed in the State of Maine.
 - C. **Shop Drawings** - Submit manufacturer's Shop Drawings including section layout, direction of expansion, and anchor stake locations. The Shop Drawings shall be sealed by a Professional Engineer licensed in the State of Maine.
 - D. **Samples** - Submit manufacturer's samples of geocell sections, anchors, and end caps.
 - E. **Material Certification** - Submit manufacturer certification of polyethylene used to make geocell material including percentage of carbon black, polyethylene density, and environmental stress crack resistance (ESCR).
- 614.03 **Materials** - Materials for the Geocell Slope Protection System shall meet the requirements of the following sections:
- 614.031 **Geocell Sections** - The geocell sections shall be a polyethylene sheet strip assembly connected by a series of offset, full depth, ultrasonic welded seams aligned perpendicular to the longitudinal axis of the strips, which, when expanded, form walls of flexible 3-dimensional, cellular slope protection confinement system. The geocell material shall be manufactured by Presto Products Company, Appleton, Wisconsin, Webtec Geosynthetics, Charlotte, North Carolina, or an approved equal. Sections shall be in conformance with manufacturers design recommendations or engineering design for this Project.

1. **Geocell base material** - The geocell material shall be polyethylene stabilized with black carbon, with the following properties:
 - a. **Density** - ASTM D1505: 58-60 pcf.
 - b. **Environmental stress crack resistance (ESCR) ASTM D1693** - 3000 hours.
 - c. **Ultraviolet light stabilization** - carbon black.
 - d. **Carbon Black Content** - 1.5 to 2% by weight, through the addition of a carrier with a certified carbon black content.
 - e. Homogeneously distributed through material.
2. **Geocell Strip Properties and Assembly**
 - a. **Perforated Strip/Geocell**
 - i. **Strip sheet thickness** - ASTM D5199: 50 mil minus 5%, plus 10%. Determine thickness in the flat before surface disruption.
 - ii. **Sheet thickness** - 60 mil +/- 6 mil.
 - iii. **Polyethylene Strips** - Perforated with horizontal rows of 0.40" diameter holes.
 - iv. **Perforation Within Each Row** - 0.65 to 0.75" on center.
 - v. **Horizontal Rows** - staggered and separated 0.50" relative to hole centers.
 - vi. **Edge of strip nearest edge of perforation** - 0.24" minimum.
 - vii. **Centerline of spot welds to nearest edge of perforation** - 0.70" minimum.
 - b. **Assembly of Geocell sections**
 - i. Fabricated using strips of sheet polyethylene each with a length of 12 ft and a width equal to cell depth.
 - ii. Connect strips using full-depth, ultrasonic spot-welds align perpendicular to longitudinal axis of strip.
 - iii. **Ultrasonic weld melt-pool width** - 1.0" maximum.
3. **Geocell Properties**
 - a. **Individual Cells** - Uniform in shape and size when expanded. Over- or under-expansion of uniform individual cells will be allowed on curved slopes.
 - b. **Individual Cell Dimensions**
 - i. **Length** - 8.8" +/- 10%
 - ii. **Width** - 10.2" +/- 10%
 - iii. **Nominal area** - 44.8 sq in +/- 1%
 - iv. **Nominal depth** - 4"

4. **Geocell Seam Strength Tests**

- a. The seams for geocell sections shall consist of 2 carbon-black stabilized strips welded together.
- b. **Short Term Seam Peel Strength Test**
 - i. **Cell Seam Strength** - Uniform over full depth of cell.
 - ii. **Minimum seam peel strength** - 320 lbf for 4" depth.
- c. **Long Term Seam Peel Strength Test**
 - i. **Conditions** - Minimum of 168 hours (7 Days) in a temperature-controlled environment that undergoes change on a 1 hour cycle from room temperature to 130°F.
 - ii. **Room temperature** - ASTM E41.
 - iii. **Test Samples** - Weld two 4" wide strips together.
 - iv. **Test** - Test sample consisting of 2 carbon black stabilized strips shall support a 160 lb load for the test period.

614.032 **Anchoring Components** - The anchoring system shall consist of straight No. 4 steel reinforcing rods with an ATRA clip, or an approved equal, as end cap. Length shall be as specified in the manufacturer's recommendations or the Project-specific design.

614.033 **Granular Borrow** - Granular Borrow shall meet the requirements of MaineDOT Section 703.19 - Granular Borrow, Material for Embankment Construction.

614.034 **Geocell Infill Material** - Geocell infill material shall be as specified in the Project-specific design or as shown on the Plans and shall meet the requirements of the following specifications:

Loam	615.07
Dirty Borrow	615.10
Aggregate for Crushed Stone Surface	703.12

614.035 **Surface Treatment** - For geocell slopes with Loam infill, the surface treatment shall consist of seed and an erosion control blanket. The seed shall meet the requirements MaineDOT Section 618 - Seeding, Method Number 2, or as indicated on the Project-specific design, Plans and Notes. The erosion control blanket shall meet the requirements of MaineDOT Section 613 - Erosion Control Blanket. When infill other than loam is specified, the surface treatment shall be as indicated on the Project-specific design, Plans or details.

614.04 **Construction Requirements** - The Geocell Slope Protection System shall have the following construction requirements:

A. **Subgrade Preparation**

1. Prepare the subgrade by removing the all existing vegetation and loose surficial soils from the slope.
2. Excavate and the slope section as needed.
3. Place, compact, and shape Granular Borrow as needed, so that when placed the top of installed geocell section is flush with or slightly lower that the final grade as indicated on the Plans.
4. Install non-woven erosion control geotextile underlayer, if required, on the prepared surface, ensuring required overlaps are maintained and outer edge of geotextile are buried a minimum of 6" below grade.

B. **Placement and Anchoring**

1. Anchor geocell sections at the crest of the slope or as per manufacturer's recommendations. Use type of anchor and frequency of anchoring as indicated on the shop drawings.
2. Expand geocell sections down slope. Confirm each geocell section is expanded uniformly to required dimensions and outer cells of each layer are correctly aligned.
3. Interleaf edges of adjacent sections. Ensure that the upper surface of adjoining geocell sections are flush at the joint and adjoining cells are fully anchored. Anchor with specified anchors in prescribed pattern throughout the slope surface.

C. **Placement of Infill**

1. Place infill in expanded cells with suitable material handling equipment, such as a backhoe, front-end loader, conveyor, or crane mounted skip. Limit drop height to a maximum of 3 ft. Avoid displacement of the geocell sections by infilling from crest to toe of slope.
2. Overfill and compact infill in accordance with consistency of material and cell depth as follows:
 - a. For geocell slopes with loam infill, overfill the geocell with 1 to 2" loam and lightly tamp or roll to leave soil flush with top edge of cell walls.
 - b. For geocell slopes with Aggregate for Crushed Stone Surface or Dirty Borrow infill, overfill the cells approximately 1" and compact with a plate tamper or backhoe bucket. Remove loose surface material so infill is flush with top edges of cells.

3. Apply specified surface treatment as specified in Project-specific design or on the Plans.

614.05 **Delivery, Storage, and Handling**

- A. **Delivery** - Deliver material to site in manufacturer's original unopened containers and packaging, with labels clearly identifying product name and manufacture.
- B. **Storage** - Store materials in accordance with the manufacturer's instructions. Store material out of direct sunlight.
- C. **Handling** - Protect materials during handling and installation to prevent damage.

614.06 **Method of Measurement** - The Geocell Slope Protection System measurement will be by the square foot of material installed.

614.07 **Basis of Payment** - The Geocell Slope Protection System will be paid for at the Contract unit price per square foot which shall be full compensation for design, all labor and materials, including non-woven erosion control geotextile, the geocell material, anchoring components, granular borrow, infill, and surface treatments. The unit price shall be full compensation for subgrade preparation, and placing and compacting Granular Borrow to the subgrade.

Payment will be made under:

Pay Item		Pay Unit
614.30	Geocell Slope Protection System	Square Foot

SECTION 615 - LOAM

615.01 **Description** - This work shall consist of furnishing and placing loam or dirty borrow for seeding or sodding, in reasonably close conformity with the thicknesses called for on the plans or as authorized.

615.02 **Materials** - Materials shall conform to the requirements specified in the following Sections of Division 700 - Materials:

Common Borrow	703.18
Humus	717.09

Loam shall meet the following requirements:

Organic Content	Percent by Volume
Humus	5% - 10%, as determined by Ignition Test
pH	5.5 - 7.5

Mineral Content Percent passing sieve	
85-100%	#10
35-85	#40
10-35%	#200

The loam shall be screened, loose, friable, and shall be free from admixture of subsoil, refuse, large stones, clods, roots, or other undesirable foreign matter. It shall be reasonably free of weeds, roots, or rhizomes.

Dirty Borrow - shall meet the requirements of Section 703.18 - Common Borrow with the following addition and deletions:

- **703.18** - Second sentence delete the word peat
- Dirty Borrow shall contain no particles or fragments with a maximum dimension in excess of the compacted thickness of the layer being placed.

Mineral Content

- Percent passing sieve
- 75-100% #10
- 5- 40% #200
- Dirty Borrow must have an organic content of 3% to 8% as determined by ignition test.

The Contractor may elect to manufacture loam or dirty borrow from a combination of Project materials that the Contractor is entitled to use, combined with other suitable materials furnished by the Contractor.

The Resident shall obtain a sample from loam stockpiles identified by the Contractor Samples will be submitted to Department testing facility. Only loam from passing stockpiles shall be used.

The Contractor may elect to manufacture loam from a combination of Project materials that the Contractor is entitled to use, combined with other suitable materials furnished by the Contractor.

- 615.03 **Preparing Areas** - All slopes and other areas where loam or dirty borrow is to be placed shall be shaped to the required grade. Before placing the loam on hard or compacted soils, the areas under preparation shall be scarified and loosened to a depth of at least 2".
- 615.04 **Placement of Loam** - Loam shall be spread uniformly on prepared areas to the depth shown on the plans or as directed. Any remaining clods, roots, stones over 2" in its greatest diameter and all other foreign matter, shall be removed. On areas to be seeded under Method Number 1, all rocks over 1" in diameter shall be removed. All loam shall be brought to a true, even surface, meeting the required grade. The Contractor shall compact the loam with a 100 pound roller or

other approved means. Loam thickness shall meet the specified depth after compaction.

Dirty Borrow shall be spread evenly and uniformly on prepared areas to the depth shown on the plans or as directed, and shall be brought to a true, even surface, meeting the required grade.

- 615.05 **Method of Measurement** - Loam or dirty borrow will be measured by the cubic yard complete in place after finishing to the required depths as shown on the plans or directed. Lateral measurements will be parallel with the slope of the ground.

Removal of existing topsoil salvaged from within the lines of improvement will be measured for payment in accordance with Section 203.18. The depth of the salvaged topsoil to be included for payment shall be the depth authorized. There will be no deduction from borrow quantities resulting from the authorized excavation of salvaged topsoil.

- 615.06 **Basis of Payment** - The accepted quantities of loam or dirty borrow will be paid for at the Contract unit price per cubic yard complete in place. Existing topsoil removed from within the lines of improvement and stockpiled for later use as dirty borrow will be paid for under Pay Item 203.20 - Common Excavation, after removal and stockpiling, and will be paid for under Pay Item 615.10 - Dirty Borrow, when placed in its final position. Grading surplus topsoil, salvaged but not required for use on slopes as loam or dirty borrow, will be paid for under the appropriate items of Section 631 - Equipment Rental, Section 618 - Seeding, and Section 619 - Mulch.

Payment will be made under:

Pay Item		Pay Unit
615.07	Loam	Cubic Yard
615.0701	Loam - Plan Quantity	Cubic Yard
615.10	Dirty Borrow	Cubic Yard

SECTION 616 - SODDING

- 616.01 **Description** - This work shall consist of furnishing and placing approved live sod on a bed of friable soil for the replacement of lawns or other areas called for on the plans or authorized.

- 616.02 **Materials** - Materials shall meet the requirements in the following Sections of Division 700 - Materials:

Fertilizer	717.01(b)
Agricultural Ground Limestone	717.02

Sod may be either field sod or cultivated sod as approved by the Resident.

Field sod shall consist of a dense, well-rooted, vigorous growth of turf forming perennials indigenous to the locality where it is to be used. Field sod shall be taken from approved sources where the sod will not break or crumble during cutting, transporting and laying. Field sod shall be reasonably free from noxious weeds, large stones, tree roots, or other materials harmful to growth or subsequent maintenance of the sod. Field sod shall be cut to a uniform thickness of not less than 2".

Cultivated sod shall consist of a Kentucky Bluegrass/Red Fescue turf obtained from an approved commercial sod farm and shall be substantially free from objectionable grassy and broadleaf weeds. Cultivated sod shall be cut to a uniform minimum thickness of not less than ¾".

Pegs for holding sod shall be of approved sound wood and at least ¾" in thickness and at least 8" in length or approved equal.

- 616.03 **Cutting and Transporting** - The area from which sod is to be cut shall be mowed and cleared of excess clippings and other foreign matter shortly before cutting starts. The sod shall be freshly cut with an approved sod cutter into strips of uniform thickness having a minimum width of 12" and a minimum length of 12" and transported in an unbroken condition to the area to be sodded. Sod shall be placed in its final position within 24 hours after cutting. No storage of sod will be allowed unless specifically authorized by the Resident. Cut sod shall be protected from drying during the time between cutting and placing.
- 616.04 **Site Preparation** - Sod shall be placed over 4" of moist loam in accordance with Section 615. The areas to be sodded shall be brought to the grades shown on the plans, allowing for the thickness of the sod. Areas to be sodded shall be cleared of stones, roots, clods, and other debris that might interfere with laying sod or subsequent maintenance of the sodded area. The fertilizer shall be incorporated into the soil by a mechanical spreader or other approved method capable of maintaining a uniform, measurable rate of application. Fertilizer shall be applied before laying sod, at the rate of 4 lb/1000 ft². On hard packed soil, the areas under preparation shall be scarified or otherwise loosened to a depth of at least 4" before placing loam and laying sod, unless otherwise directed.
- 616.05 **Laying Sod** - Sod shall be moist when laid and shall be placed on a moist soil bed. The sod shall be placed at a right angle to the slope, commencing at the lower end and tightly fitted, edge to edge, to provide a uniform surface. Transverse joints shall be staggered. Sod shall be fitted to produce a tight surface without gaps.

The sod shall be compacted and bonded to the soil with an approved tamper or light roller. After tamping or rolling, the sod shall have a smooth, even surface free from humps and depressions.

Unless otherwise directed, on areas with a gradient of 2 horizontal to 1 vertical or steeper, the sod shall be anchored with wooden pegs or staples as approved by the Resident. The pegs shall be spaced no more than 2 ft apart in any direction

and driven through the sod into the ground perpendicular to the ground surface. The top of the pegs shall be driven flush with the surface of the sod.

The Contractor shall water the sod as necessary and shall insure continued growth of the sod. Sod not surviving for 3 months after installation shall be removed and replaced by the Contractor at their expense until established.

Frozen sod shall not be used nor shall sod be placed on frozen soil.

616.06 **Method of Measurement** - Sodding will be measured by the square yard, measured along the slope, complete in place, or as otherwise directed.

616.07 **Basis of Payment** - The accepted quantities of sodding will be paid for at the Contract unit price per square yard completed and accepted in place, which shall include supplying and installing sod, fertilizer, limestone and watering. Necessary excavation for placing sod will not be paid for separately but will be considered incidental to the Contract unit price for sodding.

Payment will be made under:

Pay Item		Pay Unit
616.08	Sodding	Square Yard

SECTION 617 - SOIL CONDITIONERS - Reserved

SECTION 618 - SEEDING

618.01 **Description** - This work shall consist of furnishing and applying seed, and other materials to areas shown on the plans or as authorized by the Resident.

- a. **Seeding Method Number 1** - shall consist of the application of "Park Mixture", fertilizer, lime or liquid lime, and humic acid soil conditioner to loamed areas which are expected to be maintained by frequent mowing: i.e. private lawns.
- b. **Seeding Method Number 2** - shall consist of the application of "Roadside Mixture Number 2," lime or liquid lime, humic acid soil conditioner and fertilizer to existing soils, dirty borrow or loamed areas which are expected to be maintained by infrequent mowing: i.e. inslopes, ditches, and rural lawns.
- c. **Seeding Method Number 3** - shall consist of the application of "Roadside Mixture Number 3," inoculant and lime or liquid lime, humic acid soil conditioner to existing soils, erosion control mix, or riprap areas which are not expected to be mowed: i.e. backslopes, guardrail areas.
- d. **Special Seeding** - shall consist of the application of a special seed mix and amendments as defined by Special Provision.

- e. **Temporary Seeding** - shall consist of the application of seed to control erosion to slopes and stockpiles that have been disturbed during construction and will be left incomplete for more than 30 Days. Seed for Temporary Seeding shall be oats, winter wheat, buckwheat, or rye.
- f. **Crown Vetch Seeding** - shall consist of the application of seed, inoculant, lime or liquid lime, and humic acid soil conditioner to areas that will not be mowed: i.e. riprap or erosion control mix.

618.02 **Materials** - Materials shall meet the requirements of the following Sections of Division 700 - Materials:

Fertilizer	717.01
Humic Acid	717.011
Agricultural Ground Limestone and Liquid Lime	717.02
Seed	717.03

618.03 **Rates of Application** - Application rates are set forth below. One unit is defined as 1,000 ft².

- a. The Contractor shall apply agricultural ground limestone at the rate of 33 lb/unit. For hydroseeding, liquid lime shall be applied at the rate of 1 pound (dry weight) per unit, hydraulic method. These rates shall apply to all Seeding Methods and Crown Vetch.
- b. The fertilizer application rate for seed establishment shall be 4 ½ lb/unit, Seeding Method 1 and 2 only.
- c. Humic acid soil conditioner shall be applied at the rate of 2 lb/unit, hydraulic method for Seeding Methods 1, 2, 3, and Crown Vetch.
- d. The seed mixture sowing rate for Seeding Method 1 and 2 shall be 4 lb/unit.
- e. The seed mixture sowing rate for Seeding Method 3 shall be 1 lb/unit.
- f. The Temporary Seed sowing rate shall be 3 lb/unit.
- g. The Crown Vetch Seed sowing rate shall be ½ lb/unit.

618.04 **Time of Initial Seeding** - The Contractor shall not seed during January, February, or March, or when the ground is frozen or snow covered, or at other times as the Department may direct.

618.05 **Applying Fertilizer and Agricultural Ground Limestone Conventional Method** - The Contractor shall apply fertilizer and agricultural ground limestone when the soil is moist and before sowing the seed. The Contractor shall apply these materials to the soil by an approved method capable of maintaining a measured rate of application, thoroughly incorporating materials into the soil to a depth of not less than 1". The Contractor shall not apply these materials simultaneously unless using an approved hydraulic method.

- 618.06 **Sowing Seed - Conventional Method** - The Contractor shall sow seeding materials uniformly at the required rate and mulch seeded areas the same Day as sown. The Contractor shall roll lawn areas with a light lawn roller after seeding but before mulch is applied.
- 618.07 **Sowing Seed and Applying Fertilizer and Agricultural Ground Limestone - Hydraulic Method** - The Contractor may use the hydraulic spray method of sowing seed where approved. The Contractor shall use a commercial machine designed for the hydraulic application of seed, fertilizer, humic acid soil conditioners, liquid lime or limestone and mulch in slurry. The Contractor shall mix seed and added materials with sufficient water in the tank of the machine and keep the slurry thoroughly agitated, so the materials are uniformly mixed and suspended in the water at all times during operation. The Contractor shall uniformly distribute the seed slurry on the designated areas at the required rate.
- 618.08 **Mulching** - After seeding, the Contractor shall place hay mulch straw mulch or erosion control blanket unless cellulose fiber mulch is applied with the seed by the hydraulic method. The Contractor shall place Mulch as specified in Section 619 and Erosion Control Blankets as specified in Section 613. Mulch for Seeding Method Number 1 shall only be cellulous fiber mulch Section 619.04 (b) or straw mulch Section 619.04 (a). For other seeding methods where hay mulch has been previously applied for erosion control and there is adequate hay mulch still present on the area at the time of seeding, the Department may direct the Contractor to seed over the hay mulch. Cellulose fiber mulch may be used with Method 2.
- 618.09 **Construction Method**
- a. **Seeding Method Numbers 1 and 2**
1. After the loamed or unloamed areas to be seeded have been brought to grade, the Contractor shall scarify all ground not sufficiently loose and friable to provide bedding for the seed to a depth of at least 2" immediately before seeding or mulching. The Contractor shall remove all stones over 1" (Method 1 areas) and 2" (Method 2 areas) in the greatest dimension, tree roots, and refuse and dispose of as directed by the Department. The surface shall be a uniform grade but not smooth.
 2. The Contractor shall apply fertilizer and agricultural ground limestone to the prepared areas as specified in Sections 618.05 and 618.07.
 3. The Contractor shall sow the seed as specified in Sections 618.06 and 618.07.
 4. The Contractor shall apply mulch as specified in Section 618.08.

b. **Temporary Seeding**

1. The Contractor may place seed and limestone directly over existing ground without site preparation.
2. The Contractor shall apply agricultural ground limestone as specified in Sections 618.05 and 618.07.
3. The Contractor shall sow seed onto existing ground as specified in Sections 618.06 and 618.07.
4. The Contractor shall apply mulch as specified in Section 618.08.

c. **Seeding Method 3 and Crown Vetch Seeding**

1. The Contractor may place seed and limestone directly over existing ground without site preparation.
2. The Contractor shall apply agricultural ground limestone to the areas as specified in Section 618.07.
3. The Contractor shall sow seed as specified in Section 618.07.
4. The Contractor shall apply mulch as specified in Section 618.07. The Contractor shall not apply mulch if seeding riprap or erosion control mix.

618.10 **Maintenance and Acceptance** - The Department will accept areas seeded with Seeding Method 1 or 2 upon attainment of a reasonably thick uniform stand of permanent grass species with at least 90% coverage, free from sizable thin or bare spots. The Contractor shall perform final reseeding as follows: Upon completion of all other work on the Project, seeded areas that have not been accepted shall, within 60 Calendar Days, meet the 90% coverage requirement or be reseeded a final time. Final reseeding shall be done at the end of the 60 Day period or at any time within the 60 Days, as directed by the Resident. The Contractor will not be allowed to perform final reseeding between September 15th and April 15th, and the Department will not count this time as part of the 60 Day period. All reseeding shall comply with Sections 618.03 through 618.09.

The Department will accept areas sown with Method 3, Temporary Seed, Special Seed, or Crown Vetch at the time that areas are satisfactorily completed.

The Contractor shall maintain and protect all seeded areas until acceptance.

618.101 **Applied Water** - The Contractor shall use Applied Water to aid in the establishment of newly planted shrubs, trees, seedlings, and sod during an abnormal drought that requires excessive watering beyond what is expected with each planting in accordance with Sections 621.24 and 616.05. Applied Water shall be authorized by the Department. The Contractor shall use Applied Water from approved sources and in a manner to allow the soil to absorb the water without runoff.

- 618.11 **Method of Measurement** - The Department will measure Seeding for payment by the area of seeded surface in Units of 1000 ft² along the slope of the ground.

The Department will measure Applied Water for payment by the gallon in calibrated tanks or by accurate water meters. Delivery slips, as specified in Section 108.1.3-f will be required. Watering deemed necessary by the Contractor to assure a growth of grass under the guarantee provisions of Section 618.10, Maintenance and Acceptance, will not be measured for payment.

- 618.12 **Basis of Payment** - The Department will pay for the accepted quantities of seeding at the Contract price per Unit for the method specified, which price shall be full compensation for furnishing and spreading seed, limestone, fertilizer, and inoculant. The price shall also include any reseeding, watering, and maintenance necessary to meet the requirements of Section 618.10, Maintenance and Acceptance.

When fertilizer is omitted from Seeding Method Number 1 or Number 2 at the direction of the Department, payment for such seeding will be 85% of the Contract price for the appropriate item.

When authorized, the Department will pay for Applied Water at the Contract price per gallon.

When seeding is completed, amounts due for these items will be payable.

The Department will pay for Loam and Mulch as provided in Section 615 - Loam and Section 619 - Mulch.

Payment will be made under:

Pay Item		Pay Unit
618.13	Seeding Method Number 1	Unit
618.14	Seeding Method Number 2	Unit
618.141	Seeding Method Number 3	Unit
618.143	Special Seeding	Unit
618.15	Temporary Seeding	Pound
618.16	Crown Vetch Seeding	Unit
618.25	Applied Water	Gallon
618.13	Seeding Method Number 1	Unit
618.14	Seeding Method Number 2	Unit

SECTION 619 - MULCH

- 619.01 **Description** - This work shall consist of furnishing and applying hay, straw, bark, erosion control mix, or cellulose fiber for covering slopes and other areas with a mulch as shown on the plans or authorized.

619.02 **Mulch** - Material shall conform to the requirements specified in the following Sections of Division 700 - Materials:

Mulch	717.04
Mulch Binder	717.05

619.03 **General** - Cellulose fiber mulch shall be used with Seeding Method 1 and may be used with Seeding Method 2" approved areas, which may include, but are not limited to, lawns adjacent to developed property, areas subject to high air blasts created by moving vehicles, and areas where hay mulch would create a hazard. Straw mulch shall be used in all wetland areas.

619.04 **Applying Mulch** - Mulch shall be any of the following types of material.

- a. Hay or straw mulch for both seeded and unseeded areas shall be spread evenly and uniformly over the designated areas. Unless otherwise directed, mulch shall be applied at the rate of 70 to 90 lb/unit. Too heavy an application of mulch shall be avoided. Lumps and thick mulch material shall be thinned.

Unless otherwise authorized, hay or straw mulch shall be anchored in place by uniformly applying an acceptable mulch binder. Mulch binder shall be applied as soon as the mulch is placed. Application of a concentrated stream of mulch binder will not be allowed. Mulch binder will be paper fiber mulch applied at 5 lb/unit or approved equal. Water spray may be used as a temporary binder.

Temporary mulching shall be applied as per the Contractor's SEWPCP, spread immediately to protect soil from erosion during all stages of construction throughout all seasons of the year.

- b. Cellulose Fiber Mulch shall be applied as a waterborne slurry. The cellulose fiber and water shall be thoroughly mixed and sprayed on the area to be covered so as to form a uniform mat of mulch at the rate of not less than 40 lb of mulch material per 1000 ft² unit of area.

Cellulose fiber mulch may be mixed with the proper quantities of seed, fertilizer, and agricultural limestone as required under Section 618 - Seeding or may be applied separately the same Day as seeding.

- c. Bark mulch not incidental to plantings and erosion control mix shall be placed to cover the slope with a 4" deep blanket or as called for on the Plans or by the Resident.

619.05 **Maintenance** - The Contractor shall maintain the hay, straw, or fiber mulch by repairing all damaged mulch and by correcting all shifting of the mulch due to wind, water, or other causes, until an acceptable growth of grass has been achieved.

If cellulose fiber mulch is used, any reseeding will require additional cellulose fiber mulch.

Bark mulch and erosion control mix will be accepted upon completion. Upon acceptance of each area, the Contractor will be relieved of further responsibility for maintaining that area or repairing damage except that resulting from their own or Subcontractor's operations.

If water spray is used as a temporary binder, it shall be maintained in a manner acceptable to the Resident.

- 619.06 **Method of Measurement** - The Department will measure Mulch for payment by the area of surface in Units of 1000 ft² along the slope of the ground.

The quantity of bark mulch and erosion control mix measured and accepted for payment will be the number of cubic yards each, delivered and installed to the required depth as shown on the plans or as directed. Measurement will be parallel with the slope of the ground.

- 619.07 **Basis of Payment** - The accepted areas mulched will be paid for at the Contract price per unit; Bark Mulch and Erosion Control Mix will be paid for by the Cubic Yard; which shall be full compensation for furnishing and spreading the hay or straw and mulch binder, cellulose fiber mulch, bark mulch or erosion control mix.

When mulch is measured by bales, each bale will be paid for at 60% of the Contract price per unit.

Payment will be made under:

Pay Item		Pay Unit
619.12	Mulch	Unit
619.13	Bark Mulch	Cubic Yard
619.14	Erosion Control Mix	Cubic Yard

SECTION 620 - GEOTEXTILES

- 620.01 **Description** - This work shall consist of the furnishing and installing of woven geotextile fabric or non-woven geotechnical fabric, hereinafter called fabric, as shown in the Contract, or otherwise directed. This Section is intended for use in conjunction with Section 722 - Geotextiles.

- 620.02 **Materials** - Fibers used in the manufacture of geotextiles, and the threads used in joining geotextile by sewing, shall consist of long-chain synthetic polymers, composed of 95% by weight of polyolefins or polyesters. They shall be formed into a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including salvages.

Geotextiles shall meet the requirements in the following Sections of Division 700
- Materials:

Stabilization/Reinforcement Geotextile	722.01
Drainage Geotextile	722.02
Erosion Control Geotextile	722.03
Separation Geotextile	722.04

620.03 **Placement**

- A. **Stabilization/Reinforcement and Separation Geotextile** - The installation site shall be prepared by clearing, grubbing, and excavating or filling the area to the design grade. This includes the removal of topsoil and vegetation. Soft spots and unsuitable areas identified during site preparation shall be excavated and backfilled with select material and compacted using normal procedures, as directed.

The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic. The subbase shall be placed by end dumping onto the geotextile from the edge of the geotextile, or over previously placed subbase aggregate. Construction vehicles shall not be allowed directly on the geotextile. The subbase shall be placed such that at least the minimum specified lift thickness shall be between the geotextile and equipment tires or tracks at all times. Turning of vehicles shall not be permitted on the first lift above the geotextile. Any ruts occurring during construction shall be filled with additional subbase material and compacted to the specified density. In stabilization applications, the use of vibratory compaction equipment is not recommended with the initial lift of subbase as it may cause damage to the geotextile.

When fabric is to be used as a reinforcement geotextile, care shall be taken to tension the fabric before completely covering with aggregate. Cover material shall be placed starting on one edge of the fabric and progress toward the opposite edge, in order to maintain tension in the fabric.

When sloped riprap is to be placed on fabric, the site shall be prepared to provide an undulating and uneven surface, as much as is practical. The fabric shall be placed loosely to prevent any bridging of the uneven surface. Fabric to be placed on slopes shall have the long direction oriented up and down the slope as shown on the Standard Detail.

The armor system placement shall begin at the toe and proceed up the slope. Placement shall take place so as to avoid stretching and subsequent tearing of the geotextile. Riprap and heavy stone fill shall not be dropped from a height of more than 1 ft. Stone with a mass of more than 220 lb shall not be allowed to roll down the slope. Slope protection and smaller sizes of stone filling shall not be dropped from a height

exceeding 3 ft, or a demonstration provided showing that the placement procedures will not damage the geotextile. Following placement of the armor stone, grading of the slope shall not be permitted if the grading results in movement of the stone directly above the geotextile.

For Separation Geotextile, when the fabric is to be placed in the roadway, the cover material shall be dumped on previously placed cover material or at the edges of the fabric and then pushed onto the fabric. The first layer of cover material shall be greater than 8" and first compacted by a track bulldozer. At no time shall construction equipment be allowed on the fabric when the fabric is covered with less than 8" of compacted cover material. Ruts shall be filled with additional cover material to maintain the minimum 8" cover over the fabric. When fabric is placed in the roadway, the fabric roll widths shall be chosen so that there will be a minimum number of overlaps of parallel rolls. The total width of surface covered is shown on the Standard Details

- B. ***Drainage Geotextile*** - Trench excavation shall be done in accordance with details of the Project plans. In all instances excavation shall be done in such a way as to prevent large voids from occurring in the sides and bottom of the trench. The graded surface shall be smooth and free of debris. The fabric shall be placed loosely with no wrinkles or folds and with no void spaces between the geotextile and the ground surface.

Placement of the drainage aggregate should proceed immediately following placement of the geotextile. The geotextile shall be covered with a minimum of 1 ft of loosely placed aggregate prior to compaction. If a perforated collector pipe is to be installed in the trench, a bedding layer of drainage aggregate should be placed below the pipe, with the remainder of the aggregate placed to the minimum required construction depth. The aggregate should be compacted with vibratory equipment to a minimum of 95% Standard AASHTO density unless the trench is required for structural support. If higher compactive effort is required, a Class 1 geotextile as described in Section 722 - Geotextiles is needed.

- C. ***Erosion Control Geotextile*** - The geotextile shall be placed in intimate contact with the soils without wrinkles or folds and anchored on a smooth graded surface approved by the Resident. The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch the geotextile, tearing it.

Anchoring of the terminal ends of the geotextile shall be accomplished using key trenches or aprons at the crest and toe of slope. The geotextile shall be placed with the machine direction parallel to the direction of water flow which is normally parallel to the slope of erosion control runoff and wave action and parallel to the stream or channel in the case of stream bank and channel protection. When riprap or stone ditch

protection is placed on fabric, the stones shall be placed so that they do not puncture or otherwise damage the fabric.

When sloped riprap is to be placed on fabric, the site shall be prepared to provide an undulating and uneven surface, as much as is practical. The fabric shall be placed loosely to prevent any bridging of the uneven surface. Fabric to be placed on slopes shall have the long direction oriented up and down the slope as shown in the Standard Details.

The armor system placement shall begin at the toe and proceed up the slope. Placement shall take place so as to avoid stretching and subsequent tearing of the geotextile. Riprap and heavy stone fill shall not be dropped from a height of more than 1 ft. Stone with a mass of more than 220 lb shall not be allowed to roll down the slope. Slope protection and smaller sizes of stone filling shall not be dropped from a height exceeding 3 ft, or a demonstration provided showing that the placement procedures will not damage the geotextile. Following placement of the armor stone, grading of the slope shall not be permitted if the grading results in movement of the stone directly above the geotextile.

In underwater applications, the geotextile and backfill material shall be placed the same Day. All void spaces in the armor stone shall be backfilled with small stone to ensure full coverage.

620.04 **Overlap** - Adjacent lengths of fabric shall be joined by overlapping a minimum of 18" at the ends and sides except when sewing is specified or fabric is placed on slopes. All overlaps on slopes shall be placed as follows:

- A. For slopes steeper than 3H:1V - Sewn seams or minimum 3 ft overlaps with no pinning or staking allowed.
- B. For slopes flatter than 3H:1V - Sewn seams or minimum 18" overlaps and pins or stakes may be used to anchor the overlaps per the manufacturer's recommended spacing.
- C. Overlaps shall be in the direction of flow.

When fabric is placed in the roadway, the fabric roll widths shall be chosen so that there will be a minimum number of overlaps of parallel rolls. The total width of surface covered is shown on the Standard Details.

- A. **Stabilization/Reinforcement and Separation Geotextile** - Adjacent geotextile rolls shall be overlapped shingle style, sewn, or joined as required in the plans. Overlaps shall be in the direction shown on the plans. On curves the geotextile may be folded or cut to conform to the curves. The fold or overlap shall be in the direction of construction and

held in place by pins, staples, or piles of fill or rock. The following Table summarizes the minimum overlap for geotextiles in this application:

AAASHTO Classification	Minimum Overlap
A-1, A-2, A-3, A-4	18"
A-5, A-6, A-7	3 ft or sewn ^a
All roll ends	3 ft or sewn ^a
^a Seams shall be sewn when the soils have a CBR equal to or less than 1, unless otherwise specified.	

B. **Drainage** - Geotextile Successive sheets of geotextiles shall be overlapped a minimum of 1 ft, with the upstream sheet overlapping the downstream sheet. In trenches equal to or greater than 1 ft in width, after placing the drainage aggregate the geotextile shall be folded over the top of the backfill material in a manner to produce a minimum overlap of 1 ft. In trenches of less than 1 ft but greater than 4" wide, the overlap shall be equal to the width of the trench. Where the trench is less than 4", the geotextile overlap shall be sewn or otherwise bonded. All seams shall be subject to the approval of the Resident.

C. **Erosion Control Geotextile** - Adjacent geotextile sheets shall be joined by either sewing or overlapping shingle style. Overlapped seams of roll ends shall be a minimum of 18" except where placed under water. In such instances the overlap shall be a minimum of 3 ft. Overlaps of adjacent rolls shall be a minimum of 18" in all instances. When overlapping, successive sheets of the geotextile shall be overlapped upstream over downstream, and/or upslope over downslope. In cases where wave action or multidirectional flow is anticipated, all seams perpendicular to the direction of flow shall be sewn. For Erosion Control applications, the thread shall also be resistant to ultraviolet radiation.

620.05 **Seams** - When sewn seams are to be used, field or factory seaming by machine will be allowed. If a sewn seam is to be used for the seaming of the geotextile, the thread used shall consist of high strength polyethylene or polyester and shall have the same or greater durability as the geosynthetic being seamed. Nylon thread shall not be used. The thread shall be adjusted in the field to be sufficiently tight but not cut the geotextile. For Erosion Control applications, the thread shall also be resistant to ultraviolet radiation. The thread shall be of contrasting color to that of the geotextile itself. Flat/prayer seams or J-/Double J-type seams shall be used with double-locked stitches (Class 40l), except the "flat" seam may be used for repair of damaged in-place fabric. A stitch density of 70 to 140 per foot shall be used for lighter-weight geotextiles while heavier geotextiles shall have 50 to 70 per foot. All field seams shall be double stitched with two parallel passes and the 2 rows of stitching shall be approximately ½ in apart and shall not cross at any point. All stitching shall be at least 1" from the fabric edge.

For seams that are sewn in the field, the Contractor shall provide at least a 6.5 ft length of sewn seam for sampling by the Resident before the geotextile is installed. For seams that are sewn in the factory, the Resident shall obtain samples of the factory seams at random from any roll of geotextile that is used on the Project. For seams that are field sewn, the seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, samples of seams from both directions shall be provided.

When sewn seams are required, the seam strength, as measured in accordance with ASTM D4632, shall be equal to or greater than 90% of the specified grab strength. The Contractor shall submit the seam assembly description along with the sample of the seam. The description shall include the seam type, stitch type, sewing thread, and stitch density. To facilitate inspection all seams shall be placed with the seam up so that repairs can easily be made if faulty seams are encountered during inspection, as shown on the Standard Detail. Procedures for testing sewn seams are given in ASTM D4884 - Standard Test Method for Seam Strength of Sewn Geotextiles.

620.06 **Certification** - The Contractor shall provide to the Resident a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile. This information shall be furnished to the Resident for approval of the fabric before installation. The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of Section 722 - Geotextiles. Documentation describing the quality control program shall be made available upon request. The Manufacturer's certificate shall state that the furnished geotextile meets Minimum Average Roll Value (MARV) requirements of the specification as evaluated under the Manufacturer's quality control program. A person having legal authority to bind the Manufacturer shall attest to the certificate. Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

620.07 **Sampling and Acceptance** - Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with the most current ASTM D4354, using the section titled, "Procedure for Sampling for Purchaser's Specification Conformance Testing." In the absence of purchaser's testing, verification may be based on manufacturer's certifications as a result of testing by the manufacturer of quality assurance samples obtained using the procedure for Sampling for Manufacturer's Quality Assurance (MQA) Testing. A lot size for conformance or quality assurance sampling shall be considered the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

Testing shall be performed in accordance with the methods referenced in Section 722 - Geotextiles for the indicated application. The number of specimens

to test per sample is specified by each test method. Geotextile product acceptance shall be based on ASTM D4759. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV. Refer to ASTM D4759 for more details regarding geotextile acceptance procedures.

- 620.08 ***Shipment, Storage, Protection, and Repair of Fabric*** - Geotextile labeling, shipment and storage shall follow ASTM D4873. Product labels shall clearly show the manufacturer or supplier name, style number, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F, and any other environmental condition that may damage the physical property values of the geotextile.

To prevent damaging the fabric, the Contractor shall exercise necessary care while transporting, storing, and installing the fabric. Atmospheric exposure of geotextiles to the elements following laydown shall be a maximum of 5 Days to minimize damage potential. At no time shall riprap stones be rolled down the slope where fabric has been placed.

Before installation, the fabric shall be protected from rain, from sunlight or other ultraviolet exposure and from dust, mud, debris, or other elements that may affect its performance. Fabric that is torn, punctured, or otherwise damaged shall not be placed. During installation, direct weather exposure of the fabric shall be limited to a maximum of 5 Days, from laydown to covering of the fabric.

- A. ***Stabilization/Reinforcement Geotextile*** - Before covering, the geotextile shall be inspected by the Resident to ensure that the geotextile has not been damaged during installation. Damaged geotextiles, as identified by the Resident, shall be repaired immediately. Cover the damaged area with a geotextile patch that extends an amount equal to the required overlap beyond the damaged area. If placement of the backfill material causes damage to the geotextile, the damaged area shall be repaired as previously described. The placement procedure shall then be modified to eliminate further damage from taking place.
- B. ***Drainage Geotextile*** - Should the geotextile be damaged during installation or drainage aggregate placement, a geotextile patch shall be placed extending beyond the damaged area by a distance of 18", or the specified seam overlap, whichever is greater.

- C. **Erosion Control Geotextile** - The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch the geotextile, tearing it. Care shall be taken during installation so as to avoid damage occurring to the geotextile as a result of the installation process. Should the geotextile be damaged during installation, a geotextile patch shall be placed over the damaged area extending 3 ft beyond the perimeter of the damage. When riprap or stone ditch protection is placed on fabric, the stones shall be placed so that they do not puncture or otherwise damage the fabric. Field monitoring shall be performed to verify that the armor system placement does not damage the geotextile. Any geotextile damaged during backfill placement shall be replaced as directed by the Resident at the Contractor's expense.

620.09 **Method of Measurement** - The quantity of geotextile will be measured by the number of square yards of surface area covered and in direct contact with the cover material. Measurement will not be made for overlaps, patches and repairs of damaged geotextile unless additional overlap width is required by the Resident in which case measurement will be made for that added overlap area.

620.10 **Basis of Payment** - Geotextiles will be paid for at the Contract unit price per square yard. Such payment shall be full compensation for furnishing and placing geotextile fabric; for all required surface preparation; for all labor, tools, materials and equipment; for repairing torn and damaged geotextile; and when required, for sewing seams and for furnishing and placing all pins or stakes or other hold down devices; for excavation for and furnishing and placing protective aggregate cushion; and for all other incidentals necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
620.54	Stabilization/Reinforcement Geotextile	Square Yard
620.55	Stabilization/Reinforcement Geotextile (sewn seams)	Square Yard
620.56	Drainage Geotextile	Square Yard
620.57	Drainage Geotextile (sewn seams)	Square Yard
620.58	Erosion Control Geotextile	Square Yard
620.59	Erosion Control Geotextile (sewn seams)	Square Yard
620.60	Separation Geotextile	Square Yard
620.61	Separation Geotextile (sewn seams)	Square Yard

SECTION 621 - LANDSCAPING

621.01 **Description** - This work shall consist of the Contractor furnishing and planting trees, shrubs, vines, and other plants and shall include all planting operations and material as well as the care and replacement of the plants during the Maintenance Period, all in accordance with the specifications, Standard Details,

planting plans and schedules and the directions of the Resident. Planting operations will be divided into two classes.

- a. **Class A** - Planting will consist of planting into the existing soil that has been amended with organic humus, peatmoss, compost, and/or other standard horticultural soil amendments as approved by the Resident.
- b. **Class B** - Planting will consist of planting into the existing soil without amendments.

Unless otherwise specified, all planting shall be Class A.

621.02 **Materials - General** - All non-plant material shall conform to the requirements specified in the following Sections of Division 700 - Materials.

Fertilizer	717.01
Mulch	717.04
Humus	717.09

Water shall be free from oil, acids, alkalines, salts, or any other substances harmful to plantings.

621.03 **Plant Material - All Classes**

- a. All plants shall conform to the current edition of the “American Standard for Nursery Stock” (ANSI Z60.1) unless otherwise indicated in the plans or specifications.
- b. All plants shall be first class representatives of their normal species or varieties, unless otherwise specified. All plants must have a good, healthy, well-formed upper growth and a large, fibrous, compact root system. Plants sheared into stiff or formal shapes will be rejected unless they have outgrown such shearing.

Large-growing, deciduous trees shall have straight trunks and a single leader or as may be characteristic of the species. Tops shall be thickly branched, densely foliated, well balanced and in good proportion to the height of the tree. Trees with weak trunks, thinly or irregularly branched or with unnatural shape of proportions due to undesirable pruning or for any other cause will be rejected. Trees with leaders or branches too severely cut back or with bottom limbs trimmed too high will be rejected.

Small-growing deciduous trees shall be thickly branched with a well-balanced, natural shape. Plants which are poorly furnished or have grown or been pruned into unnatural shapes will be rejected.

Tree “Clumps” shall have three or more main stems starting from the ground.

- c. All plants shall have been grown under climatic conditions similar to those in the locality of the site of the Project under construction or have been acclimated to such conditions for at least two years. All plants must

have been grown in a latitude north of Washington, D.C. The Resident may require a sworn affidavit from the Contractor stating the source where all plants were grown. Payment for plants may be withheld until this affidavit is received.

All plants shall be nursery grown unless otherwise stipulated. No plant will be considered nursery grown unless it has been transplanted at least once and has been growing in a nursery for at least 2 years. Where collected stock is allowed, all plants in addition to meeting all other requirements for nursery-grown stock, shall have a diameter of ball or root spread at least one-third greater than that required for nursery stock. Plants showing signs of lack of root pruning, cultivation or other proper nursery care will be classified as collected stock regardless of their source.

- d. All plants must be healthy and vigorous; free from disease, injurious insects and their eggs or larva, mechanical wounds, broken branches, decay, or any other defects.
- e. All plants shall be true to name. Each bundle or each plant when not tied in bundles shall be labeled legibly and securely. The current edition of "Standardized Plant Names" prepared by the Editorial Committee of the American Joint Committee on Horticultural Nomenclature shall be the authority for all plant names.

Care shall be taken throughout the operation to keep each plant species or variety segregated and labeled. The Resident will reject any plants concerning any doubt or confusion arising about nomenclature, either at the time of delivery or at any subsequent time.

- f. The Contractor shall take all precautions that are customary in good trade practice to insure upon arrival at the planting site the plants are in good condition for successful growth. All plants must show appearance of normal health and vigor. Plants with loose or broken balls; dried out roots, twigs or needles; or plants which have become overheated in transit or are found not to comply with these specifications in any way will be rejected. The Resident will not assume responsibility for such rejected material.

The Resident reserves the right to plainly mark all rejected plants with paint or by other means to ensure that they are not used on the job. Rejected plants may not be used on the Project, will not be paid for, and must be replaced by the Contractor with approved plants. If plants with communicable diseases are not removed or destroyed immediately, upon discovery of the disease, all plants that were left in contact will also be rejected.

621.04 **Plant Size and Root Balls**

Class A Plants - The plant sizes specified in the “American Standards for Nursery Stock” are the minimum sizes acceptable. (ANSI Z60.1) Plants, which meet the sizes specified but do not have a normal shape and balance between height and spread, will be rejected. Thin, poorly branched, or sparsely rooted plants will be rejected, regardless of whether they meet the minimum technical requirements of the American Standard for Nursery Stock .

Where bare roots are irregular, the size of the root spread will be the average root spread considering all sides of the plant and not the maximum root spread. The Resident may allow moderate deviations from exact sizes of plants that normally have irregular root systems.

Coarse-rooted plants, which lack sufficient fibrous feeding roots, will be rejected.

Recently cut stubs of large roots on either balled or bare root stock will be considered evidence of lack of proper nursery care and root-pruning and will be sufficient grounds for rejecting such plants or classifying them as collected stock. Acceptable roots will retain sufficient fibrous feeding roots.

Where a size range with a maximum and minimum is given, an average size is required. At least 40% of the plants in a size range shall be at or above the average for this size range.

A solid ball is referred to as one encompassing the roots of a plant. A solid ball shall consist of the soil in which the plant was originally grown. The ball shall have been dug up in such a manner as not to disturb the roots. Where such a ball is required the designation B and B, Balled and Burlapped, will be used. No B and B stock will be accepted if this solid soil ball has disintegrated or if loose soil apparently has been packed around the roots.

Peat Balls and other fiber material will not be acceptable where B and B stock is called for but said root balls may be furnished where bare root stock is called for if approved by the Resident.

Per ASNS Standards, the caliper of trees shall be the diameter of the trunk taken 6" above the root collar for up to and including 4" caliper size . If the caliper at 6" exceeds 4" in diameter, the caliper will be measured at 12" above the ground.

Class B Plants - Unless otherwise specified, plants used in Class B plantings shall be seedlings, plugs or lining out stock with heavy, fibrous, compact root systems. The comparative size of the plants shall be as stated under the heading “Seedling Trees and Shrubs” in the “American Standard for Nursery Stock.” All conifers must have dormant buds and secondary needles. Where B and B plants are designated, ball sizes shall be the same as Class A plants.

621.05 ***Vacant***

621.06 ***Inspection*** - A preliminary check of the plants may be made at the time of delivery for condition of the plants and conformity to the specifications. The Contractor shall inform the Resident at least 48 hours in advance, as to what plants are to be planted and in what location. Inspection will continue throughout the life of the Contract up to the time of Final Acceptance. Plants which are not true to name, do not conform to the specifications, show evidence of improper handling or lack of proper care or which appear to be in a seriously unhealthy condition must be removed by the Contractor at once and replaced by acceptable plants as soon as the planting season allows. Any unacceptable plants when pointed out to the Contractor by the Resident shall be removed at once. If this occurs during the planting season, these plants shall be replaced at once; if between planting seasons, they shall be replaced at the next subsequent planting season, unless conditionally directed by the Resident for evergreens and other preferred spring planted items.

621.07 – 621.16 ***Vacant***

621.17 ***General Construction Requirements*** - Planting operations shall be performed in accordance with the plans and specifications and as directed by the Resident.

621.18 ***Layout*** - The location of plants as shown on the plans shall be considered approximate only. The exact locations will be designated on the ground by the Resident, making such changes as may be required to adjust the planting to local conditions. Plant quantities may, in some cases, be increased or decreased as provided in Section 109.1 - Changes in Quantities. Locations for trees and shrubs shall be staked out on the ground by the Resident before herbicides are applied and any plant pits or beds are dug.

The Contractor shall furnish the stakes for use in marking plant locations. Stakes shall be wire survey flags at least 21" tall. Layout stakes shall be approved by the Resident before the Contractor commences any work on the Project.

The Contractor shall mark the stakes legibly with indelible marking material and may also be required to furnish personnel, capable of locating plants from plans, to carry out the staking under the direction of the Resident.

Before actively starting work on the Project, the Contractor shall provide the Resident with a planting sequence schedule to be used in establishing priorities in staking plant locations. The Contractor shall give the Resident at least 4 Days advance notice of any deviations from this schedule. The Resident will not be responsible for any delay or inconvenience caused by unfinished staking resulting from the Contractors failure to follow the above procedure.

All stakes used to locate plants shall be replaced in the correct plant pits after each operation and shall remain there until the Resident directs their removal. When plants are set out in wrong locations due to stakes being misplaced during

digging and planting operations, the Contractor shall be required to move the misplaced plants to the proper location at their own risk and expense.

621.19 **Plant Pits and Beds**

- a. **Plant Beds** - Areas designated as plant beds must have the entire surface cultivated, cleared of weeds and be completely covered with mulch. Actual mulch limit will extend 2½ ft out from the center of plant or to the pavement edge, bridge wall, and roadside face of guardrail. Cultivation must include complete removal of all weed and grass roots, loose stones over 3" maximum diameter and any other debris. Approved herbicides are permitted for weed control in place of sod removal.
- b. **Rock Excavation** - When ledge or boulders over ¼ yd³ in size are encountered in digging plant pits, the Contractor shall notify the Resident who will change the location of the plants. No excavation of ledge or boulders over ¼ yd³ in volume will be required and no extra payment will be made for rock excavation or for shifting of plant holes due to rock.
- c. **Class A Planting** - Size of plant pits shall bear the following relationship to the spread of roots or root ball diameter of the plants to be planted in them:

For all plant materials, the holes shall be 2 times the diameter of the ball or container size.

The plant pit shall be deep enough so that when installed the top of the root ball is even with to 1" higher than the existing ground. In all cases, the depth shall be sufficient to contain all the roots of the plant without crowding.

In certain areas of poor drainage or heavy soil, the Resident may require raising the plant elevation. When required, the raising of the plants shall be included as a part of the cost of the plant.

Excavated soil mixed with organic humus shall be used as backfill around the roots. Stones larger than 2" in maximum diameter, large roots, roots or rhizomes of weeds or other injurious materials shall be removed and not used as backfill. Any additional material needed to fill plant pits to the level of the surrounding ground shall be loam (Section 615) furnished by the Contractor at their own expense.

- d. **Class B Planting** - Class B plants will be planted in the existing soil. Plant holes must be deep enough to allow room, for the full depth of the root without doubling or folding and wide enough to allow room for its normal spread. Plants must be set straight and at the same depth at which they were previously growing. Soil must be firmly compacted about the roots leaving no air pockets.

- 621.20 **Planting Seasons** - Seasons for planting, unless otherwise directed, shall be within the following dates:

Bare Root Plants	
Spring	April 1 st to May 31 st
Fall	Sept. 15 th to Oct. 15 th
Evergreens Container or Balled and Burlapped	
Spring	April 1 st to June 15 th
Fall	August 15 th to September 30 th
Potted & Container Grown Deciduous Plants	
Spring	April 1 st to June 30 th
Fall	August 15 th to Nov. 30 th
Balled & Burlapped Deciduous Plants	
Spring	April 1 st to June 15 th
Fall	August 15 th to Nov. 30 th

Plants will not be planted in frozen soil, soil that is excessively wet, or excessively dry.

Preparations for planting may begin earlier than the specified season and planting work may continue beyond the specified time limits if approved by the Resident. However, the Resident may require that all plants planted out-of-season shall receive special attention as directed. Any out-of-season planting shall be at the Contractor's risk and expense.

- 621.21 **Removed**

- 621.22 **Removed**

- 621.23 **Setting Plants**

- a. **Placement Plants** - shall be set plumb and straight in the prepared pits and beds and at a level such as will result, after settlement, in the top of the root ball being level with or to within 1" above the surrounding ground surface.
- b. **Staking** - If the Resident or Landscape Architect determines a tree requires staking, the Landscape Contractor will provide staking incidental to the cost of the plant. Tree staking shall be done in accordance with horticultural industry standards; trees shall be staked to allow slight sway and movement all the way to the ground. Stakes shall not extend into tree branches. Stakes shall be driven into undisturbed soil and not permitted to penetrate root balls.

Staked trees shall remain in a plumb position throughout the Maintenance Period. Staking materials shall be removed after one growing season or if longer time is needed at the end of the Maintenance Period.

- 621.24 **Backfill Class A** - For all Class A plants backfill shall consist of 3 parts of soil excavated from the plant pit thoroughly mixed with one part of organic humus

and/or horticultural amendments as approved by the Resident. Sods or clods may not be used as backfill. The backfill material shall be placed and compacted in the bottom of the planting pit and shall be worked around the roots and thoroughly compacted as the backfilling proceeds, leaving no air pockets. The backfill shall be filled in around the root ball to half the depth of the ball, and the remaining wire basket shall be removed and the remaining burlap around the ball shall be loosened and spread out away from the plant or if it is too bulky, cut away and removed. The backfilling shall then be completed, watered and tamped firm. Plastic film wraps shall be completely removed during planting. Nursery containers shall be completely removed before planting. The roots of bare root plant materials shall be placed in their natural arrangement with the backfilling carefully performed to prevent damage to the plant's root system. Broken or bruised roots shall be pruned immediately, making a clean cut. Shallow basins or saucers of earth will be required to be placed around each plant. However, when drainage conditions are poor, as in heavy clay soil, the Resident may require that such saucers be omitted or used only temporarily. All plants shall be thoroughly watered and liquid fed the Day they are planted and as often thereafter as necessary for the plants to become safely established.

621.25 **Fertilizing**

- a. **Water Soluble Fertilizer** - The Contractor shall liquid feed all class A plantings as the first watering, unless otherwise directed by the Resident.

Liquid fertilizer shall be completely dissolved and mixed in water at the rate of 6 lb of the fertilizer concentrate to 100 gal of water.

The resulting solution shall be poured around the plant in the plant saucer. The solution shall be applied at the following rates for each application:

- Containerized plants shall receive watering-in fertilizer solution of volume equal to container size.
 - Plant materials including B&B shrubs and deciduous trees specified by height/spread shall receive 1 gal of water per each 1 ft (12") of height/spread.
 - Plant materials specified by caliper shall receive 1 gal of water per each ¼" of caliper measurement.
 - Evergreen plant materials shall receive 2 gal of water per each 1 ft (12") of height.
- b. **Slow Release Fertilizer Tablets** - All Class A plantings shall be fertilized with slow release fertilizer tablets or equivalent as approved by the Resident, at the time of planting, unless otherwise directed by the Resident. Fertilizer tablets shall be placed equidistantly within the planting pit adjacent to the ball or root mass, but not in direct contact with roots. Placement depth shall be 6 to 8" below ground level.

The application rates shall be as follows:

- Deciduous and Evergreen Shrubs shall receive one tablet per each 1 ft (12") of size.
- Deciduous Trees and Evergreen Trees specified by height shall receive one tablet for 2 ft height, plus one additional tablet for each additional 1 ft (12") of size.
- Deciduous Trees specified by caliper shall receive one tablet for each ½" caliper.

Specification	Plant size	Tablets
Height/Spread	12" - 23"	1
Height/Spread	2 ft – 3 ft	2
Height/Spread	3 ft – 4 ft	3
Evergreen/Ht.	3 ft – 4 ft	3
Evergreen/Ht.	5 ft – 6 ft	5
Caliper	2" – 3"	4
Caliper	3" – 4"	6

- Perennials, Vines and Ground Covers shall receive one tablet or appropriately proportioned equivalent.

621.26 **Mulching** - The disturbed surface area of plant beds and pits shall be evenly and uniformly covered to a depth 4" with bark mulch or as directed by the Resident. All plant pits and beds must be entirely free of weed or grass growth and free of live roots of all weeds and grasses prior to the time mulch is applied. Mulch shall be removed from or installed with no contact to trunk or bark surfaces.

Mulching will not be required on Class B plantings, unless otherwise specified on a Project specific basis.

Measurement of the depth of mulch will be made after one heavy rain or after a 3-week period without heavy rain.

All plant pits and beds must be entirely free of weed or grass growth and free of live roots of all weeds and grasses at the time mulch is applied.

When plant beds are installed near guardrails, or as stated in Section 621.19(a), the space between the plants and the guardrail or the nearest pavement when it extends behind the guardrail, shall be treated as a part of the plant bed and shall be weeded and mulched.

Plants shall not be damaged when the mulch is applied. Smothered or otherwise damaged plants must be replaced. Mulch, in place, will not be permitted to be directly in contact with the base of plant trunks or stems. Plants shall be mulched at the time of installation.

621.27 **Cultivation** - All plant pits and beds shall be kept free of weeds and grass by the Contractor from the time the plants are planted until final acceptance. This shall

be accomplished by manual weeding, cultivation, or use of approved herbicides. Application of herbicides to control weeds or grass shall be performed only by a Maine licensed pesticide applicator with an appropriate category as determined by the Board of Pesticide Control. There will be no payment for unsatisfactory work.

- 621.30 **Pruning** - Pruning shall be done to each plant individually in such a manner as to preserve the natural character of the plant and shall be done only after delivery and inspection. All pruning shall be done with sharp tools by experienced persons in accordance with the best horticultural practice. Plants pruned in such a manner as to seriously impair the appearance or character of the plant will be rejected. Bench pruning with knives or axes will not be permitted. Broken or badly bruised branches, soft wood, and sucker growth shall be removed with clean cuts.

Excessive pruning shall not be accepted as a means of disposing of dead wood or unhealthy plants. Plants in such poor condition that they can only be revived by pruning of more than $\frac{1}{3}$ or more of the growth will be considered unsatisfactory and will be rejected. At the time of final acceptance, all plants must be at least the size called for in the specification.

- 621.31 **Potted and Container Grown Plants** - Plants supplied in Containers must have been established in containers at least one full growing season before planting and shall have a well rooted condition evidenced by the firmness of the mass of soil and roots. The outside of the ball of soil shall be well matted with healthy working roots, but shall not be pot bound. Plants shall be adequately hardened off before planting. Root growth shall be loosened prior to planting.

Containers shall be of such shape as to permit easy removal of the plant.

No plant will be accepted if the container ball is cracked or broken upon removal from the container.

- 621.33 **Protection of Plants** - It will be the responsibility of the Contractor to take necessary steps to protect all plants from rodents during the Maintenance Period. Protection from rodents will be included in the cost of the individual plants and the Contractor will receive no extra compensation for this work.

- 621.34 **Cleanup and Repair** - All excess excavated material and debris resulting from the planting operation shall be promptly disposed of outside of and out of sight of the Project, unless otherwise directed by the Resident. Any areas disturbed by the Contractor showing bare earth, that do not require mulching, shall be seeded with approved grass seed, fertilized and mulched, as directed by the Resident.

The Contractor shall be responsible for any damage caused by their operations and shall restore the disturbed areas to their original condition. Cost of cleanup and repair shall be incidental to the work.

- 621.35 **Prosecution and Progress** - It is essential that each portion of the planting work in any area be promptly followed by cleanup of subsoil and debris, fertilization,

watering, cultivation, pruning, mulching, spraying as needed, repair and restoration of damage caused by the Contractor, etc. The Contractor shall provide sufficient labor and supervisory personnel to carry out this work without undue delay. Any delay in carrying out this phase of the work which, results either in danger to the health or growth of the plants or a poor appearance of the Project from the point of view of the public will be considered due cause for withholding all or part of any payment due the Contractor for plants delivered and planted or for any other work done.

Partial payments on the Contract do not constitute approval or acceptance of any specific plants or work operations. The right is reserved to reject any plants or work, which are discovered to be unsatisfactory at any time before the end of the Maintenance Period.

- 621.36 ***Maintenance Period*** - The acceptability of the plant material furnished and planted under this Contract shall be at the end of the Maintenance Period, during which the Contractor, as necessary, shall employ all possible means to preserve the plants in a healthy and vigorously growing condition and to insure their successful establishment. During this period, the Contractor shall water, cultivate and prune the plants, and do any other work necessary to maintain the plants in a healthy growing condition. This shall include seasonal spraying with approved insecticides or fungicides as may be required. The Contractor shall also be responsible for protecting the plants from rodents. All dead or rejected plants shall be promptly removed from the Project and replaced by live healthy plants meeting the same specifications. If such plants are declared unacceptable during the planting season, they shall be replaced during this planting season, otherwise, they shall be replaced during the next subsequent planting season.

Such replacement plants are subject to the same requirements as the original plants and must be replaced in turn if they fail to meet the required standards. Plants designated for spring planting only, will be replaced only during the spring planting season unless otherwise directed by the Resident.

The Maintenance Period shall commence after Physical Work Complete but not before the Landscape Warranty Bond has been received by the Resident if required by Special Provision and shall extend for 2 years after that date unless otherwise directed. Necessary replacements shall be made so that at the end of the Maintenance Period all plants shall be in a healthy, vigorous growing condition and free from sizable die-back.

Replacements will be required for plants lost, damaged, or rejected, whatever the cause. The Contractor will be considered responsible for the plants until the end of the Maintenance Period.

It shall be the sole responsibility of the Contractor to replace any unsatisfactory plants on the Project regardless of whether they are specifically designated by the Resident. In the case of individual doubtful plants, the Contractor may call

upon the Resident to make a determination as to their acceptability, but it shall not be incumbent on the Resident to furnish the Contractor with exact lists of replacements.

All replacements of plants shall be completed by the end of the planting season before the end of the Maintenance Period. All replacement planting shall conform in every way to the requirements of the original planting. The Resident may require that any replacement plants that are not dormant, or that are planted late in the season, be sprayed, as directed with an approved anti-desiccant.

621.37 **Method of Measurement** - The quantity of plants to be measured for payment will be the number of individual plants furnished and planted as required and accepted, excluding replacements.

621.38 **Basis of Payment** - Each item of "Planting" will be paid for at the Contract unit price for each accepted plant furnished and planted. Payment shall constitute full compensation for; furnishing and placing plants, digging, delivering, rodent protection, preparing plant pits, beds and drains; planting, watering, fertilizing, mulching, pruning, and the cleanup of planting areas; for all, fertilizer, mulch and other necessary materials; all labor, equipment, tools, Maintenance Period work, Replacement and Bonding (if required by Special Provision) and any other incidentals necessary to complete the work.

When a bid item calls for a "Group" of trees, shrubs, vines or other plants, the Contractor shall furnish each individual species within this "Group" for the same unit bid price.

The name and estimated number of individual species within each "Group" will be shown on the estimated quantities sheet of the plans.

Payment will be made under:

Pay Item		Pay Unit
621.XX	Name plant or plant group as detailed in Schedule of Items in Proposal Book	Each

SECTION 622 - TRANSPLANTING SHRUBS, HEDGES, AND TREES

622.01 **Description** - This work shall consist of digging, moving and replanting existing shrubs, hedges, and trees in accordance with these specifications and in conformity with the plans or as directed.

622.02 **Materials - General** - All non-plant materials shall conform to the requirements specified in the following Sections of Division 700 – Materials:

Fertilizer	717.01
Mulch	717.04
Humus	717.09

622.03 **Shrubs and Hedges**

- a. **Digging** - The earth of shrubs and hedges to be moved shall be carefully encompassing the roots as is customary in good nursery practice. Minimum size of the rootball shall be as indicated in the current edition of the "American Standards for Nursery Stock" (ANSI Z60.1)
- b. **Moving** - The earth rootball shall be maintained as a solid unit during the moving of the shrubs and hedges and must be protected from breaking or cracking by careful handling. The rootball shall be tightly wrapped with burlap or similar material. Earth rootballs greater than 18" in diameter shall be tightly bound with cord or rope placed over the burlap unless the shrubs or hedges are to be replanted immediately after digging.
- c. **Planting** - The plants shall be planted in the designated new location at the same depth below ground surface as before they were moved. Backfill consisting of 3 parts excavated soil and one part organic humus shall be placed under and around the rootball to eliminate all air pockets and to support the plant. Insofar as feasible, when hedges are to be transplanted, the individual plants shall be replanted in the same relationship to each other that existed before they were moved.

Fertilizer tablets shall be placed into the backfill at the following rates.

- Shrubs to 2 ft high or spread: 1 tablet
 - Shrubs to 4 ft high or spread: 2 tablets
 - Shrubs to 6 ft high or spread: 3 tablets
- d. **Time of Transplanting** - Plants shall be dug and transplanted only when dormant, unless otherwise directed by the Resident. When dug, shrubs and hedges shall be moved directly to the final planting site and planted immediately, if possible. The rootball must be kept moist at all times during transplanting operations. If construction makes it impossible to replant the plants immediately after digging, the rootballs of the plants shall be kept completely covered with a thick layer of earth, straw, bark mulch, peat moss, or similar material which shall be kept moist at all times while the plants remain unplanted. Shrubs may be held in approved pots under conditions of delayed replanting.
 - e. **Pruning** - All pruning shall be done in accordance with the best horticultural practice. Dead, diseased, or injured shoots and branches shall be removed. In order to restore a normal balance between top and roots, deciduous shrubs shall be thinned by removing uniformly scattered, selected branches which shall be cut back to the main stem, as directed. The Resident may also require tip pruning. Tip pruning may also be required for evergreens. In the case of hedges, the Resident may require shearing to uniform, even surfaces.

- f. **Watering** - As soon as the plants are planted they shall be thoroughly watered to the point where the roots and the surrounding earth are well saturated. The first application of liquid fertilizer shall be made during planting.
- g. **Mulching** - After removing all weeds and grass, the ground surface over the entire area of the planting pit shall be covered to a depth of 4" with bark mulch.

622.04 **Trees**

- a. **Digging** - All trees to be moved and replanted shall be dug with a solid ball of earth around the roots as is customary in good nursery practice. The diameter of the ball shall be not less than 10 times the diameter of the trunk of the tree measured 1 ft above the surface of the ground. Depth of the ball shall be not less than 60% of its diameter for balls up to 48" diameter. For balls over 48" diameter the ball shall have sufficient depth to maintain a solid structure and to encompass all the feeding roots under the ball area.
- b. **Moving** - The ball must be maintained as a solid unit during the moving of the tree. The ball must be protected from breaking or cracking by careful handling and by being tightly bound with cord or rope over canvas, burlap, or similar wrapping. The ball shall be firmly attached to a tree platform of suitable size during moving operation, as required.
- c. **Planting** - The trees shall be planted in the designated new location at the same depth in relation to the ground surface as before they were moved. Backfill consisting of 3 parts excavated soil and one part humus shall be placed under the ball and around the periphery of the ball. Backfill shall be puddled and firmed in place to eliminate all air pockets and give adequate support to the ball. Fertilizer shall be applied as specified in Section 621.25.
- d. **Protection** - Every care shall be taken to prevent injury to the tree during the transplanting operation. All parts of the tree shall be carefully protected. Branches shall be tied out of the way of possible injury. No chain, cable, or heavy rope may be attached to the trunk or branches without protective padding adequate to prevent bruising or other injury.
- e. **Time of Transplanting** - Trees shall be dug and transplanted only when dormant, unless otherwise directed. When dug, trees shall be moved directly to the final planting site and planted immediately if possible. The ball must be kept moist at all times during transplanting operations. If construction problems make it impossible to replant the tree immediately after digging, the ball of the tree must be completely covered with a thick layer of earth, bark mulch, peat moss or similar material which shall be kept moist at all times while the tree remains unplanted. Pruning,

watering, fertilizing, mulching, and supporting shall be as specified in the applicable Sections of Section 621 - Landscaping.

- 622.05 **Maintenance** - It shall be the Contractor's responsibility to protect and care for transplants. They shall be watered weekly during dry weather or as otherwise directed. The Contractor shall take steps required to protect the plants from damage and from diseases and pests. Should damage occur it shall be repaired by the Contractor, according to the best horticultural practice. The Contractor shall be responsible for transplants through one growing season.
- 622.06 **Replacement** - If the ball is badly broken or the plants are otherwise badly damaged or if, in the opinion of the Resident, during the life of the Contract the plants show such signs of loss of health or appear to be in danger of dying, the Contractor will be required to replace the plants with others of the same size and variety or approved plants of equal value, at the proper season.
- 622.07 **Method of Measurement** - Transplanting shrubs or trees will be measured in place after transplanting by the single shrub or tree unit.
- 622.08 **Basis of Payment** - The accepted quantities of transplanting shrubs or trees will be paid for at the Contract unit price for each plant properly transplanted and accepted, which payment shall include digging, binding, moving, replanting, pruning, mulching, care and maintenance and if required, replacement of the shrubs, and for all fertilizer, mulch and other materials, and for all incidentals necessary to complete the item.

Payment will be made under:

Pay Item		Pay Unit
622.10	Transplanting Shrub	Each
622.11	Transplanting Tree	Each

SECTION 623 – MONUMENTS - Reserved

SECTION 624 - Vacant

SECTION 625 - WATER SERVICE SUPPLY LINES

- 625.01 **Description** - This work shall consist of installing water pipe and pipe sleeve in reasonably close conformity with the lines and grades shown on the plans or established. The installation shall include the assembly of all components and materials shown on the plans or as directed.

625.02 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Copper Tubing	712.32
Non-metallic Pipe, Flexible	712.33
Non-metallic Pipe, Rigid	712.34
Metallic Pipe	712.341

625.03 **General** - This work shall be done with as little interruption of water service as possible. Ample notification shall be given to the users of the water before any disruption of water service.

625.04 **Sleeve** - Pipe for sleeves shall be metallic or non-metallic rigid and be laid on a firm foundation at the line and grade designated. When the pipe installation is in a trench all excavating and backfilling shall be in accordance with Section 206 - Structural Excavation.

After installation of the pipe, special care shall be taken to protect the pipe from heavy hauling equipment loads, rocks or any other damage caused by the Contractor's work. All pipe broken from such causes shall be removed and replaced at the Contractor's expense.

Pipe sleeves to be placed in concrete shall be supported during placement of concrete. Special care shall be taken while placing and compacting concrete around the sleeves to prevent voids around the outside of the sleeves. Ends of the sleeves shall be capped with end plates until the water pipes are installed through the sleeves.

625.05 **Water Pipe** - Water pipe shall be copper tubing or non-metallic flexible pipe, as called for. After the sleeve has been placed, the water pipe shall be inserted into the sleeve and connected to the existing pipes at each end. All connections to existing pipes shall be done in accordance with recognized plumbing practices.

Necessary fittings, adapters, and reducers shall be furnished as required.

625.06 **Method of Measurement** - Pipe sleeve, copper tubing, and non-metallic pipe will be measured by the linear foot.

625.07 **Basis of Payment** - The accepted quantities of pipe sleeve, copper tubing and non-metallic pipe will be paid for at the Contract unit price per linear foot for the types and sizes specified complete in place, which payment will be compensation for furnishing and installing all necessary fittings, for connecting to existing systems and for capping the ends of the pipe sleeve.

Excavation will not be paid for separately but will be considered included in the work of the Contract items.

Payment will be made under:

Pay Item		Pay Unit
625.081	¾" Copper Tubing	Linear Foot
625.082	1" Copper Tubing	Linear Foot
625.083	1¼" Copper Tubing	Linear Foot
625.084	1½" Copper Tubing	Linear Foot
625.085	1¾" Copper Tubing	Linear Foot
625.086	2" Copper Tubing	Linear Foot
625.101	¾" Non-metallic Pipe-Flexible	Linear Foot
625.102	1" Non-metallic Pipe-Flexible	Linear Foot
625.103	1¼" Non-metallic Pipe-Flexible	Linear Foot
625.104	1½" Non-metallic Pipe-Flexible	Linear Foot
625.105	1¾" Non-metallic Pipe-Flexible	Linear Foot
625.141	2" Pipe Sleeve	Linear Foot
625.142	3" Pipe Sleeve	Linear Foot
625.143	4" Pipe Sleeve	Linear Foot
625.144	6" Pipe Sleeve	Linear Foot
625.145	8" Pipe Sleeve	Linear Foot

SECTION 626 - FOUNDATIONS, CONDUIT, AND JUNCTION BOXES FOR HIGHWAY SIGNING, LIGHTING, AND SIGNALS

- 626.01 **Description** - This work shall consist of furnishing, installing, modifying, or removing concrete foundations, conduits, and junction boxes for highway lighting, traffic signals, and highway signing in accordance with these Specifications and in reasonably close conformity with the Contract Documents.
- 626.02 **Materials** - The materials furnished by the Contractor shall be new. Where an existing system is to be modified, the existing material shall be removed and abandoned or salvaged as shown in the Contract Documents or as directed by the Resident.

All electrical equipment shall conform to NEMA or UL standards, wherever applicable. In addition to these requirements, all materials and workmanship shall conform to the requirements of: NEC, ASTM Standards, the ANSI, the local electrical Utility Company, and any local ordinances that may apply.

Materials shall meet the requirements specified in the following Sections of Division 700 - Material Details:

Gravel Borrow	703.20
Reinforcing Steel	709.01
Precast Concrete Units	712.06
Steel Conduit	715.02
Non-metallic Conduit	715.03
Anchor Bolts	720.07

- 626.021 **Miscellaneous Materials** - Transformer pads shall conform to the requirements of the local electrical Utility Company.

If grouting is necessary to correct surface irregularities in the top of the concrete foundations a non-shrink material included on the MaineDOT Qualified Product List (QPL) and satisfactory to the Resident shall be used.

All concrete foundations shall be constructed of Class LP concrete in accordance with the applicable requirements of Section 502 - Structural Concrete.

All concrete for concrete encasement of conduit shall be Class S or Class Fill concrete in accordance with the applicable requirements of Section 502 – Structural Concrete, or a Prepackaged Concrete Mix from the Department’s Qualified Products List (QPL).

The above ground portion of concrete foundation surfaces shall receive an application of Type 1c penetrating silane concrete sealer from the MaineDOT QPL.

- 626.022 **Equipment List and Drawings** - Unless otherwise permitted in writing, the Contractor shall within 30 Days following execution of the Contract, submit a list of equipment and materials which are to be installed. The list shall include the name of manufacturer, size, and identifying number of each item. The list shall be supplemented by such other data as may be required, including detailed scale drawings of proposed minor deviations from the Contract Documents. If requested, the Contractor shall submit for review, design data and sample articles of the material proposed for use. All of the above data shall be submitted in duplicate except samples for testing. Following checking, correcting, and reviewing, two complete sets of drawings shall be submitted. The Department will not be liable for material purchased, labor performed, or work delayed before such review.

Upon completion of the work, the Contractor shall submit three complete sets of corrected plans showing all construction changes.

626.03 **General** - All work shall conform to NEC and NESC standards as set forth in the NIST Handbook H-32, except when otherwise noted in the Contract Documents or in the Special Provisions.

The Contractor shall be responsible for and shall repair all damage caused to underground drainage structures, utilities or lighting conduit, which are encountered during construction.

The Contractor is responsible for final design of the above-grade components of the highway lighting, traffic signals, and highway signing structure(s) in accordance with Standard Specification Sections 634, 643 and 645, respectively.

626.0301 **Electrical Supply Lines and Service Connections** - The following requirements shall apply to Electric Supply Lines and Service Connections feeding traffic signalization equipment control boxes and lighting breaker boxes.

Whenever possible, the meter and breaker panel feeding traffic signal control boxes or lighting control boxes shall be constructed within 30 ft of the service drop pole.

All underground service connections that are constructed in trenches and carrying Secondary Utility Power to a MaineDOT meter and breaker panel, or, directly to MaineDOT traffic signalization control cabinets or lighting breaker boxes shall be in Rigid Metal Conduit or concrete encased PVC conduit.

Where trenchless technologies are employed to install the service connection conduit, Schedule 120 PVC conduit shall be used for the trenchless bore section of conduit. In addition, concrete encasement shall be used for any PVC conduit placed in trench sections and carrying Secondary Utility Power more than 10 ft before or after the limits of the trenchless bore conduit.

The construction practices described above shall be used for service connections up to a maximum of 600 ft. There may be rare exceptional cases where the service connection must exceed 600 ft. In these cases, the power companies may require primary power be run over 600 ft for the purpose of power consumption and dependable service. These cases will be evaluated on a case-by-case basis for alternate power feed methods and/or the need for steel or concrete encased conduit.

626.031 **Conduit** - If the trench for conduit is located in wet, spongy or otherwise unsuitable ground, as determined by the Resident, the trench shall be further excavated to a depth sufficient to overcome this condition, as determined by the Resident, and shall be backfilled with approved gravel. The gravel shall be compacted in layers

not exceeding 8", loose measure. The grade of the bottom of the trench shall be parallel to the proposed grade of the conduit.

Trenches for conduits shall be excavated to a width that will permit proper installation of the conduit and to a minimum depth of 3 ft below finish grade as measured from the top of the conduit. If deeper depths are required, the conduit shall be installed at the depth shown in the Contract Documents or as directed by the Resident. Conduit shall not interfere with poles, guardrail posts, foundations or other objects.

All junction or pull boxes shall be vehicle rated (22,000 lb) and concrete junction boxes shall be Class LP concrete, in accordance with the applicable requirements of Section 502 – Structural Concrete and installed as shown in the Contract Documents

Where conduits enter exposed junction boxes, they shall be sloped to drain towards the conduit entrance holes, unless otherwise directed by the Resident. Weep holes of 1/4" diameter shall be placed in all pull boxes, junction boxes, and fuse boxes.

After the trench has been excavated as specified, the bottom of the trench shall be prepared with a 6" thick (minimum) sand bedding material. After placing the conduit, sand shall be placed around the sides and over the top of the conduit, when shown in the Special Details. The entire trench shall then be backfilled with approved material, placed in layers not exceeding 8", and thoroughly tamped. Where concrete encasement is required around the conduit, the concrete shall meet Class S, Class Fill in accordance with the applicable requirements of Section 502 – Structural Concrete, or a Prepackaged Concrete Mix from the Department's Qualified Products List (QPL).

All conduit ends shall be capped with conduit caps until wiring has begun.

All conduit shall be sealed to prevent rodent ingress after cables have been installed. Any blocking material shall be removable without use of tools.

The size and type of conduit required will be noted in the Contract Documents, except that the minimum size of conduit risers required for traffic signal installations shall be determined by percentage fill in a single conduit, as

specified in the latest revision of the NEC. Where more than one conduit is required to be installed in the same location, the conduits may be placed in the same trench.

The weather head on conduit risers on Utility Company poles shall not be less than 1 ft from any utility wires. Conduit risers on Utility Company poles shall be located as required by the Utility Company.

Within 10 Days after completion of each section of conduit, the Contractor, in the presence of the Resident, shall rod and pull through each duct a mandrel and brush of a pattern satisfactory to the Resident, but which shall not be more than $\frac{1}{8}$ " smaller than the bore of the ducts. Where obstructions in the ducts prevent passage of the mandrel, the Contractor shall, at their own expense, remove and relay those portions of the ducts necessary to clear the obstruction.

The Contractor shall install a suitable nylon pulling string with a rated 210 lb tensile strength in all unused conduits. The ends of the string shall be secured in such manner as to prevent accidental withdrawal of the string.

626.032 ***Metallic Conduit Installation*** - Conduits shall be of the sizes noted in the Contract Documents, which are indicated as the nominal inside diameter. All conduits shall be joined with threaded couplings using approved thread sealant. Conduit shall be installed so that it is continuous and watertight between boxes or equipment. Running threads will not be permitted. When necessary, the Contractor shall use an approved electrical union-type coupling. Conduits shall be protected at all times from the entrance of water or other foreign matter. Conduit runs shall be made with as few couplings as standard lengths will permit. The total angle of all bends in one run and the radius of conduit bends shall conform to the NEC requirements. All field bends and offsets shall be made with approved hickey or conduit benders. Pull boxes shall be used wherever necessary to facilitate the installation of the wires.

In making up a run of conduits, all cut ends shall be reamed to remove rough edges and cut threads shall be painted with an approved thread sealant in such a manner that there will be no unprotected surfaces and joints will

be watertight. All conduits shall have electrical continuity and shall be adequately grounded.

Conduits to be placed in the superstructure of bridges and similar structures shall be securely supported and fastened, in order to maintain the conduits' position within the superstructure, as shown in the Contract Documents. Pull boxes shall be located as shown in the Contract Documents. Clearance between conduit runs shall preferably be 2", but at no time shall be less than the maximum size of the aggregate used in the embedding concrete. At all joints where relative movement between adjacent parts of a structure can occur, a double "O"-ring expansion coupling, or other approved expansion device shall be installed.

Exposed conduit shall be rigidly and securely fastened with acceptable fasteners or supports, as indicated in the Contract Documents or approved. Fasteners or supports shall not be placed more than 6 ft apart on centers, except as otherwise authorized. Conduits shall generally be supported by an approved spacer at the point of support, so that there is an air space between the conduit and the supporting surface. Ends of conduit runs terminating in a metallic box without a threaded hub shall be provided with a metallic locknut on the outside of the box, and a metallic locknut and insulated bushings on the inside. A lock washer and a galvanized steel flat washer shall be installed between the outside locknut and face of the box.

626.033

Polyvinylchloride Conduit Installation -

Polyvinylchloride conduit and High Density Polyethylene, hereafter called PVC conduit, shall be installed in accordance with the applicable methods as specified in Section 626.032 for metallic conduits. In addition, PVC conduit used for Electrical Supply Lines and Services constructed as underground service connections in trenches and carrying Secondary Utility Power to a MaineDOT meter and breaker panel, or, directly to MaineDOT traffic signalization control cabinets or lighting breaker boxes shall be concrete encased. When trenchless technologies are used to install PVC conduit, concrete encasement shall not be required.

Concrete encasement shall consist of a minimum of 4" of concrete above, below and on both sides of the conduit that shall have a minimum compressive strength of 3000

psi and a maximum aggregate size of 1" (Fill Class concrete). The concrete encasement may be backfilled no sooner than 24 hours after placement.

Non-Metallic Under Pavement Conduit Installation -

Where noted in the Contract Documents, non-metallic under pavement conduit of schedule 80 or greater rating shall be provided to facilitate conduit crossing of the existing highway and ramps without disruption to the existing highway and ramp pavement surface. The non-metallic under pavement conduit shall be hydraulically jacked or directional bored below the highway and ramp at a depth of not less than (36"). Under pavement conduit shall extend for a distance of (10 ft) beyond the highway or ramp edge at each side.

PVC conduit shall be made watertight by joining with solvent or in accordance with the manufacturer's specifications.

Conduit shall be bent carefully to avoid damage and without the use of an open flame. Bends sharper than 45° [$\frac{1}{8}$ bend] will not be permitted in PVC conduit. The total angle of all bends in one run and the radius of bends shall conform to the NEC requirements.

Conduits to be placed in the superstructure of bridges and similar structures shall be securely supported and fastened, in order to maintain the conduits' position within the superstructure, as shown in the Contract Documents. Pull boxes shall be located as shown in the Contract Documents. Clearance between conduit runs shall preferably be 2", but at no time shall be less than the maximum size of the aggregate used in the embedding concrete. At all joints where relative movement between adjacent parts of a structure can occur, a double "O"-ring expansion coupling, or other approved expansion device shall be installed.

To allow for expansion and contraction of PVC conduit during installation of long runs, one end shall be left unconnected or a double "O"-ring expansion coupling shall be inserted near one end of the run until final covering of the conduit is in progress.

Where PVC conduit runs are placed parallel to other conduit runs or cross one over another, they shall be separated by a minimum of 3" of sand or soil cushion. The

bottom of trenches for PVC conduit shall be lined with a 6" minimum bedding of tamped sand or soil before laying the conduit. Backfill to a compacted depth of 6" above the top of the conduit shall be sand or soil, free from rocks or hard lumps.

No aluminum wire shall be allowed underground. No pre-wired conduit shall be allowed. Conduit and wire sizes shall be as shown in the Contract Documents.

626.034 **Concrete Foundations** - The Department has completed an appropriate test boring program to characterize the subsurface conditions in the general vicinity of proposed foundations for highway lighting, traffic signals, and highway signing foundations. The associated boring log(s), as well as foundation type and size and any other foundation-specific details and information, as designed by the Department, are provided in the Contract Documents. The Contractor shall construct the foundation(s) as shown in the Contract Documents and in accordance with these Specifications, unless otherwise directed by the Resident. Alternate foundations to those designed by the Department and shown in the Contract Documents will not be permitted unless directed by the Department.

Foundations shall consist of cast-in-place, reinforced concrete, drilled shafts in soil or bedrock unless another foundation type (i.e., grouted, rock-anchored foundations; spread footings; or Special Foundations) is specified in the Contract Documents. Reinforcing shall be as specified in the Contract Documents. Precast foundations shall not be allowed except as specified in Section 626.036. Special Foundations shall only be permitted if designated by the Department.

Design computations for the Contractor's design of the above-grade components of the highway lighting, traffic signals, and highway signing structure(s) shall be submitted to the Department and shall include the actual loads (bending moment, shear force, torsion and axial load) at the top of each foundation. These actual loads at the top of each foundation will be used by the Department to check the efficacy of the foundation design shown in the Contract Documents. The Contractor shall not commence foundation construction prior to receiving approval from the Department.

All unsuitable material (including but not limited to peat, organic material, and material that has been disturbed and/or dumped) within the limits of a foundation shall be removed to the minimum limits directed by the Resident. Foundation depths shall be increased as directed by the Department to account for the unsuitable material. Unsuitable material removed from below subgrade for spread footing foundations shall be replaced with compacted material as set forth below for foundation backfill.

In areas where bedrock is encountered above the proposed bottom of the foundation, the Contractor shall notify the Resident and the Department will determine whether:

1. the bedrock should be removed and the foundation should be constructed at the design depth shown in the Contract Documents, or
2. the foundation should be constructed using a grouted, rock-anchored foundation system or spread footing. If an alternative grouted, rock-anchored foundation system or spread footing foundation design is required due to shallow bedrock it will be provided by the Department.

Drilled shaft foundation holes, except in bedrock, shall be excavated by auger method to the neat line of the outside dimensions of the shaft without disturbing the soil around or below the proposed shaft. Drilled shafts in bedrock shall be excavated by standard rock drilling method. Drilled shafts shall not be permanently cased except for the top 3.0 ft or as otherwise shown in the Contract Documents. Concrete shall be tremie poured directly against the surrounding soil and/or bedrock. Spread footings shall be founded at least 5.0 ft below the lowest surrounding proposed finished grade for frost protection. The 5.0 ft embedment for spread footings constructed on cleaned bedrock is waived. If soil conditions differ materially from those described on the boring logs, the Contractor shall stop work on that foundation and contact the Resident.

Concrete for drilled shafts shall be placed (via tremie methods) as soon after excavation as practicable to prevent debris from collecting in the excavated area. The

Contractor shall provide temporary dewatering of excavations for foundations such that concrete is placed in the dry. Concrete for drilled shafts shall be placed in accordance with Section 502.10 as temporary casing is withdrawn to prevent debris from contaminating the foundation and to ensure concrete is cast against the surrounding soil. At all times, the level of the concrete inside the temporary casing shall be above the bottom of the casing.

Grout used for rock-anchored foundations shall be non-shrink grout included on the MaineDOT Qualified Product List (QPL) and approved by the Resident.

Backfill for spread footing foundations shall be Gravel Borrow meeting the requirements of Section 703.20 - Gravel Borrow. Gravel Borrow shall be placed in layers not exceeding 8" in depth before compaction (i.e., loose lifts). Each layer of backfill shall be thoroughly compacted to at least 95% of the material's maximum dry density as measured in the field by an approved method using a calibrated nuclear device. All backfilling and compacting shall be in accordance with the applicable provisions of Section 206 – Structural Excavation.

Before placing concrete, the required elbows of entrance conduits, reinforcing steel and anchor bolts shall be carefully positioned. The anchor bolt size and the bolt circle diameter shall be determined from data furnished by the supplier of the above-grade components of the highway lighting, traffic signals, and highway signing structure(s) or as shown in the Contract Documents. Anchor bolts for use with breakaway couplings, longitudinally grooved-type, shall be 1" diameter and shall Project between 2½ and 3" above the top of the foundation. All other anchor bolts shall be a minimum of 1" diameter and shall Project sufficiently to accommodate the thickness of the base plus all nuts and washers. The bolt length shall also be sufficient to allow clearances of approximately ½" below the leveling nut and ¼" above the top nut. At least two threads on each anchor bolt shall Project beyond the outside of the nuts holding the plumbed pole.

All foundations shall be warrantied against leaning and corrosion for 2 years after the Project is completed. If the lean is greater than 2° from normal or the foundation is

spalling within the first 2 years, the Contractor shall replace the foundation at no extra cost.

The finished ground at each foundation shall be graded flush with the top of the foundation except at locations where the foundation is protected by guardrail, by curb, or is outside the clear zone in which case the foundation shall have a 3" reveal. If required, approved backfill material shall be added to grade the slopes as specified. There will be no additional compensation for furnishing, placing and compacting material flush around the foundation. In all cases, the surface area around the foundations shall be graded to drain away from the foundation and loamed and seeded in accordance with the requirements of Section 615 and Section 618.

The concrete portion of the foundations exposed to view shall have a troweled finish. A drainage groove shall be formed in the horizontal surface of the foundation. The top of the concrete foundation shall be horizontal.

The above ground portion of concrete foundation surfaces shall receive an application of Type 1c penetrating silane concrete sealer from the MaineDOT QPL. The application rate and method of application shall be in accordance with the manufacturer's published recommendations. On surfaces to be treated, all voids shall be filled with mortar and the entire surface shall be dressed by dry rubbing to remove marks and blemishes to present a neat appearance. The silane application shall not be done until a minimum of 14 Days after casting and the surfaces shall be free of laitance, oil, grease, dirt, dust, curing compound or any other deleterious material. The temperature of the concrete shall be above 40°F and below 90°F at the time of application, or per the manufacturer's published recommendations.

When the anchor bolt template is removed, the threads of the anchor bolts shall be greased and protected with a metal sleeve, held in position with nuts and washers to be furnished with the bolts. This thread protection shall remain in place until the pole or other equipment is installed.

A copper-clad steel ground rod shall be installed when shown in the Contract Documents.

626.035 ***Foundations to be Modified or Removed*** - Concrete foundations designated to be modified or removed shall be modified or removed as shown in the Contract Documents. Debris resulting from the modification or removal shall be removed from the Project. Once removal has been completed, the area shall be brought to grade by addition of granular material and loam, or by loam only, depending on the extent of modification or removal as directed by the Resident. The area shall then be seeded in accordance with Section 618.

626.036 ***Precast Foundations*** - In the absence of foundation type and size and any other foundation-specific details and information, as designed by the Department, provided in the Contract Documents, precast foundations will be permitted for 18 and 24" diameter foundations for structures less than 30 ft tall with no Projecting arms. No foundation design will be required for precast 18 and 24" diameter foundations for structures less than 30 ft tall with no Projecting arms. A foundation design prepared by a Professional Engineer licensed in the State of Maine will be required for all other foundations. Where precast foundations are permitted flowable concrete fill shall be used as backfill in the annular space and placed from the bottom up. Construction of precast foundations shall conform to the Standard Details and all requirements of Standard Specification Section 534 - Precast Structural Concrete, except that dimensional tolerances shall be in conformance with the applicable referenced specification or the established industry standards for the product being produced. Concrete shall be Class P1.

The construction requirements of Section 626.034 apply to precast foundations used by the Contractor and their Subcontractor(s).

626.04 ***Method of Measurement*** - Precast Concrete Junction Box, and Remove or Modify Concrete Foundation will be measured by each unit.

All conduit will be measured by the number of linear feet.

Drilled shaft foundations in soil, bedrock, or anchored to bedrock will be measured by Linear Foot. Spread footing foundations will be measured by cubic yard. Grouted, rock-anchored foundations will be measured by cubic yard. Modified or removed concrete foundations will be measured by Each unit. Special Foundations will be measured by Each unit.

The quantity of structural earth excavation to be measured for payment below grade will be the amount actually excavated from 1 ft below the bottom of the foundation to the required foundation bottom elevation, provided the maximum allowable horizontal dimensions do not exceed those bounded by vertical surfaces 9" each side of the installation, as shown in the Contract Documents. The quantity of structural rock excavation to be measured for payment will be the number of cubic yards actually removed, provided the maximum allowable horizontal dimensions do not exceed those bounded by vertical surfaces specified herein.

- 626.05 ***Basis of Payment*** - The accepted quantity and/or volume of foundations will be paid for at the Contract Unit Price for each type of foundation. This payment shall include: all excavation, bedrock removal, unsuitable soil excavation, concrete, anchor bolts, reinforcing steel, conduit within the foundation and extending 12" from the foundation, backfill, loam, seeding, mulching and all labor, equipment, and materials, necessary to complete the work. If a design is required by the Contractor, payment shall include the test boring(s), structural, and geotechnical design.

The accepted quantity of junction boxes will be paid for at the Contract Unit Price Each. Payment for junction boxes shall include furnishing and installing precast concrete or bituminized fiber boxes as designated, including that portion of conduit extending 12" outside the box.

Excavating and backfilling for junction boxes, foundations, and excavating, backfilling and sand bedding for conduit ducts will be considered incidental in the respective Contract Unit Prices and no separate payment will be made, except as hereafter provided.

Excavating and backfilling as shown in the Contract Documents, or as required to overcome soft or otherwise unsuitable material, or for excavating rock will be paid for as provided in Section 206. Required backfill material, except sand bedding as shown on the detail Plan, will be paid for as provided in Section 304.

Payment will be made for the total number of linear feet of prewired conduit actually furnished, installed, and accepted at the Contract Price per Linear Foot. This price shall include the cost of hand digging, trenching, or plowing; furnishing and installing the prewired conduit; and all labor, equipment and incidentals necessary to complete the work.

The accepted quantity of ground mounted cabinet foundations will be paid for at the Contract Unit Price Each, which payment shall include conduit within the foundation and extending 12" from the foundation and for loam, seeding, mulching and all incidentals necessary to complete the work.

The accepted quantity of Remove or Modify Concrete Foundations will be paid for at the Contract Unit Price Each. Such price shall include disposing of concrete removed, backfilling with granular material, loaming, seeding, and all incidentals necessary to complete the work.

Payment for restoration of roadway pavement, sidewalks, grass areas and resetting curbing removed in conjunction with this work shall be considered incidental to the respective Contract Unit Prices for each related item except as otherwise provided.

Payment will be made for the total number of linear feet of under pavement conduit actually furnished, installed and accepted at the Contract Price per Linear Foot. This price shall include the cost of: furnishing and installing the conduit; excavating; furnishing special backfilling materials, pull wire, fittings, grounding and bonding; test cleaning interiors of conduits and all materials, labor, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
626.11	Precast Concrete Junction Box	Each
626.21	Metallic Conduit	Linear Foot
626.22	Non-metallic Conduit	Linear Foot
626.221	Non-metallic Conduit, Concrete Encased	Linear Foot
626.251	Non-Metallic Under Pavement Conduit	
	(Schedule 80 or greater rating)	Linear Foot
626.35	Controller Cabinet Foundation	Each
626.36	Remove or Modify Concrete Foundation	Each
626.37	Special Foundation	Each
626.38	Ground Mounted Cabinet Foundation	Each
626.411	18" Diameter Foundation	Linear Foot
626.421	24" Diameter Foundation	Linear Foot
626.43	30" Diameter Foundation	Linear Foot
626.44	36" Diameter Foundation	Linear Foot
626.451	42" Diameter Foundation	Linear Foot
626.46	48" Diameter Foundation	Linear Foot
626.47	54" Diameter Foundation	Linear Foot
626.48	60" Diameter Foundation	Linear Foot
626.501	Spread Footing Foundation	Cubic Yard
626.60	Grouted, Rock-Anchored Foundation	Cubic Yard

SECTION 627 - PAVEMENT MARKINGS

- 627.01 **Description** - This work shall consist of furnishing and placing reflectorized pavement lines and markings, removing pavement lines and markings, and furnishing and applying reflectorized paint to curb in reasonably close conformity with the Plans and as designated.
- 627.02 **Materials** - Materials shall conform to the requirements specified in the following Sections of Division 700 - Materials. The pavement marking material

used shall be from the Department's QPL and shall have been tested through AASHTO Product Evaluation & Audit Solutions.

Pavement Marking Paint	708.03
Reflectorized Plastic Pavement Marking	712.05

Temporary Bi-directional Yellow Delineators shall be Temporary Object Markers (T.O.M.) as manufactured by the Davidson Plastic Company, 18726 East Valley Highway, Kent, WA 98031 or an approved equal.

When pavement marking paint must be applied on pavement with an air temperature between 35°F and 50°F, a low temperature waterborne paint may be used upon the Department's approval as noted below. The Contractor shall submit the following information for Department review and approval at least 10 Calendar Days prior to application:

- The manufacturer and product name of the low temperature waterborne paint;
- The manufacturer's technical product data sheets;
- The product's SDS sheets;
- All required and recommended application specifications for the product;
- The manufacturer's requirements for temperature, surface preparation, paint thickness and the bead application shall be followed. No additional payment will be made for the use of low temperature waterborne paint.

627.04 **General** - All pavement lines and markings shall be applied in accordance with the latest edition of the Manual on Uniform Traffic Control Devices.

Longitudinal lines placed on tangent roadway segments shall be straight and true. Longitudinal lines placed on curves shall be continuous smoothly curved lines consistent with the roadway alignment. All pavement markings placed shall meet the tolerance limits included in the Contract Documents.

Unless otherwise shown on the Plans, non-interstate lines shall be 4" wide and broken lines shall consist of alternate 10 ft painted line segments and 30 ft gaps. On controlled access divided highways and on the interstate system lines shall be 6" wide and broken lines shall consist of alternate 15 ft painted line segments and 25 ft gaps. Width tolerance shall be +/- ¼".

Temporary pavement marking lines will be applied as many times as necessary to properly delineate traffic lanes for the safe passage of traffic. Bi-directional delineators may be used in place of temporary lines if allowed by the Resident. Delineators will be applied at 40 ft intervals.

In overnight lane closure areas that are not to be overlaid, temporary plastic lines or temporary bi-directional delineators shall be used through the length of the taper.

Newly painted lines, markings and curb shall be protected from traffic using cones, drums, lane closures or other approved methods until the paint is dry.

- 627.05 **Preparation of Surface** - Immediately before applying the pavement marking paint to the pavement or curb, the surface shall be dry and entirely free from dirt, grease, oil, or other foreign matter.

Surface preparation for application of plastic markings shall conform to the manufacturer's recommendations.

- 627.06 **Application** - Prior to applying paint for final pavement lines, the Contractor shall perform a test for paint thickness by furnishing and placing a piece of smooth, clean metal with an area of at least 144 in² in the path of the striping truck. The striping truck shall be passed over the piece of metal, painting the surface as it passes, without applying beads. The result of this test will be used to determine the pressure setting and speed of the truck when applying paint to obtain the specified thickness. Additional paint thickness testing may be required on the final paint markings. The wet thickness of paint without beads on final pavement lines shall be a minimum of 16 mils.

On other final pavement markings and on curb, where the paint is applied by hand painting or spraying, application shall be one uniform covering coat at least 16 mils thick. Before the paint has dried, the glass beads shall be applied by a pressure system that will force the glass beads onto the undried paint as uniformly as possible.

Painted lines and markings shall be applied in accordance with the manufacturer's published recommendations. These recommendations will be supplied to the Resident prior to installation.

Glass beads shall be applied to the final and temporary pavement lines, marking and curb at a sufficient rate and in sufficient quantity to assure complete and uniform coverage of hand painted surfaces and achieve proper reflectivity.

Permanent and temporary white lines and markings shall have a minimum final reflectivity value of 250 millicandelas per square meter per lux (mcd/m²/lux) and permanent and temporary yellow lines and markings shall have a minimum final reflectivity value of 150 millicandelas per square meter per lux (mcd/m²/lux), as measured by the Department. Measurements taken to determine reflectivity shall be done within 4 weeks after final placement.

The final reflectivity will be acceptable if 90% or more of the painted pavement lines and markings meet the specified minimum value. If less than 90% of the painted pavement lines and markings meet the specified minimum final reflectivity values, the Contractor shall repaint those areas not meeting required reflectivity at no cost to the Department.

If, after repainting, analysis of the final reflectivity values results in the need for a second repainting, the Contractor will submit in writing a plan of action to meet the reflectivity minimums prior to continuing any work. Once the plan has been

reviewed and approved by the Department, the Contractor shall reapply at no cost to the Department.

Temporary painted lines and markings shall be applied as specified for permanent painted lines.

The plastic final pavement lines and markings shall be applied in accordance with the manufacturer's recommendations by the inlay method of application.

- 627.07 ***Establishment Period*** - Inlaid plastic pavement lines and marking material furnished and installed under this Contract for final pavement markings shall still be subject to a 6 month period of establishment.

The period of establishment shall commence as soon as the plastic pavement lines and markings are complete and in place and shall continue for 6 months. At the end of the establishment period, a minimum of 95% of the plastic pavement lines and markings shall be remaining to be acceptable.

If less than 95% of the plastic pavement lines and markings are in place after 6 months, the Contractor shall replace all unsatisfactory plastic pavement lines and markings on the Project without additional payment. Plastic pavement lines and markings designated for replacement shall be installed according to these specifications, unless otherwise directed. Plastic pavement lines and markings replaced at the end of the 6 month establishment period will not be subject to a further establishment period.

- 627.08 ***Removing Lines and Markings*** - When it is necessary to remove pavement lines and markings, it shall be done by high pressure water, grinding or other approved acceptable means. The method chosen must be capable of completely eradicating the existing line or marking without excessive damage to the pavement. Burning or using solvents to remove temporary markings from final pavement or from existing pavement not to be resurfaced will not be permitted.

- 627.09 ***Method of Measurement*** – For the quantity of pavement marking lines identified in the Contract as a plan quantity pay item, the measurement for payment will be the number of feet shown in the Schedule of Items. This quantity will be considered final, and no adjustments will be made except when changes resulting in increases or decreases are made by the Resident.

The quantity of temporary or permanent pavement marking lines when identified in the Contract as being paid for by the linear foot shall be measured by the actual length of painted line, as further described below.

Double yellow centerline, broken or solid, will be considered one line for measurement purposes. The measurement of broken lines will include the gaps when painted and will not include the gaps when plastic. Double Yellow Centerline, broken or solid shall not be applied through intersections or side roads and will be measured by the actual length of painted line.

Broken white lines will include the gaps when painted and will not include the gaps when plastic inlaid pavement lines are applied. Yellow or white solid edge lines shall not be applied through intersections or side roads and will be measured by the actual length of painted line.

Temporary pavement marking lines shall not be applied through intersections or side roads and will be measured by the actual length of painted line.

Reflectorized curb will be measured or computed by the square foot of curb surface actually painted and reflectorized.

The accepted quantity of removing existing pavement markings will be measured by the square foot.

Temporary Bi-directional Yellow Delineators will be measured by each unit.

627.10 **Basis of Payment** - The accepted quantity of pavement marking lines identified in the Contract as a plan quantity pay item will be paid for at the Contract unit price for plan quantity. No adjustment will be made to the quantity for payment, except as described in Section 627.09 - Method of Measurement.

The accepted quantity of permanent or temporary pavement marking lines identified in the Contract as being paid for by the linear foot will be measured for payment as described under Section 627.09 - Method of Measurement.

The accepted quantity of re-striping of temporary pavement marking lines will be measured as described under Section 627.06 - Method of Measurement, and will be paid for by the linear foot. The frequency of re-striping of temporary pavement marking lines will be as authorized by the Resident.

All other permanent pavement markings will be paid for at the Contract unit price per square foot in accordance with Section 627.09 - Method of Measurement.

Payment for final plastic pavement lines and markings will be made in two parts. The first payment of 75% will be made when plastic pavement lines and markings are placed. The payment of the remaining 25% will be made at the end of the establishment period for all plastic line and pavement markings accepted.

The accepted quantity of any pavement marking lines will be paid for at the Contract unit price and will include as many applications as required and removal when required.

The accepted quantity of Temporary Bi-directional Yellow Delineators will be paid for at the Contract unit price, complete, in place, and maintained.

Payment will be made under:

Pay Item		Pay Unit
627.18	12" Solid White Pavement Marking Line	Linear Foot
627.711	White or Yellow Pavement Marking Line - Plan Quantity	Linear Foot
627.733	4" White or Yellow Painted Pavement Marking Line	Linear Foot
627.744	6" White or Yellow Painted Pavement Marking Line	Linear Foot
627.75	White or Yellow Pavement & Curb Marking	Square Foot
627.77	Removing Existing Pavement Marking	Square Foot
627.78	Temporary 4" Painted Pavement Marking Line, White or Yellow	Linear Foot
627.781	Temporary 6" Painted Pavement Marking Line, White or Yellow	Linear Foot
627.407	Reflectorized Plastic, White or Yellow Pavement Marking	Square Foot
627.4071	Reflectorized Plastic, White or Yellow Pavement Marking Line - Plan Quantity	Linear Foot
627.811	Temporary Bi-directional Yellow Delineators	Each

SECTION 628 - Vacant

SECTION 629 - HAND LABOR

629.01 **Description** - This work shall consist of furnishing and supervising laborers when authorized or directed by the Resident in accordance with these specifications.

629.02 **General** - Work under this section shall require no special skill but shall be accomplished in a competent manner. The personnel shall be physically and mentally capable of efficiently performing the assigned duties.

Nothing in this section shall be construed to relieve the Contractor of their responsibility for furnishing personnel under other Contract items. The intent is that this item shall be used to perform necessary work not covered or provided for under existing Contract items or other sections of the specifications.

629.03 **Method of Measurement** - Hand labor will be measured by the hours of work actually performed, measured to the nearest ¼ hour.

629.04 **Basis of Payment** - The accepted quantities of labor will be paid for at the Contract unit price per hour

The Contract unit price shall be full compensation for hiring, transporting, supervising, payment of workmen's compensation, social security taxes, unemployment insurance, overtime, benefits and for all hand tools, protective clothing and all incidentals necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
629.05	Hand Labor, Straight Time	Hour

SECTION 630 – Vacant

SECTION 631 - EQUIPMENT RENTAL

- 631.01 **Description** - This work shall consist of furnishing and operating construction equipment as directed by the Resident.
- 631.02 **General** - Equipment used for work under this section shall conform to the following minimum sets of requirements (Table continues on next page):

Equipment - Description	Minimum Size
Air Compressor - Gasoline or diesel powered unit with compressor, receiver and adequate air hose	85 ft ³ per minute at 100 psi
Air Tool - Single compressed air hand drill, driven tamper, hammer, chipper, or pavement breaker	
All Purpose Excavator - Approved truck, mounted type class	3 ton capacity lifting at 15 ft radius
Heavy Duty Purpose Excavator - Approved truck, mounted type class	7 ton capacity lifting at 15 ft radius
Mini All Purpose Excavator - Approved truck, mounted type class	89 hp; 27,100 operating weight, 0.5 to 1.0 yd ³ rated capacity
Mini-All Purpose Excavator - Track mounted	89 hp; 27,100 operating weight, 0.5 to 1.0 yd ³ rated capacity
Bulldozer - Crawler or pneumatic tired tractor with pushing blade	93 hp (flywheel), Weight(tractor) 8.75 ton
Small Bulldozer -Crawler with pushing blade	30 hp
Skid Steer – Pneumatic tired with push blade	46 hp
Chain Saw - Gasoline or electric powered with endless chain type blade	18" cutting blade
Culvert Cleaner - Water Jet nozzle, pump and tank	35 gal per minute at 1,250 psi
Front End Loader - Front end scoop mounted on pneumatic tires	2 cy rated capacity
Small Front End Loader - Front end scoop mounted on crawler or pneumatic tires	6 ft ³ minimum rated capacity
Grader - Tandem drive	7 ton

Road Broom - Engine driven rotary broom	7 ft broom
Roller (earth or base course) - Self-propelled pneumatic tire type	Gross weight 2,500 lb/ft of rolling width. 40" width. Tire ground pressure 65 psi.
Roller (pavement) - Self-propelled pneumatic minimum, 7 wheels	Gross weight 28 ton. 12" by 24" smooth tread tires capable of 110 psi inflation pressure; pressure fully ballasted wheel loads = 8,000 lb or more.
Brush Chipper – Disk Style	30" diameter disk
Rototiller - Rotary cultivator mounted on pneumatic tired tractor	25 hp
Stump Chipper - Gasoline powered stump chipping machine	60 hp
Truck, small - Pneumatic tired with dump body rated capacity	5 cy to 8 cy manufacturers rating
Truck, large - Pneumatic tired with dump body rated capacity	8 cy or greater manufacturers rated
Tractor Mounted Hydraulic Hammer - Hydraulic hammer to be mounted on a Heavy Duty All Purpose Excavator	2.5 Ton minimum weight, 0.5 ft minimum hammer Dia., 8,000 ft-lb minimum impact energy

- 631.03 **General** - Nothing in this section shall be construed to relieve the Contractor of the responsibility for completing work under other Contract items. These items shall be used to perform only such work as directed by the Resident.
- 631.05 **Grading** - All grading shall be done in a manner to leave the area smooth and suitable for machine mowing and to provide proper drainage or as otherwise directed by the Resident. Suitable excavated material shall be placed and compacted on embankment slopes or other areas as directed. Unsuitable material shall be disposed of in approved waste areas.
- 631.06 **Rolling** - All material under this item shall be compacted to the satisfaction of the Resident. Only those portions of roadway designated for rolling shall be rolled. The work shall be performed under such conditions that maximum compaction can be obtained.
- 631.07 **Method of Measurement** - Equipment rental will be measured by the hour to the nearest ¼ hour. Time spent moving to and from the site within the Project limits and from beyond the Project limits, servicing, maintaining, and changing attachments will not be measured for payment.

Supervision required in the performance of hourly equipment rental work will be measured for payment only when called for on the Plans. This item does not relieve the Contractor of the responsibility to supervise other Contract items. Foreman will be measured by the hour to the nearest ¼ hour of time actually spent supervising operators of hourly equipment rental pay items. The name of the supervisor will be supplied to the Resident.

631.08 **Basis of Payment** - The accepted quantities of equipment rental will be paid for at the Contract unit price per hour for each type of equipment used. Payment shall include operators, fuel, grease, oil, and other incidentals necessary to operate the equipment.

No separate payment will be made to direct work done under these items, except when called for on the Plans. Payment will then be made under Pay Item 631.36. Payment made will be limited to the grade of foreman and limited to hours spent in actually supervising equipment operators. Such related costs as use of pickup truck, meal and room expenses, benefits, insurance, retirement, travel time, and overtime will not be paid for separately but will be considered incidental to the unit price bid for this pay item.

Payment for equipment rental will be based on experienced operators, familiar with the work being performed. Operators, determined to be below normal acceptable standards of production or workmanship, will be paid for at reduced hours as determined by the Resident.

Payment will be made under (Table continues on next page):

Pay Item		Pay Unit
631.10	Air Compressor (including operator)	Hour
631.11	Air Tool (including operator)	Hour
631.111	Tractor Mounted Hydraulic Hammer	Hour
631.12	All Purpose Excavator (including operator)	Hour
631.121	Heavy Duty All Purpose Excavator (including operator)	Hour
631.122	Mini All Purpose Excavator (including operator)	Hour
631.13	Bulldozer (including operator)	Hour
631.131	Small Bulldozer - Grader (including operator)	Hour
631.132	Small Bulldozer (including operator)	Hour
631.133	Skid Steer (including operator)	Hour
631.14	Grader (including operator)	Hour
631.15	Roller, earth and base (including operator)	Hour
631.16	Roller, Pavement (including operator)	Hour
631.171	Truck-small (including operator)	Hour
631.172	Truck-large (including operator)	Hour
631.18	Chain Saw Rental (including operator)	Hour
631.20	Stump Chipper Rental (including operator)	Hour

631.21	Road Broom (including operators and hauler)	Hour
631.22	Front End Loader (including operator)	Hour
631.221	Small Front End Loader (including operator)	Hour
631.28	Brush Chipper (including operator)	Hour
631.29	Rototiller (including operator)	Hour
631.32	Culvert Cleaner (including operators)	Hour
631.36	Foreman	Hour

SECTION 632 - Vacant

SECTION 633 - Vacant

SECTION 634 - HIGHWAY LIGHTING

634.01 **Description** - This work shall consist of furnishing and installing a highway lighting system or modifying or removing an existing highway lighting system, including the design of Light Standards, in accordance with these specifications and in reasonably close conformity with the plans.

634.02 **General** - All material furnished by the Contractor shall be new unless otherwise specified. Substitutes for specified material may be accepted, upon approval of the Fabrication Engineer. Substitutes shall provide equal or better service. Where an existing system is to be modified, the existing material shall be removed, upgraded, or disposed of as shown on the plans or as directed.

All electrical equipment shall conform to NEMA, UL, or EIA standards, wherever applicable. In addition, all materials and workmanship shall conform to the requirements of the NEC, the local electrical Utility Company, and all local ordinances, which may apply.

634.021 **Materials** - Materials shall meet the requirements specified in the following Section of Division 700 - Materials:

Steel Conduit	715.02
Non-metallic Conduit	715.03
Prewired Conduit	715.04
Metallic Junction and Fuse Box	715.05
Secondary Wiring	715.07
Luminaires, Lamps and Ballast	715.08
Luminaires, Lamp and Ballast for High Mast Lighting	715.09
Photo Electric Control	715.10
Service Equipment	715.11
Lowering System for High Mast Lighting	715.12
Aluminum Supports	720.01

Aluminum Mast Arm and Bracket Arm	720.02
Steel Supports	720.03
Steel Mast Arm and Bracket Arm	720.04
High Mast Light Standard	720.05
Steel H-beam Poles	720.06
Anchor Bolts	720.07
Wood Ornamental Light Standard	720.09
Wood Utility Pole	720.10
Mast Arm for Wood Utility Pole	720.11
Breakaway Devices	721.01

Transformer enclosures shall conform to NESC requirements. They shall be approximately 46" high, 42" wide and 42" deep. Dimensions should be verified with the electrical Utility Company before ordering. Clearances shall be provided as required by the NESC. The enclosure shall be painted inside and outside with one coat of red iron-oxide primer and a finish coat of gray baked enamel. Doors shall be furnished with padlock lugs.

The electric portable power unit shall be a heavy-duty reversing electric motor for the voltage and frequency shown on the plans and shall have a remote control.

The following are the minimum requirements for the high mast lighting lowering system:

- Ball bearing motor
- Grounded frame
- Torque limiter
- Power unit mounting frame
- Coupling to winch drive shaft
- Remote control unit with cable
- Cable with twist lock receptacle and plug for operator of power unit

All bolts for mounting lighting fixtures under bridge structures shall conform to the requirements of ASTM A307. These bolts and other fastening hardware shall be galvanized in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695, Class 50, Type I.

Screened sand for bedding and covering direct buried cables shall meet the requirements of Section 703.22, except that there shall be 0-10% passing the No. 200 sieve.

- 634.022 ***Equipment List and Drawings*** - Unless otherwise permitted in writing, the Contractor shall submit for review a list of equipment and materials which is proposed to be furnished. The list shall include the name of manufacturer, size, and identifying number of each item and

other necessary data, including detailed scale drawings, wiring diagrams of special equipment and any proposed minor deviations from the plans. If requested, the Contractor shall submit sample articles of the material proposed for use. All of the above data except sample articles, shall be submitted in duplicate. Following checking, correction, and approval, not less than two complete sets of approved drawings shall be submitted. The Department will not be liable for material purchased, labor performed, or work delayed before such review. Where electrical equipment is to be constructed as shown on the plans, the submission of detailed drawings and diagrams will not be required.

Upon completion of the work, the Contractor shall submit three complete sets of corrected plans showing all construction changes.

634.023 **Miscellaneous Material** - Insulating tape shall be of the self-bonding type. Jacket tape shall be of the water-resisting type. Friction tape shall be rubber-impregnated, woven cotton fabric.

634.024 **Light Standards** - The terms “conventional standard” or “conventional light standard” shall mean the assembled metal base flange, transformer base or breakaway device, metal columnar shaft, metal overhanging bracket arm and incidental hardware.

The term “high mast pole” shall mean the assembled base plate flange, metal columnar shaft, luminaire tenon, mounting and lowering device and incidental hardware. For purposes of this specification, a structure shall be considered a high mast pole if the pole height, from base plate to the center of the luminaire, exceeds 55 ft.

The design, materials and fabrication of Light Standards shall meet the requirements of the current edition of AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and interims thereto, as noted below except as otherwise indicated within these specifications or on the plans.

Light Standards with a luminaire mounting height in excess of 55 ft (high mast pole) shall be designed using the following criteria:

- Basic wind speeds based on a 1,700 year mean recurrence interval
- K_z as specified in Table C3.8.4-1 (Height and Exposure Factors)
- K_d as specified in Table 3.8.5-1 (Directionality Factors)
- G as 1.14, minimum (Gust Factor)
- C_d as specified in Table 3.8.7-1 (Wind Drag Coefficients)
- Fatigue Importance Category I with V_{mean} having a range of 9 mph < $V_{\text{mean}} \leq 11$ mph.

Light Standards with a luminaire mounting height of 55 ft or less shall be designed using the following criteria:

- Basic wind speeds based on a 700 year mean recurrence interval
- K_z as specified in Table C3.8.4-1 (Height and Exposure Factors)
- K_d as specified in Table 3.8.5-1 (Directionality Factors)
- G as 1.14, minimum (Gust Factor)
- C_d as specified in Table 3.8.7-1 (Wind Drag Coefficients)
- Fatigue analysis is not required

For structural design purposes the luminaire mounting height for roadside installation is defined as the distance from the center of luminaire to the base plate bottom. For Light Standards mounted on structures and approaches to structures, the luminaire mounting height shall be defined and measured as the distance of the center of the luminaire to one of the following:

- a. **For bridges over bodies of water** - Above the prevailing water level or, in the case of tidal waters, above mean high tide.
- b. **For overpass structures** - Above the lower roadway level.
- c. **For approach ramps** - Above the average adjacent ground level, if said ground level is more than 10 ft below the base of the light standard.

The design weight of luminaires shall be 60 lb with an effective Projected area of 2.5 ft², except that pole top-mounted luminaires shall have an effective Projected area of 5.0 ft².

Light Standards mounted on a bridge structure or Light Standards fabricated with aluminum shall be equipped with an approved damping or energy-absorbing device.

Deflections of Light Standards and bracket arms shall be limited as follows:

- a. **Conventional Light Standards** - shall be able to support a 500 lb transverse load, applied at 18" below the pole top with a maximum deflection of 5% of the nominal pole length. A computer simulation or detailed computation using Service I load combination (as specified in the AASHTO LRFD Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals) establishing a maximum of 7% deflection of the nominal pole length may be used as an alternate method.

- b. **Bracket arms** - shall be able to support a horizontal load, perpendicular to the axial vector of the arm, of 50 lb and a concurrent vertical load of 100 lb, both loads applied at the luminaire tenon, without developing a measurable permanent set.
- c. **High mast Light Standards** - shall have a maximum deflection of 7% of the nominal pole length under full design load when equipped with four luminaires.

Conformance to the above deflection criteria for Light Standards, bracket arms and high mast Light Standards shall be substantiated by detailed computations or computer simulation, accompanied by written methodology, or actual tests on materials produced for delivery under a Maine Department of Transportation Contract.

The base plates of Light Standards shall have workable leveling nuts beneath and above them with flat washers against both nuts, when erected. The distance between the bottom of the base plate and top of the foundation shall not exceed twice the diameter of the anchor bolts. Grout, or other material, shall not be placed between the base plate and foundations.

Approval for deviations from the plans and/or specifications shall be requested in writing and shall be approved by the Fabrication Engineer before being incorporated in the manufacturer's drawings. Requests for substitution for all specified material shall be submitted in writing with full documentation (specifications, mill certifications, etc.) enabling the Department to evaluate the proposal.

A Certificate of Compliance shall be provided for all applicable materials noted in Section 634.021 – Materials, in accordance with the requirements of the General Statement of Division 700 - Materials. Shop certification in accordance with Section 504.04 is required.

- 634.025 **Conventional Light Standards** - After execution of the Contract for conventional Light Standard(s), and before any shop work is commenced, the Contractor shall submit for approval the manufacturer's drawings of all standards and accessories proposed to be furnished and erected under this Contract. The drawings shall be of sufficient detail to indicate material and/or dimensional conformance with these specifications and the plans. Each drawing shall contain a reference to the design criteria and certification that the design criteria have been met for the Light Standards, including bracket arms and associated hardware, fittings and breakaway devices, as submitted. A Professional Engineer licensed in accordance with the State of Maine regulations shall sign the certification under their official seal. The drawings shall use the same units as found in the Project plans.

It is the intent of these specifications that the Contractor shall be fully responsible for the adequacy of the sizes, wall thickness, materials and connections of the Light Standards, including bracket arms and associated hardware, fittings and breakaway devices. Approval of the drawings will signify only approval of the material(s), mounting heights(s) and bracket arm length(s).

- 634.026 **High Mast Light Standard** - For all high mast Light Standards, as defined in this Section, the Contractor shall submit for approval, in addition to the manufacturer's drawings, 3 sets of the design computations, including fatigue considerations consistent with AASHTO requirements. Approval of the drawings and computations will signify approval of all structurally significant details of the Light Standard and if any, the luminaire mounting and lowering device. All drawings and computations shall be signed by a Professional Engineer licensed in accordance with the State of Maine regulations. Approval will be based on the applicable provisions of Section 105.7.

The shaft shall be provided with an equipment access opening approximately 2 ft² and centered approximately 2 ft above the base. The access opening shall be reinforced to maintain the full design strength of the shaft and shall be provided with a hinged, removable, access door equipped with a vandal proof means of being locked in place. A positive means of internal grounding shall be provided inside of the access door.

All shaft sections shall be one plate thickness, except that a doubler plate may be used around the equipment access opening. The walls of polygonal shafts shall have an inside corner radius to wall thickness ratio not less than 2.

The Contractor may propose a galvanized and painted pole, in lieu of using weathering type steel. The steel shall be a base metal listed in the current edition of the AWS Structural Welding Code, D1.1. Paint color will be designated by the Fabrication Engineer. Galvanizing and surface preparation shall be in accordance with Section 504 and paint shall be a two-coat system designed for use on galvanized surfaces approved by the Engineer. The Contractor shall supply sufficient additional coating material and instructions for touchup work.

- 634.027 **Breakaway Supports** - Breakaway supports, approved by the Engineer, shall be supplied for use at all locations designated as breakaway. Breakaway Support Certification of both breakaway and structural adequacy shall be provided by the Manufacturer. Design calculations or test data of production samples to support certification shall be provided. Breakaway support components shall provide the same or greater structural strength than the support post

or pole utilizing the breakaway device. Breakaway couplings shall not be used in conjunction with transformer bases. Breakaway devices must include a reaction plate connecting all anchor bolts under the breakaway device. Poles containing conductors must contain a fusible breakaway device disconnecting all ungrounded conductors simultaneously

Breakaway devices are subject to the applicable provisions of Section 721 - Breakaway Devices.

- 634.03 **General** - The location of the roadway lighting systems and other incidental work will be shown on the plans. They are diagrammatic only, but shall be followed as closely as actual conditions at the site and the work of other Contractors will permit. As the work progresses, the drawings may be revised or supplemented by the Resident, and the Contractor shall perform the work required by such revisions or supplements without additional compensation, except as provided in Section 109.

Work shall be scheduled to assure that each highway lighting system shall be completed and ready for operation upon completion of the corresponding section of the roadway or as specified in Special Provision 107.

Before proceeding with any work under this Contract, the Contractor shall conduct continuity and insulating tests to establish the integrity of cable runs already in place. The Contractor shall report all cable faults to the Resident. In cases faults are located while Contract work is in progress and the Contractor does not report them, the Contractor will be responsible for correcting those faults without extra compensation.

- 634.031 **Foundations** - Foundations for Highway Lighting shall meet the requirements of Section 626 – Foundations, Conduit, and Junction Boxes for Highway Lighting, Traffic Signals, and Highway Lighting.

- 634.04 **Cable Installation** - The Contractor shall pull all wires through conduits without overstressing or stretching any wire or scoring, cutting, twisting or damaging the protective covering or insulation. When pulling cable into conduits, if the strain on the cables is likely to prove excessive, the Contractor shall use soapstone powder or listed cable pulling lubricant as a lubricant. Where two or more cables are to occupy the same conduit, they shall be drawn in together and kept parallel to each other by the use of a pulling head. No aluminum wire shall be installed underground for primary and secondary wiring.

Both ends of each length of cable shall be sealed to prevent the entrance of moisture during shipment or during outdoor storage. Defective and damaged cable will be rejected and shall be replaced at no cost to the State.

Secondary wiring shall be installed as shown on the plans. Secondary wiring shall not be spliced underground. Splicing shall only occur in above ground hand holes and transformer bases. The wire for secondary circuits, which is pulled

through ducts, shall be fed slack from the feed end. Secondary wiring being pulled through a junction box shall be provided with enough slack for the center of the cable to be positioned a minimum of 1 ft outside the top of the junction box

Cables in junction boxes shall be provided with enough slack for the center of the cable to be positioned a minimum of 1 ft outside the top of the junction box and shall be arranged as directed. After cables have been installed, the end of each section of cable in Light Standards and panel boxes shall be carefully sealed with DAC Heavy Duty KWIK Foam Polyurethane Sealant, Minimum Expanding or an approved equal. Sealant shall penetrate a minimum of 4" into the conduit. All wiring shall be finished to provide a neat and orderly appearance. Ends of cable not connected to any device shall be insulated and sealed.

There will be no underground splicing of power conductors.

The trench for direct-buried cable shall be excavated to the width and depth shown on the plans or as directed.

Placement of the sand bedding shall be coordinated with the installation of the cables. After the cables and screened sand have been placed, the remainder of the trench shall be promptly backfilled with selected excavated material. Surplus material shall be disposed of as directed and the surface of the trench shall be loamed and seeded in accordance with Sections 615 and 618.

When connecting sockets, outlets and other similar equipment, the most accessible bare parts of each piece of equipment shall be connected to the grounded neutral. In order to ensure this has been done, each piece of equipment shall be tested after installation, under the supervision of the Resident, with a test lamp or other instrument, one leg of which has been connected to a definite ground, or by other approved means of testing.

All cables in junction boxes and Light Standards shall be tested for circuit connections, which shall be in conformity with those indicated on the plans. After verification of circuit connections, all cables in junction boxes, light standards and service panels shall be provided with individual metal tags, die-stamped with a phase designated A or B, as applicable. The tags shall be securely attached to the cables.

Splices to form continuous circuits shall be made by the Contractor and will only be permitted in accessible above ground locations. All other splices shall be made with approved crimp-type connectors.

Conductors shall not be pulled into conduit until pull boxes are set to grade, crushed rock sumps installed, grout placed around the conduit, concrete bottom of pull boxes placed and the metallic conduit bonded.

Where roadways are to remain open to traffic and existing lighting systems are to be modified, the existing lighting system shall remain in operation and the final connection to the modified circuit shall be made so that the modified circuit will be in operation by nightfall of the same Day.

634.05 **Erecting Light Standard** - To provide continuously aligned lamp post installations, Light Standards shall be located in accordance with the details governing the spacings and setbacks shown on the plans, unless otherwise directed.

The bracket arms shall be set normal to the edge of the roadway, unless otherwise directed. The bracket shall be assembled and attached to the shaft before the light standard is erected. If it is anticipated that there will be a period in excess of 24 hours between the erection of the Light Standards and the installation of the luminaires, the Contractor shall install a weight, weighing between 50 to 75 lb, at the outboard end of each bracket arm. This weight shall be designed and fastened in such a way that it will not pose a hazard to persons or vehicles passing beneath it.

Light Standards shall be erected in a vertical position, with a maximum deviation from the vertical of $\frac{1}{4}$ " in 5 ft, using either the leveling nuts provided with the anchor bolts or the breakaway couplings. Once the Light Standard is in its final position, the top nuts shall be tightened as follows:

- a. **Anchor Bolts with Breakaway Couplings** - The manufacturer's recommendation shall be used.
- b. **Anchor Bolts without Breakaway Couplings** - the nut shall be tightened to snug tight condition by utilizing the full effort of a worker using a standard spud wrench or comparable tool. After all nuts have been brought to a snug tight condition, each nut shall be tightened an additional $\frac{1}{3}$ turn using an impact wrench, torque wrench or large crescent wrench.

A minimum of 2 bolt threads shall project beyond the outside face of the nut.

Nuts for bolts other than anchor bolts shall be tightened as outlined under b. above, for anchor bolts.

The bottom of all transformer bases shall be coated with a bitumen-mastic, epoxy paint.

When foundations and anchor bolts for Light Standards have been installed by others, the Contractor shall verify the anchor bolt dimensions at each location so that bases will be furnished with the proper bolt holes.

Wires in the shaft shall be supported with a Kellum-type, braided, strain-relief grip attached to a "J" hook mounted inside the shaft near the top.

Wood Ornamental Light Standards shall be installed as shown on the plans.

634.051 **Removing Light Standards** - Before removing Light Standards, the luminaires shall be removed from the Light Standards and disposed of as noted on the plans.

Care shall be exercised in removing and transporting the Light Standards. The Contractor will be required to replace, at their expense, all equipment damaged or destroyed by their operations.

634.052 **Portable Power Unit for Lowering Luminaires** - The number of portable electric power units with remote control required for operation of the high mast luminaire lowering system, will be 1 for every 10 high mast poles, or as shown on the plans.

634.06 **Luminaires** - Luminaires shall not be installed until the lamp socket position has been inspected and approved for conformance with the manufacturer's recommended position for the specified distribution. All luminaires shall be adjusted to produce the maximum illumination on the roadway surface and shall be full IES cutoff.

The connections between the luminaires and connector kits shall be made with single conductor, number 12 wires AWG copper stranded THHN, minimum size. A 14" long Teflon sleeve shall be placed over each end of each conductor in the luminaire.

Installation of a connector kit, fused or non-fused, shall be in accordance with the manufacturer's instructions to provide watertight connections.

634.061 **Under-Bridge Lighting** - Under-bridge lighting shall be installed in accordance with the plans and specifications, or as directed.

Circuits shall be fused in fuse boxes with 5-ampere cartridge-type, midget fuses, $\frac{3}{8}$ " diameter and 1 $\frac{1}{2}$ " long, unless otherwise indicated on the plans. Wiring connections in the under-bridge lighting units shall be made with 300°F wire.

All under bridge lighting, luminaires shall be installed and adjusted for maximum illumination of the roadway surface. The beam angle shall be adjusted as indicated on the plans.

In vehicular undercrossings, underpass lights shall be placed in operation as soon as practicable after falsework has been removed from the structure. Lighting for pedestrian structures shall be placed in operation before opening the structure to pedestrian traffic.

634.07 **Removed**

634.08 **Service** - The Contractor shall install metal conduit riser with entrance cap, entrance switch, multiple control relay, and other equipment as shown on the plans.

The lighting system will be supplied with electrical power by the local power company. The type of service will be single phase, three wire, 240/480 volt or the voltage indicated on the plans, 60 hertz, alternating current. The meter trim will include a bypass handle to allow the power company to change the meter without disconnecting the power. An external, standalone breaker capable of

shutting off the lighting control cabinet or signals will be provided to disconnect power to the control cabinet. No power shall be routed in or out of the control cabinet before this breaker. The power company will make all connections of the roadway lighting system cables at the power company's service pole. The Contractor shall notify the power company at least 2 weeks in advance of the time they intend to start construction at each of the sites and shall make all necessary arrangements with the power company for the required installation.

Roadway lighting cabinets shall be installed on stub poles with doors accessible from the roadway. All connections to equipment and terminals shall be neat and orderly conforming to the requirements specified.

Details for the fabrication and installation of service poles with cabinets and other equipment are shown on the plans.

Transformer enclosures used to protect overhead type transformers mounted on concrete pads shall be installed as shown on the plans. Transformers will be furnished by the power company.

All meter mounting devices shall be installed so that the meters will be upright (plumb). They shall be installed with the top of the meter not less than 48" nor more than 60" from the floor to the final grade. Exceptions to this height requirement will be made where special permission has been given to install group or modular metering, overall metering enclosures, or pole-mounted meters. Level grade shall be maintained for a minimum of 3 ft in front of the meter enclosure to provide a safe working space. In order to meet this requirement on uneven terrain, as an option, the Contractor may install a pressure-treated wood platform.

For any non-residential (industrial or commercial) self-contained meter socket the by-pass requirements are single phase, 100 or 150 amp, single handle lever operated.

The Contractor shall meet all requirements and regulations of Utility Companies when installing equipment on their poles and for the service connection. It is the responsibility of the Contractor to contact the appropriate Utility to determine their specific requirements.

634.081 **Bonding and Grounding** - All metal conduit ends, Light Standards, luminaires, control cabinets, and exposed noncurrent carrying metal parts of fixed equipment shall be connected to the grounding conductor. All grounding and bonding shall conform to the current provisions of the NEC.

634.09 **Testing** - Before acceptance of the work the Contractor shall cause the following tests to be made on all lighting circuits, by a licensed electrician. The tests do not need to be performed in the presence of the Resident, but the test results shall be recorded on the Highway Lighting Quality Control Check List and submitted to the Resident by the Contractor for acceptance. The form shall be signed by the

licensed electrician certifying that the highway lighting meet the requirements of section 634.09.

- a. **Continuity** - Each circuit shall be tested for continuity.
- b. **Ground** - Each circuit shall be tested for grounds.
- c. **Resistance** - The resistance to ground on non-ground conductors shall be at least five megaohm at 60°F measured with a 1,000 volt megger. The ground resistance shall not be more than 25 ohms.
- d. **Voltage** - Voltage readings shall be made at each service pole, in the load Contractor, with load and without load, and at each fixture with load.
- e. **Current** - Current readings shall be made on the load side of each load Contractor phase and neutral. Readings shall be made at night with lighting systems in normal operation.
- f. **Test Data** - Electrical test data obtained from the above tests shall be furnished in writing.
- g. **Operational Test** - The Contractor shall conduct an operational test for the completed installation under normal operating conditions. This operational test shall have a duration of not less than 2 full Days. The Resident shall be the sole authority to judge the adequacy of the length of the testing period in order to assure the satisfactory operation of the entire system or any of its sections. The work will not be accepted until the operational test has been successfully completed.
- h. **Functional Test** - With all equipment connected to the wiring system, a functional test shall be performed by the Contractor, in the presence of the Resident, to demonstrate that the system and all parts thereof function as specified. All defective materials or faulty installations shall be corrected by repairs or replacements by the Contractor to the satisfaction of the Resident at no additional cost.

Lighting circuits shall be subjected to such other tests as may be required and it shall be the responsibility of the Contractor to ascertain what tests are required and to perform these tests in the presence of the Resident. All tests shall be performed at the expense of the Contractor. Cost for power to conduct tests shall be paid by the Contractor.

634.091 **Acceptance** - All systems shall be complete and in operation to the satisfaction of the Resident at the time of acceptance of the work.

The Contractor shall be responsible for the proper performance in service, in whole or in part, of the various lighting systems and all other electrical installations furnished and installed under this Contract and shall correct, at their own expense, all deficiencies in the operation which may arise prior to acceptance of the work. The Contractor shall be responsible for the cost of power until the work is accepted.

634.092 **Method of Measurement** - Highway lighting system will be measured by the lump sum.

Light Standards will be measured by the single unit, complete in place and accepted.

The quantity of luminaires for high mast lighting will be measured by each single unit.

634.093 **Basis of Payment** - The accepted quantity of Light Standards will be paid for at the Contract unit price each for the number of units of the respective types. Payment shall be full compensation for the Light Standard and breakaway transformer base or breakaway device, bracket arm and all incidentals necessary to complete the work, including design of the Light Standards. Conduits, junction boxes, and foundations will be paid for under Section 626.

Payment for furnishing and installing luminaires for high mast lighting will be made for the accepted quantity at the Contract unit price each, which shall include luminaire, ballast, lamp, and incidentals necessary to complete the work, including design of the high mast lighting.

The accepted highway lighting system will be paid for at the Contract lump sum price for the complete lighting system shown on the plans, except that luminaires for high mast lighting and Light Standards will be paid for at the Contract unit price each.

Lump sum payment for highway lighting system shall be full compensation for furnishing, installing and erecting: ballast, lamps, wiring in underground conduit, pole wiring, and all other wiring (except prewired conduit), transformer enclosures, luminaires (except luminaires for high mast lighting), break-away devices when applicable, all identification tags, and all materials, labor, equipment, tools, miscellaneous hardware and incidentals necessary to complete the work. Payment shall also include removing and resetting light standards, installing breakaway devices on existing poles, disposing of unused light standards, as noted on the plans, and for furnishing portable electric power units.

No separate payment will be made for bonding, grounding and ground rods; these costs shall be included in the Contract price for conduit, light standards, service panels, or other items requiring bonding and grounding.

Trenching for direct buried cable will be incidental to highway lighting system and shall include excavating, furnishing and placing screened sand and backfilling.

Payment will be made under:

Pay Item		Pay Unit
634.160	Highway Lighting	Lump Sum
634.164	Luminaires for High Mast Lighting	Each
634.2041	Luminaires	Each
634.206	Light Standard for Post Top Luminaire	Each
634.207	High Mast Light Standard	Each
634.209	Wood Ornamental Light Standard	Each
634.210	Conventional Light Standard	Each

SECTION 635 - Removed

SECTION 636 - Removed

SECTION 637 - DUST CONTROL - Removed

SECTION 638 - BRIDGE LIGHTING - Reserved

SECTION 639 - ENGINEERING FACILITIES

639.01 **Description** - This work shall consist of providing, erecting, lighting, equipping and maintaining buildings to be solely used by the Resident and other assigned Department representatives as a field office. Upon completion of the work, the buildings and equipment shall remain the property of the Contractor.

639.02 **Materials** - Materials for buildings shall be of good quality customarily used in standard frame house or office trailer construction.

639.03 **General** - The building of the type called for shall be provided before the start of work, and shall remain until work is completed and accepted, unless earlier removal is authorized. The location shall be approved by the Resident and should be adjacent or virtually adjacent to the Project.

A fire extinguisher shall be provided in each building or office trailer for electrical and chemical fires and effective on all solvents used in the building.

Walls, roof, floor, windows, and doors shall be tightly constructed to the required area.

Furnishings shall be supplied as called for. Doors shall be equipped with locks and all keys shall be in the possession of the Resident. Windows shall be equipped with latches so they may be locked on the inside. Window screens and

screen doors shall be supplied when necessary. Adequate desk and desk space shall be provided. If a portable table is supplied, it should be adjustable to accommodate the various heights of employees. A 5-way adjustable office chair shall be provided in the quantities listed.

- 639.04 **Field Offices** - Field Offices are designated Type A, Type B, or Type C. Buildings, including trailers, may be provided if they substantially equal or exceed the following requirements. Air conditioning, appropriate to the building size, shall be provided in all field offices.

The walls, roof, and floor of the building shall be completely insulated with a minimum insulation value of R-15. Office trailers shall be either new or in very good used condition. The interior walls shall be covered with suitable wall paneling. The entire office trailer shall be for the exclusive use of the Resident. The office trailer shall be winterized and completely enclosed at the bottom, if the trailer will be used in cold weather.

Other types of buildings and facilities may be furnished of equal or better quality.

A public work area will be provided in the field office that shall be designed and constructed so that individuals with disabilities can approach, enter, and exit this area.

At least one accessible route to the field office shall be provided from accessible parking. The accessible route shall comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and this specification.

The minimum clear width of an accessible route shall be 36" except at doors. The least possible slope shall be used for an accessible route. An accessible route with a running slope greater than 1:20 shall be considered a ramp. Maximum ramp slope is 1:12. The maximum rise for any run of a ramp shall be 30" and the minimum clear width shall be 36". Nowhere shall the cross slope of an accessible route exceed 1:50. Changes in level up to ¼" may be vertical and without edge treatment. Changes in level between ¼" and ½" shall be beveled with a slope no greater than 1:2. Ramp floor surfaces shall be stable, firm, and slip-resistant.

Ground floor surfaces along accessible routes and in accessible rooms and spaces including floors, walks, ramps, stairs, and curb ramps, shall be stable, firm, and slip-resistant.

The main door to the public work area shall have a minimum clear opening of 32" with the door opened 90°, measured between the face of door and the opposite stop. Minimum maneuvering clearances at doors shall be provided. The floor or ground area within the required clearances shall be level and clear.

The handle and other operating devices on accessible doors shall have a shape that is easy to grasp with one hand and does not require tight grasping. Lever-operated mechanisms push type mechanisms, and U-shaped handles are

acceptable designs. Hardware required for accessible door passage shall be mounted no higher than 48" above finished floor.

A minimum of 3 parking spaces will be supplied for Class B & C Field Offices and 6 for Class A. One wheelchair accessible parking space shall be located on the shortest accessible route of travel from adjacent parking to an accessible entrance.

Level landings shall be provided at bottom and top of each run. The landing shall be at least as wide as the ramp run leading to it with a minimum length of 60".

If a ramp run has a rise greater than 6" or a horizontal Projection greater than 72", then it shall have handrails on both sides. Handrails shall have the following features:

- 1) Handrails shall be provided along both sides of ramp segments. The inside handrail on switchback ramps shall always be continuous.
- 2) If handrails are not continuous, they shall extend at least 12" beyond the top and bottom of the ramp segment and shall be parallel with the floor or ground surface.
- 3) The clear space between the handrail and the wall shall be 1½".
- 4) Gripping surfaces shall be continuous.
- 5) Top of handrail gripping surfaces shall be mounted between 34 and 38" above ramp surfaces.
- 6) Ends of handrails shall be either rounded or returned smoothly to floor, wall, or post.
- 7) Handrails shall not rotate within their fittings.
- 8) The diameter or width of the gripping surfaces of a handrail shall be 1¼ to 1½", or the shape shall provide an equivalent gripping surface.

Firm and sturdy steps shall also be provided with 7" maximum riser and 11" minimum depth, and at least one handrail extending from the top of the steps to a minimum 12" beyond the bottom of the steps.

The Contractor will make reasonable effort(s) to provide wheelchair accessible toilet facilities when "portable" facilities are provided.

The Contractor shall provide wheelchair accessible toilet facilities when flush type facilities, that is, those with running water, are provided; and the Contractor shall provide wheelchair accessible portable facilities, if used, when the Contract duration exceeds two continuous construction seasons.

In addition to the facilities previously specified in this subsection, each field office shall meet the following minimum requirements:

Description	Quantity		
	Type A	Type B	Type C
Floor Area (Outside Dimension) - ft ²	312	220	125
Inside Wall Height – ft	7	7	7
Window Area - ft ²	55	35	35
Drafting Table Surface Area - ft ²	15	15	15
Drafting Stools - each	2	1 1	
Office Desks - each	2	1	1
Ergonomic Swivel Chairs -each (5-way adjustable)	3	2	2
Folding Chairs - each	3	2	2
Lighting Units - each	4	2	2
Electric Wall Outlets - each	6	4	3
Power Strip Surge Protectors - each	3	2	1
Wall Closets - each	1	1	1
Plan Rack for minimum of 6 sets of plans	1	1	0
Toilet Facility	1	1	1
Wastebaskets - each	2	2	1

- All windows shall be provided with shades or blinds.
- The toilet facility shall be for the exclusive use of State personnel. If requested, the Contractor will supply a lock to ensure exclusive use.
- The Resident will have the option to reject any furniture or supplies provided to the field office based on general condition.
- One hundred 10 volt, 60 cycle, continuous electric service shall be supplied for lighting and 15 amp duplex wall outlets. Lighting shall consist of fluorescent light units with rapid start bulbs or LED shop style lights located over the work areas for a minimum of 50 foot-candles overall. At least one external light source will be provided.
- Drafting surfaces shall be 40" above the floor and have shelves beneath. Shelves for plans and rolls shall also be furnished overhead. Drafting stools shall be approximately 28" high.
- Desks shall be single or double pedestal standard office type, and shall be in addition to "built-in" type desks in the office trailer.
- Field offices shall be furnished with one four-drawer letter size metal filing cabinet.

- Wall closets shall be 21" wide, 15" deep, and at least 4 ft high.
- Each office shall be furnished with a broom, dustpan, sweeping compound, trash bags, and with cleaning material for cleaning glass. If the field office is carpeted, then a vacuum cleaner will be provided. The Contractor will be responsible for disposing of trash from the field office.
- The Contractor shall provide a fully functional wireless desktop copier/scanner/printer, capable of copying field books, for the Resident's use during the Project. All maintenance and supplies, except paper, shall be the responsibility of the Contractor.
- The Contractor shall provide bottled water and a microwave for the duration of the Project. All maintenance and supplies shall be the responsibility of the Contractor. Alternate source of water, such as a water cooler, may be provided as approved by resident.
- The Contractor shall provide a 4 ft³ refrigerator in the field office for the duration of the Project.
- Each office shall be furnished with a 10 person general-purpose first aid kit. The first aid kit shall be periodically inspected and refilled as necessary.

639.05 – 639.07 **Removed**

639.08 **Heat** - Heat appropriate to the building size shall be supplied by the Contractor to maintain an acceptable room temperature during occupancy.

639.09 **Telephone - Removed**

639.091 **Broadband Connection** - The Contractor will supply one computer broadband connection, modem lease and router. The router shall have wireless access and be 802.11n or newer capable. The type of connection supplied will be contingent upon the availability of services (i.e. DSL or Cable Broadband). It shall be the Contractor's option to provide dynamic or static IP addresses through the service. The selected service will have a minimum download connection of 5 Mbps and 1.0 Mbps upload. The Contractor shall be responsible for the installation charges and all reinstallation charges following suspended periods. Monthly service and maintenance charges shall be billed by the Internet Service Provider (ISP) directly to the Contractor.

639.10 **Method of Measurement** - Field office will be measured by the unit or lump sum for each building provided, equipped and maintained satisfactorily.

639.11 **Basis of Payment** - The accepted quantity of field office will be paid for at the Contract unit price each or lump sum which payment shall be full compensation for furnishing until Contract completion, erecting, equipping, maintaining,

furnishing electricity, heating, installing and maintaining toilet facilities and if necessary removing the buildings or office trailers.

Payment for these items will be made in 3 parts; the first payment of ½ to be made after the Contractor has supplied the building or office trailer and it has been approved. The remaining payments shall be made at intervals as follows:

- A second payment of ¼ shall be made when one-half of the anticipated work has been completed.
- The final payment of the remaining ¼ shall be made upon completion of the work.

Payment will be made under:

Pay Item		Pay Unit
639.18	Field Office, Type A	Each
639.19	Field Office, Type B	Each
639.20	Field Office, Type C	Each

SECTION 640 - Vacant

SECTION 641 - REST AREA FACILITIES - Reserved

SECTION 642 - STEPS

642.01 **Description** - This work shall consist of the construction of wooden steps, precast concrete steps or cast-in-place concrete steps in accordance with these specifications and in reasonably close conformity with dimensions and designs shown on the plans.

642.02 **Materials** - Materials for the steps shall meet the requirements as specified in the following Sections of Division 700 - Materials:

Exterior Ready Mixed Paint	708.01
Timber Preservative	708.05
Precast Concrete Units	712.06

Wood shall be well-seasoned spruce or pine, Number 1 dimension lumber. Nails and hardware shall be galvanized.

Precast concrete steps shall conform to the specifications of precast units except as modified herein and shall be of the dimensions detailed on the plans or as otherwise approved. Exposed surfaces shall have a rubbed finish as specified in Section 502.14-d-2.

Cast-in-place concrete steps, shall conform to the requirements of Section 502 - Structural Concrete, Class A.

642.03 **Wooden Steps** - Wooden steps shall be fabricated and fastened in accordance with standard commercial building practices.

After members have been cut to size, the ends shall be soaked in an approved timber preservative. Before assembling the steps, all contact surfaces shall be painted 2 coats of paint, color to be designated. The first coat of paint shall be thinned.

642.04 **Precast Concrete Steps** - Precast concrete steps shall be placed on a compacted gravel bed with horizontal joints level and vertical joints plumb. The foundation shall be prepared in advance of setting the steps by grading and compacting the aggregate subbase to the proper elevation. The steps shall be set with a uniform tread width to match the finish grade of the slope. All remaining excavated areas surrounding the steps shall be filled to the required grade with approved materials and thoroughly tamped.

642.05 **Cast-in-place Concrete Steps** - Cast-in-place concrete steps shall conform to the applicable requirements of Section 502 - Structural Concrete.

642.06 **Method of Measurement** - Wooden steps and precast Portland Cement concrete steps will be measured by each unit, complete in place and accepted. Cast-in-place concrete steps will be measured for payment by the cubic yard in place.

642.07 **Basis of Payment** - The accepted wooden steps will be paid for at the Contract unit price each, complete and accepted in place which price shall be full compensation for furnishing all materials, labor and other incidentals necessary to complete the work.

The accepted quantity of precast concrete steps will be paid for at the Contract unit price each, complete in place, which price shall be full compensation for furnishing and placing all materials including reinforcing steel.

Excavation and backfill will be measured and paid for as provided in Section 206 - Structural Excavation.

The accepted quantity for cast-in-place concrete steps will be paid for at the unit Contract price per cubic yard complete in place which price shall be full compensation for furnishing and placing all materials including reinforcing steel.

Payment will be made under:

Pay Item		Pay Unit
642.12	Wooden Steps	Each
642.15	Precast Concrete Steps	Each
642.17	Cast-in-place Concrete Steps	Cubic Yard

SECTION 643 - TRAFFIC SIGNALS

643.01 **Description** - This work shall consist of furnishing and installing all equipment necessary for the erection and operation of a traffic signal, including traffic signal structures, flashing beacon, temporary traffic signal or modification of a traffic signal, all in reasonably close conformity with the plans.

643.02 **General** - All equipment shall be new unless otherwise specified. Any existing signal equipment that will be retained, as noted on the plans, shall be cleaned, repainted, and reconditioned. Requests for substitution of any specified material shall be submitted in writing with all documentation (specifications, mill certifications, etc.) in order to enable the Department to evaluate the proposal. Any submitted substitute material shall give equal or better functional service than the specified material. Substitutes for specified material may be accepted upon approval by the Fabrication Engineer.

All equipment, installation of equipment, and other incidental work shall conform to the latest applicable provisions of: NEC, MUTCD, NESC, NEMA, and the ITE Standards for traffic control equipment. The meaning of specific terms shall be as defined in MUTCD, NESC, and the ITE Standards for traffic control equipment. All work shall be done to the satisfaction of the Resident.

643.021 **Materials** - Material shall meet the requirements specified in the following Sections of Division 700 - Materials:

Steel Conduit	715.02
Non-metallic Conduit	715.03
Prewired Conduit	715.04
Metallic Junction and Fuse Box	715.05
Secondary Wiring	715.07
Vehicular Signal Indications	718.01
Pedestrian Signal Indications	718.02
Signal Mounting	718.03
Vehicular Loop Detectors	718.04
Microwave Detectors	718.05
Pedestrian Detectors	718.06
Controllers	718.07
Controller Cabinet	718.08
Flasher	718.09
Program Selection	718.10
Contacts and Relays	718.11
Conductors	718.12
Non-Invasive Detection – Stop Bar	718.13
Non-Invasive Detection – Advance	718.14
Field Monitoring Unit	718.15
Aluminum Supports	720.01
Aluminum Mast Arm and Bracket Arm	720.02

Steel Supports	720.03
Steel Mast Arm and Bracket Arm	720.04
Anchor Bolts	720.07
Wood Utility Pole	720.10

MaineDOT is transitioning to MASH2016 criteria for Work Zone Traffic Control Devices on the following schedule: Temporary Traffic Control Signals will be crash tested and/or evaluated to MASH2016 criteria by January 1, 2030. Current Category 4 devices in useful serviceable condition that are successfully tested to NCHRP Report 350 or MASH2009 criteria may be utilized through December 31, 2029.

- 643.022 **Paint** - Aluminum paint shall conform to AASHTO M69, Type II. green, black, bronze, or yellow enamel paint, as indicated on the plans, shall meet or exceed the latest Federal Specification TT-E-489.

Unless otherwise indicated, all exterior parts of the following equipment shall be delivered to the project finished with enamel:

- Vehicular Signal Heads
- Pedestrian Signal Heads
- Pedestrian Push Button Detectors
- Traffic Controller Cabinets

The Contractor shall apply one coat of enamel to all existing equipment designated on the plans to be painted. The Contractor shall touch up all scratches on exposed surfaces of new equipment with matching enamel after the equipment has been installed.

All exposed signal parts to be painted shall be cleaned and shall be dry when the paint is applied. No painting shall be done in damp weather nor when the air temperature is below 40°F, unless otherwise permitted.

The Contractor shall identify recently painted equipment with "Wet Paint" signs and shall be responsible for all claims for damages resulting from contact with wet paint surfaces.

- 643.023 **Traffic Signal Structures** - The design, materials and fabrication of Traffic Signal Structures shall meet the requirements of the current edition of AASHTO "LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" and interims thereto, as noted below except as otherwise indicated within these specifications or on the plans.

All poles and mast arms shall be designed using the following criteria:

- Basic wind speeds based on a 700 year mean recurrence interval
- K_z as specified in Table C3.8.4-1 (Height and Exposure Factors)
- K_d as specified in Table 3.8.5-1 (Directionality Factors)
- G as specified in Table 3.8.6-1 (Gust Factor)
- C_d as specified in Table 3.8.7-1 (Wind Drag Coefficients)
- Deflection requirements as specified in Section 10.4

Traffic signal support structures shall be classified as Fatigue Category III if they are located on roads with a speed limit of 35 mph or less, Fatigue Category II if they are located on roads with a speed limit of greater than 35 mph, and Fatigue Category I if noted on the Contract Plans. Fatigue Importance Factors shall be as specified in Table 11.6-1 (Fatigue Importance Factors). Fatigue analyses are not required for span-wire (strain) pole traffic signal support structures with heights of 55 feet or less unless required by the current edition of AASHTO "LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

All Traffic Signal Structures with mast or bracket arms shall be equipped with an approved damping or energy-absorbing device.

After execution of the contract and before any shop work is commenced, the Contractor shall submit for approval the manufacturer's drawings, including design computations and fatigue computations, of all Traffic Signal Structures proposed to be furnished and erected under this Contract. The drawings shall be of sufficient detail to indicate material and dimensional conformance with these specifications and the plans. Each drawing shall contain a reference to the design criteria and a certification that the design criteria have been met for the Traffic Signal Structures, including poles, mast arms and associated hardware and fittings, as submitted. The certification shall be signed by a Professional Engineer licensed in accordance with State of Maine regulations under their official seal.

It is the intent of these specifications that the Contractor shall be fully responsible for the adequacy of the sizes, wall thicknesses, materials and connections of the Traffic Signal Structures, including poles, mast arms and associated hardware and fittings. Approval of the drawings by the Fabrication Engineer will signify only approval of the materials, mounting height(s) and mast arm length(s). Approval of deviations from the plans and/or specifications shall be requested in writing and approved by the Fabrication Engineer before being incorporated in the manufacturer's drawings.

The Contractor shall furnish and install all electrical fittings, pipe, switches, fuses, and such other material necessary to install the equipment properly and securely. All equipment shall conform to the applicable code and be of first-class workmanship. All electrical fittings shall be complete with weatherproof gaskets.

A Certificate of Compliance shall be provided for all applicable materials noted in Section 634.021 - Materials, in accordance with the requirements of the General Statement of Division 700 - Materials. Shop certification in accordance with Section 504.04 is required.

643.024 **Miscellaneous Materials** - Span wire shall be minimum 5/16" diameter, minimum, 7 strand, extra-high strength, galvanized steel wire. Anchors shall be power installed and sized according to strain and soil conditions. All hardware, such as strand vise feed-through dead ends, preforming guy grip dead ends and angle thimble-eye bolts, shall be standard pole line hardware.

Guying of poles shall meet the requirements of Grade "B" Construction as defined in the NESC. Guys shall be installed in line with the direction of pull. Anchors shall be power installed so that the centerline of the anchor rod will be within 10° of the line of the guy wire. The holding capacity of the anchor shall be 1.25 times the calculated load on the guy wire. Guy wires shall be utility grade and the maximum working stress shall not exceed half of the maximum ultimate tensile strength of utility grade guy strand. Where bedrock is encountered, rock anchors shall be used.

Pipe standoffs for sidewalk anchors shall be galvanized steel pipe sized according to the offset distance from anchor to pole and shall be fitted with standard guying hardware.

Messenger wire shall be ¼" diameter, 7 strand, extra-high strength, galvanized steel wire, unless otherwise specified.

LED lamps shall have a regulated power supply designed to electrically protect the diodes. The lamp shall be watertight and sealed to eliminate contaminants. The lamps shall be capable of operating at ambient air temperatures of -40°F to 140°F.

Lamp life shall be a minimum of 100,000 hours of continuous operation. They shall be manufactured using the Allen Gap Technology. Power consumption for 12" indications including power supply shall not exceed 20w.

643.03 **General Installation** - details will be shown on the plans and/or detailed in the specifications. The location shown for all equipment and vehicle detectors is approximate; final locations will be determined in the field.

During installation, all heads installed but not operating shall be covered or otherwise concealed from view.

The requirements of certain Sections of this specification may be waived for temporary traffic signals and traffic signal modifications, if so noted on the plans.

- 643.04 **Poles** - Wood poles shall be placed in the ground to a depth of 20% of their overall length, with a maximum deviation from the vertical of ¼" in 5 ft.

After each wood pole has been set in the ground and plumbed, the space around the pole shall be backfilled with selected earth or sand, free of rocks and other deleterious material, placed in layers approximately 4 inches thick. Each layer shall be moistened and thoroughly compacted.

Traffic Signal Structures shall be erected in a vertical position, with a maximum deviation from the vertical of ¼ inch in 5 feet using the leveling nuts provided with the anchor bolts. Once the poles have been plumbed, the top nuts shall be tightened by bringing the nut to a snug tight condition using the full effort of a worker using a spud wrench or compatible tool. After all nuts have been brought to a snug, tight condition, each nut shall be tightened an additional one-third turn, using an impact wrench, torque wrench or large crescent wrench. A minimum of two full threads shall project beyond the outside face of the nut. Nuts and bolts, other than anchor bolts, shall also be tightened by the above procedure.

When foundations and anchor bolts have been installed by others, the Contractor shall verify the anchor bolt dimensions at each location so that bases will be furnished with properly located and sized bolt holes.

Wires in poles shall be supported with a Kellum-type, braided, strain-relief grip attached to a "J" hook mounted inside the pole near the top.

- 643.041 **Foundations** - Foundations for Traffic Signal Structures shall meet the requirements of Section 626 – Foundations, Conduit, and Junction Boxes for Highway Lighting, Traffic Signals, and Highway Lighting.

- 643.05 **Loop Detector and Loop Detector Wire Installation** - Detectors shall be installed according to the manufacturer's recommendation, subject to approval. Each detector shall be supplied complete with comprehensive installation instructions.

A template shall be used to layout and paint the loops. The pavement slot for wire shall be 3 to 4" below the finished surface and not closer than 18" from the edge of pavement or the curb. The right-angle corners of the pavement slot shall be chamfered to eliminate sharp bends in the loop wires and corner saw cuts shall overlap at the corners (minimum 8") to ensure the uniform required depth throughout.

Saw cuts are not permitted when the current, or expected, road and/or air temperature is less than 33°F. All debris and moisture shall be removed from the

loop pavement slot before installation of loop wires. Sharp objects shall not be used to force the sensor wires into the saw cut. Sections of backer rod shall be used to hold down the wire before sealing and shall be removed after the first pass of sealant. The pavement slot shall be filled to the road surface with an approved sealing compound, such as ProSeal 6006 EX or approved equal, to form a waterproof bond with the pavement.

Loop sensor cables shall run continuously without any splices from the roadway, through the junction box, and directly into the cabinet. Loop sensor cables shall remain twisted at the rate of 4 turns per foot from the corner of the loop to the cabinet. Loop splices are to be avoided, except as specifically authorized by the resident. Each sensor cable lead-in shall exit the pavement in a separate 1" conduit and be uninterrupted to the nearest pull box. Sensor cable lead-in conduits shall be a minimum of 18" from the apron edge of pavement, 12" apart, and 5" deep.

Loop detector wire shall be number 14 AWG stranded copper conductors drawn through vinyl plastic tubing approximately ¼" in diameter conforming to the requirements of IMSA 51-7. All installations will incorporate 4 turns of counterclockwise wrapped loops.

A megger reading of at least 500 M ohms shall be obtained for each loop installed. This test shall be made at 500 volts immediately before the sealant is installed and again after the sealant has set at least 24 hours. All sensors shall be disconnected from the detector amplifier during testing.

All pulse loop "approach" wiring shall be insulated red and shall be permanently marked "A", "B", "C", or "D", according to the "approach" guidelines in the controller cabinet. All pulse loop "presence" wiring shall be insulated black and shall be permanently marked according to the "presence" guidelines in the controller cabinet. The lead-in from the amplifier to the beginning of the loop shall be shielded pairs, as shown on the plans.

The loop detector amplifier shall be located in the cabinet. No more than four loops shall be connected to a single loop detector amplifier.

Detector conductors shall not be housed in the same jacket as the signal conductors.

643.06 ***Microwave Detector Installation*** - The microwave detector shall be installed in accordance with the manufacturer's recommendations. A four-conductor wire shall be installed from the microwave unit to the controller. All angles and adjustment of patterns shall be the responsibility of the Contractor. The detectors shall operate in either pulse or presence mode.

643.07 ***Span Wire, Messenger Wire, and Guy Wire*** - All span wire, messenger wire, and guy wire installations shall be in conformance with the requirements of the Utility Companies, when installed on Utility Facilities.

All span wire hanging traffic signals permanent or temporary will have a bottom tether wire to prevent the signal from excessive swinging. Tether wire shall be terminated on one end by a breakaway device. The Contractor shall be fully responsible for the adequacy of the tether wire, breakaway device, and other related fittings or connections.

All span wires, messenger wires, guy wires, terminal boxes, controller cabinets, or any other metallic surface that might be contacted by people, shall be bonded to ground.

All sidewalk guy wires and slant guy wires installed in a sidewalk area shall be equipped with full-round or half-round guy guards.

643.08 **Conduit** - All conductors under roadways from the controller to the mast arm poles shall be 3" schedule 80 PVC.

643.09 **Service Connection** - The Contractor shall furnish and install the necessary electrical service as directed by the Utility Company. The Contractor shall make all arrangements for the service connection and be responsible for all charges incurred thereby.

Under no condition shall any equipment, except that shown on the plans, be installed on any Utility Facilities.

Whenever a service connection is to be made, the Contractor shall contact the Utility Company involved and inform them of the location, pole number, and time proposed for the service connection.

The traffic cabinet shall be marked with an appropriate arc flash plaque or decal with the following information:

- Flash hazard boundary
- Cal/cm² hazard at 18" PPE level
- Shock hazard when cover is off Limited approach boundary Restricted approach boundary
- The prohibited approach boundary

The plaque or decal shall be located on the outside of the equipment and shall be visible, weatherproof, and fade resistant, and not easily removed.

The Contractor shall be responsible for all outstanding bills for preliminary work done by the Utility Company during the installation of the traffic signal system, to facilitate the service connection.

A total of four 10 ft service ground rods shall be installed and properly connected together on the outside of the cabinet foundation. One ground rod shall be located at each corner and shall be either flush or slightly below finished grade. The connection between the ground rod and the ground wire shall be an exothermic connection such as a Cadweld. The ground wire from the interconnected ground rods shall be routed through a conduit in the foundation and into the base of the cabinet.

The Contractor shall be responsible for grounding the system to 5 ohms or less tested without an electrical connection to the utility neutral or ground conductor. The grounding shall be performed using a ground meter with reference grounds. In the event that a 5 ohm reading is not achieved, the Contractor shall install a chem-rod grounding electrode in close proximity to the cabinet. The chem-rod shall be properly connected to the four rod, grounding system in the cabinet. The chem-rod shall consist of a 10 ft copper rod (vertical or horizontal orientation) filled with common salt and desiccant, back filled with natural earth bentonite clay ground enhancement material. The chem rod shall be installed per manufacturer's instructions. The location and orientation for the chem-rod installation shall be approved by the Resident. All testing shall be done in the presence of the Resident.

All meter mounting devices shall be installed so that the meters will be upright (plumb). They shall be installed with the top of the meter not less than 48" nor more than 60" from the floor to the final grade. Exceptions to this height requirement will be made where special permission has been given to install group or modular metering, overall metering enclosures, or pole-mounted meters. Level grade shall be maintained for a minimum of 3 ft in front of the meter enclosure to provide a safe working space. In order to meet this requirement on uneven terrain, as an option, the Contractor may install a pressure-treated wood platform.

For any non-residential (industrial or commercial) self-contained meter socket the by-pass requirements are single phase, 100 or 150 amp, single handle lever operated.

The Contractor shall meet all requirements and regulations of Utility Companies when installing equipment on their poles and for the service connection. It is the responsibility of the Contractor to contact the appropriate Utility to determine their specific requirements.

- 643.10 **Wiring** - The Contractor shall furnish and install sufficient cable and wire to operate the system properly as shown on the plans and as directed.

The following color code shall be used where possible:

Solid Red Wire	Red Indication, Main Street
Solid Orange Wire	Yellow Indication, Main Street
Solid Green Wire	Green Indication, Main Street
Red with Black Tracer Wire	Red Indication, Side Street
Orange with Black Tracer	Yellow Indication, Side Street
Green with Black Tracer	Green Indication, Side Street
Red with White Tracer	Red Arrow Indication, Main Street
Blue with White Tracer	Yellow Arrow Indication, Main Street
Green with White Tracer	Green Arrow Indication, Main Street
Red with Green Tracer	Red Arrow Indication, Side Street

Orange with Red Tracer	Yellow Arrow Indication, Side Street
Blue with Red Tracer	Green Arrow Indication, Side Street
White with Black Tracer	Don't Walk, Main Street Pedestrian
Solid Blue	Walk, Main Street Pedestrian
Black with White Tracer	Don't Walk, Side Street Pedestrian
Blue with Black Tracer	Walk, Side Street Pedestrian
Solid White	Neutral Common for all Signals and Bond
Remaining	Spares and Pedestrian Detectors

The white wire and white wire with tracer shall be used for all common connections and it shall be continuously connected to ground at the controller.

There shall be no wire splices. Connections shall be made on a terminal board inside a watertight galvanized steel or aluminum junction box or in an aerial terminal enclosure with protective cover rated for 600 volts.

Spade type copper terminal ends shall be used to attach all conductors to terminals. All exposed metal parts, including service conduit and the controller cabinet shall be bonded and grounded.

Not more than 3 conductors shall be brought to any one terminal. Terminals shall be mounted to face the cabinet door.

The number and size of conductors required in each cable will be indicated on the plans.

643.11 **Vertical Clearance** - Unless otherwise specified on the plans and/or specifications, vertical clearances for vehicular and pedestrian heads shall be in conformity with the MUTCD. All clearances shall be uniform among each type of head or mounting scheme. Clearance for span wire mounted flashing beacon heads shall be a minimum of 17 ft and a maximum of 18 ft.

643.12 **Painting** - Unless otherwise indicated, all exterior parts of the following equipment shall be delivered to the Project finished enamel:

- Vehicular Signal Heads
- Pedestrian Signal Heads
- Pedestrian Push Button Detectors
- Traffic Controller Cabinets

The Contractor shall apply one coat of enamel to all existing equipment designated on the plans to be painted. The Contractor shall touch up all scratches on exposed surfaces of new equipment with matching enamel after the equipment has been installed.

All exposed signal parts to be painted shall be cleaned and shall be dry when the paint is applied. No painting shall be done in damp weather nor when the air temperature is below 40°F, unless otherwise permitted.

The Contractor shall identify recently painted equipment with "Wet Paint" signs and shall be responsible for all claims for damages resulting from contact with wet paint surfaces.

- 643.13 **Power Factor** - In the event that the equipment is of such design that the power factor is reduced below the requirement of the Utility Company, the Contractor shall furnish and install, without further charge, all equipment necessary to restore the power factor to a satisfactory percentage. Such equipment shall be accessible and shall not be mounted on the Utility Facilities.
- 643.14 **Field Tests** - Before acceptance of the work, the Contractor shall conduct the following tests on all traffic signal equipment and circuits, by a licensed electrician. The tests do not need to be performed in the presence of the Resident, but the test results shall be recorded on the Traffic Signal Quality Control Check List and submitted to the Resident by the Contractor for acceptance. The form shall be signed by the licensed electrician certifying that the signal equipment and circuits meet the requirements of Section 634.14.
- a. **Continuity** - Each circuit shall be tested for continuity.
 - b. **Ground** - Each circuit shall be tested for grounds.
 - c. **Megger** - Megger tests at 500 volts DC shall be made on each circuit between the circuit and a ground. The insulation resistance shall not be less than 10 megaohms on all circuits, except for inductive loop detector circuits, which shall have an insulation resistance value of not less than 100 megaohms.
 - d. **Loop Inductance** - A loop test meter shall be used to determine that the inductance of the installed loop and lead-in are within the tuning range recommended by the loop detector manufacturer.
 - e. **Functional** - A functional test shall be made in which it is demonstrated that each part of the system functions as specified.

The functional test for each new or modified traffic signal and flashing beacon shall consist of not less than 28 Days of continuous satisfactory operation. If unsatisfactory performance of the system develops, the condition shall be corrected and the test shall be repeated until the 28 Days of continuous satisfactory operation is obtained.

The initial operation shall be made between 9:00 a.m. and 2:00 p.m. unless specified otherwise. Before initial operation, all equipment shown on the plans shall be installed and operable.

Initial operation of new or modified traffic signal systems shall be made only after all traffic signal circuits have been thoroughly tested as specified above.

During the test period all costs except electrical energy shall be the Contractor's responsibility.

Functional tests shall start on any Working Day except Monday, Friday, Saturday, Sunday or the Day preceding a legal holiday.

Shutdown caused by a power interruption shall not constitute discontinuity of the functional test, however, the test shall continue after power is restored.

643.15 ***Traffic Signal Start Up/Initialization, Modifications, and Malfunctions -***

Projects where a traffic signal was installed at a location that was not previously under signalized traffic control shall follow the schedule outlined below:

- a. The Contractor shall notify the Resident, at least 1 week in advance, of their intention to initially operate the signals.
- b. Once the traffic signal is fully installed and operational, the signal shall be put into flashing operation for a period of at least 14 Days. During this period of time the contractor shall be responsible for providing changeable message boards with the messages: “New Traffic Pattern” / “Signal Active (Date)” on the major approaches to the intersection. The contractor shall update the “Signal Active (Date)” message at the direction of the Resident.
- c. After the traffic signal has operated in flashing operation for at least 14 Days without any issues or malfunction, the contractor may transfer the signal to normal operations and update the message on the changeable message board to “New Traffic Pattern / “Traffic Signal Ahead”. The changeable message boards shall remain until the final acceptance of the traffic signal or at the direction of the Resident.

At the time of initial operation of a new traffic signal installation, the Contractor shall provide police protection from the local police department at the Contractor's expense until the Contractor demonstrates to the Resident that the signal operates in conformance with this specification.

For all other projects, the Contractor shall notify the Resident, at least 1 week in advance, of their intention to modify the traffic signal. Upon completion of the modifications, the Contractor shall demonstrate to the Resident that the modifications were completed and that the signal operates in conformance with this specification. Once the Contractor starts the modification to the traffic signal, the Contractor will be responsible for diagnosing and repairing any malfunctions that arise that have a negative impact to the safety of the traveling public.

643.16 ***Final Cleaning Up*** - After all work has been completed, the Contractor shall remove all barriers, “Wet Paint” signs, equipment and all debris which has accumulated during the work.

Unless otherwise specified in the plans, the Contractor shall remove and deliver all unused signal equipment and wiring to the State of Maine, Department of Transportation, as directed by the Resident. The Contractor shall notify the MaineDOT Traffic Division as to time and date of such delivery. (Deliveries will be

accepted Monday through Friday between the hours of 7:00 A.M. and 4:00 P.M. only.) Notification shall precede delivery by a minimum of 24 hours.

643.17 **Documents** - The Contractor shall furnish two operation and maintenance manuals for all controller units, auxiliary equipment, vehicle detector sensor units, control units, and amplifiers. Documents may be provided in an electronic format. Documents shall be delivered with the controller at the time of testing. Each manual must include, but need not be limited to the following:

- a. An explanation of the theory of operation, including a functional description and a detailed circuit description.
- b. A schematic diagram of each unit. A cabinet wiring diagram including all field wiring and pin locations and designations for all plug type connectors. If any circuit changes are made in the field, the changes shall be noted on the schematic diagrams.
- c. A trouble shooting and preventive maintenance procedure including both field and bench trouble shooting analysis.
- d. A parts list including a pictorial diagram showing the location and identification of each component on the chassis or circuit board.
- e. A drawing of the controller cabinet interior showing the location of all shelves, terminal blocks, relays, timers, loop amplifiers.

In addition, manufacturer's warranties and guarantees for materials shall be delivered to the Resident before acceptance of the Project.

643.18 **Method of Measurement** - Traffic signals, traffic signal modifications, interconnect wire, video detection system, traffic signal control system, and flashing beacons will each be measured for payment by the lump sum in place. Temporary traffic signals will be measured for payment by the lump sum, satisfactorily installed, operated, and removed.

Pedestal poles, strain poles, combination poles, and mast arm poles with mast arms will be measured by each unit.

Each loop detector installed, connected to appropriate phases in the controller cabinet, complete and operational will be measured by the unit.

Excavation in solid ledge rock for replacement of wood poles will be measured by the cubic yard. The depth of measurement will be to the bottom of the pole, and the diameter of measurement will be the pole diameter plus 30".

643.19 **Basis of Payment** - Traffic signal modifications, traffic signals, interconnect wire and flashing beacons will be paid for at the Contract lump sum price, which payment will be full compensation for furnishing and installing all materials, both new and reused, including, but not limited to wood poles, span wire, tether wires, backplates, visors, guys, controllers, vehicular heads, pedestrian heads, flashing beacons, wiring, cable, pole risers, LED lamps, and all appurtenances and incidentals, including design of the Traffic Signal Structures, required for a

complete functioning installation and for furnishing all tools and labor necessary for completing the installation. Conduits, junction boxes, and foundations will be paid for under Section 626.

Pedestal poles, strain poles, combination poles and mast arm poles with mast arms will be paid for at the Contract unit price each which payment shall be full compensation for furnishing and installing all materials, tools and labor necessary to erect the poles.

Payment for temporary traffic signals shall include compensation for the removal of the system upon completion of the work. All materials used for temporary traffic signals will remain the property of the Contractor. Operating the controller by hand will be paid for under Section 629.

Payment will be made for each Loop Detector at Contract price, which will be full compensation for materials, labor, and equipment for each loop installed and fully operational.

Traffic signal control system will be paid for at the Contract lump sum price, which payment will be full compensation for furnishing and installing all materials, including, but not limited to local intersection traffic signal controller, controller cabinets, on-street master controller, supervisory PC software, and all appurtenances and incidentals required for a complete functioning installation.

Non-Invasive Detection system will be paid for at the contract lump sum price, which payment will be full compensation for furnishing and installing all materials, including, but not limited to video processing unit, video cameras, other vehicle sensor devices, supervisory PC software, and all appurtenances and incidentals required for a complete functioning installation.

Payment for excavation of solid bedrock for the placement of wood poles will be made under Item 206.07.

Payment will be made under:

Pay Item		Pay Unit
643.60	Flashing Beacon	Lump Sum
643.71	Traffic Signal Modification	Lump Sum
643.72	Temporary Traffic Signal	Lump Sum
643.80	Traffic Signals	Lump Sum
643.81	Traffic Signal Control System	Lump Sum
643.83	Non-Invasive Detection – Stop Bar	Each
643.84	Non-Invasive Detection – Advance	Each
643.86	Traffic Signal Loop Detector	Each
643.90	Interconnect Wire Between	Lump Sum
643.91	Mast Arm Pole	Each
643.92	Pedestal Pole	Each

643.93	Strain Pole	Each
643.94	Dual Purpose Pole	Each

SECTION 644 - GLARE BARRIER - Reserved

SECTION 645 - HIGHWAY SIGNING

645.01 **Description** - This work shall consist of designing, furnishing and installing new signs, sign supports, delineators, Polyvinylchloride (PVC) Pipe and breakaway devices and removing, relocating and/or modifying existing signs and sign supports, in accordance with these specifications and in reasonably close conformity with the Contract Plans.

645.02 **General** - All equipment shall be new unless otherwise specified. Requests for substitution of any specified material shall be submitted in writing with all documentation (specifications, mill certifications, etc.) in order to enable the Department to evaluate the proposal. Substitutes for specified material may be accepted, upon approval of the Fabrication Engineer. Substitutes shall give equal or better service than the specified material. Where an existing system is to be modified, the existing material shall be removed, upgraded, or disposed of as directed by the Contract documents.

645.021 **Materials** - Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Polyvinylchloride (PVC) Pipe	706.08
Reflective Sheeting	719.01
Demountable High Intensity Reflectorized Letters, Numerals, Symbols and Borders	719.02
Aluminum Extrusions	719.03
Aluminum Sheets	719.04
Plywood	719.05
Demountable Reflectorized Delineators	719.06
Assembly Hardware	719.07
Aluminum Supports	720.01
Steel Supports	720.03
Steel H-beam Poles	720.06
Anchor Bolts	720.07
U-Channel Posts	720.08
Wood Sign Posts	720.12

Paint for the edge and back of plywood and field coat paint for wood sign posts shall be an exterior grade dark green enamel conforming to Federal Specifications TT-P-71b.

Materials shall meet the gradation requirements only of the following:

Aggregate for Untreated Surface Course and Leveling Course	703.10
Underdrain Backfill Material	703.22

645.022 **Sign Layout Drawings** - The Contractor shall submit 3 sets of sign-face, layout-detail, and scale drawings. Fabrication of the signs shall not begin until the Contractor has received approval of these drawings. The drawings shall contain complete detailed information and dimensions. One set of drawings will be returned to the Contractor, who will submit corrected drawings, if required. The drawings shall be detailed using the same units used on the Contract Plans.

645.023 **Sign Support Structures** - The design, materials and fabrication of Sign Support Structures shall meet the requirements of the current edition of AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and interims thereto, as noted below except as otherwise indicated within these specifications or on the Contract Plans.

Beam-mounted roadside sign supports and associated signs and hardware shall be designed using the following criteria:

- Basic wind speeds based on a 300 year mean recurrence interval
- K_z as specified in Table C3.8.4-1 (Height and Exposure Factors)
- K_d as specified in Table 3.8.5-1 (Directionality Factors)
- G as 1.14, minimum (Gust Factor)
- C_d as specified in Table 3.8.7-1 (Wind Drag Coefficients)

Bridge-mounted, bridge-type, cantilever, and butterfly-type sign supports and associated signs and hardware and all sign support structures supporting variable message signs shall be designed using the following criteria:

- Basic wind speeds based on a 1700 year mean recurrence interval
- K_z as specified in Table C3.8.4-1 (Height and Exposure Factors)
- K_d as specified in Table 3.8.5-1 (Directionality Factors)
- G as 1.14, minimum (Gust Factor)
- C_d as specified in Table 3.8.7-1 (Wind Drag Coefficients)
- Deflection requirements as specified in Section 10.4

Cantilever and butterfly-type sign supports and all structures supporting variable message signs shall be classified as Fatigue Category I. Bridge-type sign supports shall be classified as Fatigue

Category II. Fatigue Importance Factors shall be as specified in Table 11.6-1 (Fatigue Importance Factors).

For bridge-mounted sign supports (including approaches to bridge structures), the mounting height shall be measured as the distance of the mounted sign(s) center of gravity to one of the following:

- For bridges over bodies of water: above the prevailing water level or, in the case of tidal waters, above mean high tide.
- For overpass structures: above the lower roadway level.
- For approach ramps: above the average adjacent ground level, if said ground level is more than 10 ft below the base of the structure.
- All cantilever and butterfly type sign support structures shall be equipped with an approved damping or energy-absorbing device.
- For aluminum construction, welding shall conform to the current edition of AWS Structural Welding Code, Aluminum, D1.2 for aluminum construction.

After execution of the Contract and before any shop work has commenced, the Contractor shall submit for approval the drawings, and design and fatigue computations if prescribed below, for all Sign Support Structures proposed to be furnished and erected under this Contract. The drawings shall be of sufficient detail to indicate material and/or dimensional conformance with these specifications and the Contract Plans and, in the case of bridge, cantilever and butterfly type sign supports, shall be sufficiently detailed to show all significant structural details.

Approval for deviations from the Contract Plans and/or Specifications shall be requested in writing and shall be approved by the Fabrication Engineer before being incorporated in the manufacturer's drawings. Requests for substitution of all specified material shall be submitted in writing, with full documentation (specifications, mill certification, etc.) enabling the Department to evaluate the proposal.

Sign Support Structures and anchor bolts shall meet the requirements specified in Section 720 as well as the current edition of AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and interims thereto.

A Certificate of Compliance shall be provided for all applicable materials noted in Section 645.021 – Materials, in accordance with the requirements of the General Statement of Division 700 - Materials.

- a. **Beam-Mounted Roadside Signs** - The beams for beam-mounted roadside signs shall be of the size, material and

shape designated in the Contract Documents. The Contractor shall be fully responsible for the adequacy and design of any structural details not shown on the Contract Plans, and each drawing shall contain a reference to the design criteria. A Professional Engineer licensed in accordance with the State of Maine regulations shall sign the certification under their official seal that said design criteria have been met by all parts of the structure designed and/or detailed by the Contractor. Approval of the drawings will signify only approval of the size, material and length of the beam.

- b. **Bridge-Mounted Sign Supports** - Bridge-mounted sign supports shall be constructed to the configuration and sizes and of the material shown on the Contract Documents. Approval will be based on the applicable provisions of Section 105.7 - Working Drawings. Fastening sign panels directly to steel or aluminum members shall be as described in Section 719.07, as well as other applicable Sections, Plans and Specifications.

- c. **Bridge-Type, Cantilever, and Butterfly-Type Sign Supports** - The Contractor shall be responsible for the design of the Sign Support Structures for bridge-type, cantilever and butterfly-type sign supports in accordance with this specification.

Signs shall be placed on the Sign Support Structure such that the bottom edges are aligned (unless written consent from the Fabrication Engineer is obtained), while accommodating the minimum height requirement - see Section 645.06. The Contractor shall use the Contract Plans in order to determine the approximate horizontal placement of signs. Installation shall be in accordance with Section 645.06 - Installation of Type I Signs. The structure and foundation shall be designed to accommodate an additional theoretical sign load on each structure. This additional theoretical sign load for each sign shown in the Contract documents shall be computed by: For single signs increasing the sign widths an additional 25% without changing the horizontal midpoint of the sign; for multiple signs the sign widths shall be increased 25% toward the outside sign edges. The height of all signs shall be increased 25% without changing the bottom edge elevation of the signs.

Bridge-type Sign Support Structures shall be designed using either a tri-chord or four-chord truss structure as the overhead member. Each of the two upright members supporting the bridge-type overhead truss member shall consist of a

minimum of two vertical legs. A four-chord truss configuration shall be required if the Contract Documents specify placing signs on both sides of the overhead structure (two way traffic beneath structure). Cantilever and butterfly-type structures shall be designed using either a tri-chord or four-chord overhead truss member. The upright member of a cantilever or butterfly-type support structure shall have a maximum horizontal deflection in accordance with Section 10.4.2.1 of the current edition of the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, and interims thereto.

The base plates of uprights for all types of Sign Support Structures shall have heavy hex leveling nut with 2 hardened flat washers. The distance between the bottom of the base plates to the top of the foundations shall not exceed twice the diameter of the anchor bolts. Grout, or other materials, shall not be placed between base plates and the top of foundations.

In addition to the required detail drawings, the Contractor shall submit 3 copies of the design and fatigue computations meeting the all applicable requirements of this specification or the Contract Plans for each Sign Support Structure. Erection lifting points shall be clearly depicted on the shop drawing. The computations shall be sufficiently detailed to allow the Engineer to review the computations. Computer printouts will not be accepted unless they meet the above criteria. All plans and design calculations for sign support structures shall be sealed by a Professional Engineer licensed in accordance with the State of Maine regulations. Approval will be based on the applicable provisions of Section 105.7 - Working Drawings.

Overhead sign panel mounting devices shall be designed accommodating the requirements of appropriate sign panel tilting included in this specification. The design of this assembly shall include fastening sign panels directly to steel or aluminum members as further described in Section 719.07, as well as other applicable Sections, Plans and Specifications.

- d. ***Breakaway Supports for Sign Supports*** - Breakaway supports for sign supports will be required only for those locations indicated on the Contract Plans. Breakaway supports, approved by the Resident, using load-concentrating couplings shall be supplied for use at all locations designated

as breakaway. Breakaway Support Certification of both breakaway and structural adequacy shall be provided by the Manufacturer. Design calculations or test data of production samples to support certification shall be provided. Breakaway support components shall provide the same or greater structural strength as the support post or pole utilizing the breakaway device. On multi-pole sign supports designated as breakaway, each pole shall be equipped with breakaway hinges immediately below the lower edge of the sign. Hinges relying on the friction between the hinge and the pole face for transmitting the design moment will not be accepted for use. Breakaway devices are subject to the applicable provisions of Section 721.

645.024 **Bridge, Cantilever and Butterfly Support Structure Foundations** - Foundations for Highway Signing structures shall meet the requirements of Section 626 – Foundations, Conduit, and Junction Boxes for Highway Lighting, Traffic Signals, and Highway Lighting.

645.03 **Classification of Signs** - Sign sizes, color and legend designs shall conform to these specifications, the Contract Plans, and MUTCD requirements. The signs are classified according to the intended use as follows:

- a. **Sign Type I** - guide signs shall consist of high intensity prismatic, reflectorized sheeting or reflectorized, demountable letters, numerals, symbols and border mounted on a high intensity prismatic, reflective sheeting background adhered to a sign panel constructed of extruded aluminum planks.
- b. **Sign Type I** - regulatory, warning, and route marker assembly signs shall consist of high intensity prismatic, reflective sheeting letters, numerals, symbols, and border on a high intensity prismatic, reflective sheeting background adhered to a sign panel constructed of sheet aluminum.
- c. **Sign Type II** - guide signs shall consist of high intensity prismatic, reflective sheeting letters, numerals, symbols and border on a high intensity prismatic, reflective sheeting background attached to a sign panel constructed of plywood.
- d. **Sign Type II** - regulatory, warning and route marker assembly signs shall consist of high intensity prismatic reflective sheeting letters, numerals, symbols and border on a high intensity prismatic reflective sheeting background adhered to a sign panel constructed of sheet aluminum or plywood.

645.04 **Fabrication of Type I Guide Signs**

- a. **Panels** - The panels for this type sign shall be shop-fabricated from aluminum planks to the sizes designated on the approved shop drawings.

Cut edges shall be true, smooth, and free from burrs or ragged breaks. Flame cutting will not be permitted. Bolt holes may be drilled to finished size or punched to finished size, provided the diameter of the punched hole is at least twice the thickness of the metal being punched.

Fabrication of extruded aluminum sign planks, including punching or drilling holes and cutting to length, shall be completed before the metal degreasing and the application of the reflective sheeting. The bolts required for fastening the extruded aluminum planks together shall conform to the designs used in standard commercial processes for the type of extruded aluminum panels to be used as approved.

All route shields shall be on an overlay aluminum sheet of 0.080" minimum thickness and shall be in full color with reflective background; they shall not have demountable numerals and borders.

- b. **Reflective Sheeting** - The high intensity prismatic reflective sheeting shall be applied to the extruded aluminum plank in accordance with the current recommendations of the sheeting Manufacturer.

The reflective sheeting shall cover the complete panel and shall not be trimmed to conform to the border. The reflective sheeting shall overlap into the side recess of the individual planks. There shall be no paint applied to the sign panels. The surface of all completed sign panels shall be flat and free of defects. Extruded aluminum molding shall be placed on the edges of the extruded panels, as shown on the Contract Plans.

- c. **Text** - The design of upper and lower case letters, numerals and symbols, and the arrangement and spacing of texts shall be as provided on the Contract Plans and in conformance with the MUTCD and Standard Highway Signs.

Text for Guide Signs shall be composed of demountable letters, numerals, symbols, and borders and shall be high-intensity prismatic, reflective sheeting. The demountable text shall be applied to the panels by use of aluminum pop rivets, in accordance with standard commercial processes, as approved. All demountable letters, numerals, symbols, and borders shall be the same manufacturer's make for the entire Project. Cutout high-intensity, reflective sheeting text shall be applied to the sign panel with a pre-coated, adhesive backing.

645.041 ***Fabrication of Type I Regulatory, Warning and Route Marker Assembly Signs and Type II Sheet Aluminum Regulatory, Warning and Route Marker Assembly Signs***

- a. **Panels** - Sheet aluminum sign panels shall be shop-fabricated to the size shown on the Contract Plans. The corners shall be rounded to the indicated radius where shown.

Bolt holes may be drilled or punched to finished size provided the diameter of the punched hole is at least twice the thickness of the metal being punched. Cut edges shall be true, smooth, and free from burrs or ragged breaks. Flame cutting will not be permitted. Punching or drilling of holes and cutting to size shall be completed before metal degreasing and the application of reflective sheeting.

- b. **Reflective Sheeting** - The high intensity prismatic reflective sheeting shall be applied to the sheet aluminum sign panels in accordance with the current recommendations of the sheeting Manufacturer. The reflective sheeting colors shall conform to the MUTCD Standard Highway Sign colors for each type of sign. Surface of all panels shall be flat and free from defects.
- c. **Text** - The text for regulatory, warning, confirmation and route marker assembly signs shall be composed of: High intensity prismatic, reflective sheeting letters, numerals, symbols and borders; or the silver letters may be formed by applying transparent ink to the reflective sheeting background where the silk screen process is used; or other methods to form the text may be used, when approved in advance.

645.042 ***Fabrication of Type II Guide Signs and Type II Plywood, Regulatory, Warning and Route Marker Assembly Signs***

- a. **Panels** - Fabrication of all sign panels from high-density, overlaid plywood shall be performed in a uniform manner. All fabrication, including cutting, drilling, and edge routing, shall be completed prior to painting and application of reflective sheeting to the high-density, overlaid plywood. Panels shall be cut to size and shall be plywood. Panels shall be cut to size and shall be free of warping, open checks, open splits, open joints, open cracks, loose knots and other defects resulting from fabrication. Corners shall be left square. The surface of all sign panels shall be flat.

The edge and back of the plywood shall be painted with an exterior grade dark green paint.

- b. **Blanks** - Sign blanks shall be cut to shape using a saw blade that does not tear plywood grain. Holes shall be clean-cut and uniform. All cracks, open checks, open splits and other defects occurring on the edge surfaces shall be filled with a synthetic wood filler and sanded smooth prior to sealing and painting. The sign blank edges shall be sealed using an

approved sealer/primer. The edges shall then be painted with an exterior grade, dark green paint.

The surface shall not be painted before application of reflective sheeting. Before applying reflective sheeting, dirt or wax shall be removed by one of the following methods:

1. The surface shall be buffed lightly with solvent-soaked steel wool, fine or medium, using organic solvents, such as lacquer thinner, xylol, heptane, benzene or naphtha, and wiped dry with clean cloths.
 2. The panel shall be sanded lightly with fine-grade paper, cleaned with solvent, and wiped dry using clean cloths.
- c. **Reflective Sheeting** - The High intensity prismatic reflective sheeting shall be applied directly to the cleaned high-density surface in accordance with the recommendations of the reflective sheeting manufacturer.
- d. **Text** - The text for regulatory, warning, confirmation and route marker assembly signs shall be composed of cutout, High intensity prismatic reflective sheeting letters, numerals, symbols and borders or the silver letters may be formed by applying transparent ink to the reflective sheeting background where the silk screen process is used. Other methods to form the text may be used when approved in advance.

The design of the letters, numerals, and symbols, the spacing of the text and the size and spacing of the border shall conform to the MUTCD and Standard Highway Signs.

645.06 **Installation of Type I Signs** - The sign locations shown on the Contract Plans are approximate; exact locations will be determined in the field by the Resident. Signs stockpiled before erection shall be stored in a vertical position and completely covered to avoid staining, weathering, and dirt accumulation.

- a. **Sign Supports** - Poles for single and multiple support beam-mounted roadside signs shall be erected plumb, using the leveling nuts supplied with the anchor bolts. When signs are supported by more than one pole, all poles shall be carefully aligned to avoid warping of the sign panel.

Bridge-mounted sign supports shall be fabricated and assembled in accordance with the details as shown on the Contract Plans and with Section 504. Additionally, if required to be painted, bridge-mounted sign supports shall be painted in accordance with Section 506.

Bridge-type, butterfly and cantilever-type sign supports and their foundations shall be constructed, assembled and erected, in accordance with the manufacturer's details, as approved. All horizontal supports

spanning the roadway shall be level and shall have permanent camber as described in Section 10.5 of the current edition of AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, and interims thereto. If, at any time after their erection, bridge-type, butterfly or cantilever-type sign supports are to remain for a period in excess of 72 hours without the sign(s) for which they were designed being in place, suitable vibration damping devices, approved by the Resident, shall be installed until such time as the sign(s) can be erected.

Where aluminum surfaces are in contact with concrete or dissimilar metals, the contacting surface shall be thoroughly coated with an approved aluminum impregnated caulking compound, or the surfaces shall be separated by another approved material. Before signs are attached, aluminum sign supports shall be cleaned of all dirt and discoloration using methods recommended by the manufacturer.

- b. **Sign Panels** - Extruded aluminum planks for sign panels shall be bolted together, as indicated on the Contract Plans. Extruded aluminum molding shall be placed on the edges of the extruded panels. Sign panels shall be attached to the posts to provide the vertical and horizontal clearances from the roadway as indicated on the Contract Plans. Sign panels on overhead structures shall provide a minimum vertical clearance of 18 ft to the highest point of the roadway surface under the sign(s). Sign panels on bridge-mounted sign supports shall be installed with the bottom edge of the sign approximately 4" above the bottom of the bridge beam.

Sign panels mounted over the roadway shall tilt in the direction of the approaching traffic in such a manner that the angle between the sign face and the roadway grade, at the sign location shall be $85^{\circ} \pm 3^{\circ}$.

Ground-mounted signs located 4 to 30 ft from the edge of shoulder shall form an angle of 93° between the approach roadway and the sign.

Signs located more than 30 ft from the edge of the shoulder shall form an angle between the approach roadway and the sign face equal to $87^{\circ} - 1^{\circ}$ for each additional 10 ft beyond 30 ft.

Unless otherwise shown on the Contract Plans, or designated by the Resident, a minimum lateral clearance of 4 ft shall be provided between the edge of the shoulder and the edge of any sign panel.

The elevation of the bottom edge of guide sign panels shall be 7 ft above the elevation of the edge of the traveled way, at the sign location, or in case of a curb section, 7 ft above the elevation of the outer edge of the roadway, unless authorized otherwise.

Signs located 30 ft or more from the edge of traveled way shall be 5 ft above the elevation of the edge of shoulder.

In the event that a second sign is to be placed under the main sign, the elevation of the bottom edge of the principal sign shall be a minimum of 8 ft above the outer edge of the traveled way, or a minimum of 8 ft above the edge of the traveled way, in curbed sections; the bottom edge of the second sign must be at least 5 ft above the edge of the traveled way.

The elevation of the bottom edge of the regulatory, warning and route marker sign panels shall be 6 ft above the elevation of the edge of the pavement, or edge of roadway in curbed sections, at the sign location. The elevation of the bottom edge of these sign panels above the elevation of the edge of the pavement on all crossing or connecting roadways shall be 5 ft in rural areas or 7 ft in urban areas. Field conditions may require some variation in elevations, as directed.

Each sign shall have at least two fasteners connecting it to the sign poles, except signs of 1 ft or less in height may have one fastener.

- 645.061 **Installation of Type II Signs** -The exact sign locations will be determined in the field. Signs stockpiled before erection shall be stored in a vertical position and completely covered to avoid staining, weathering, and dirt accumulation.

When a steel pole is to be used, before any shop work is commenced, the Contractor shall submit 3 sets of the manufacturer's drawings of all standards and accessories proposed to be furnished and erected under this Contract. The drawings shall be of sufficient detail to indicate material and/or dimensional conformance with these specifications and the Contract drawings. Each drawing shall contain a reference to the design criteria and certification that the design criteria have been met for current edition of the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, and interims thereto, for bracket arms and associated hardware, fittings and breakaway devices, as submitted. A Professional Engineer licensed in accordance with the State of Maine regulations shall sign the certification under their official seal. The drawings shall use the same units as found in the Contract Plans. It is the intent of these specifications that the Contractor shall be fully responsible for the adequacy of the sizes, wall thickness, materials and connections of the standards, bracket arms and associated hardware, fittings and breakaway devices. Approval of the drawings will signify only approval of the material(s), mounting heights(s) and bracket arm length(s).

- a. **Sign Supports** - Support posts for Type II signs shall be U-channel posts weighing 2½ lb per foot for signs of less than 6.24 ft² in area, 4" by 4" wood posts or two U-channel posts weighing 2½ lb/ft for signs of area 6.24 ft² to 9 ft², 4" by 6"

wood posts for signs of area 9 ft² to 16 ft², and 6" by 6" wood posts for signs of area over 16 ft². All signs 60" wide or wider shall be mounted on two wood posts. Wood posts shall be set to a depth of 4 ft. U-channel posts shall be set to a minimum depth of 30". Leading signs less than 9 ft² on the apex of islands will be installed on U-channel posts. Solar powered sign mounted beacon arrays shall be mounted on galvanized steel poles. Any signs installed on/in an island, shall be installed in a PVC sleeve of the appropriate size for the type of post being installed, as shown in the standard details.

When it is necessary to set sign posts in bedrock, holes shall be excavated to the required depth and size at the locations indicated on the Contact Plans. The excavated material will be satisfactorily disposed of, as directed, and the posts set to the required depth.

When installing pressure-treated sign posts, the cut end of the posts shall not be buried in the ground.

Backfilling around the posts shall be with excavated material unless the excavated material is considered unsatisfactory, in which case the backfill shall be granular material conforming to the requirements of Section 703.19 - Granular Borrow. Backfill shall be thoroughly tamped in layers not exceeding 8" in depth.

When directed, the area around the posts shall be loamed and seeded in accordance with the applicable provisions of Section 615 and Section 618.

The Contractor shall be responsible for and shall repair all damage to underground drainage structures, utilities, or lighting conduits encountered during placing the posts.

- b. **Mounting** - Type II signs shall be mounted using assembly hardware specified in Section 719.07.

PVC pipe shall be installed in all locations where sign posts are to be placed in paved islands and shall have an inside diameter of 12". For sleeves that are to be utilized for U-channel posts, the PVC pipe shall have a minimum length of 3 ft. For sleeves that are to be utilized for wood posts, the PVC pipe shall have a minimum length of 5 ft.

Installation of the PVC pipe shall occur prior to paving of the island. The pipe shall be placed at a depth so that the top of the pipe shall have no more than a 1" reveal from finished surface pavement. Once placed, the pipe shall be backfilled

around the outside diameter in layers that are thoroughly compacted and that do not exceed a depth of 8".

Once installed and backfilled, the pipe shall be completely filled to the top of the pipe with material that meets the gradation requirements of Aggregate for Untreated Surface Course and Leveling Course Type A or Type B or Underdrain Backfill Material.

- 645.062 ***Installation of Delineators*** - Posts for delineators shall be erected so that posts and assemblies will be plumb. All posts, which are bent or otherwise damaged, shall be removed and properly replaced. Posts shall be driven 4 ft from the outside edge of shoulder, 4 ft from the face of curb and 4 ft from the normal edge of shoulder in guardrail sections. A suitable driving cap shall be used and after driving, the top of the post shall have substantially the same cross sectional dimensions as the body of the post.

When bedrock is encountered in erecting posts, the depth to be drilled into the rock shall be determined by the Resident.

After the posts are driven, delineators shall be mounted 4 ft above the elevation of the edge of the traveled way. In the event that a delineator is required to be installed on a bridge structure, it shall be installed by use of a bracket as shown on the Contract Plans.

Sign support posts to be installed in the sleeve shall be plumbed and set in the material which shall be compacted or tamped around the post. The posts shall be placed so that there is a 2 ft maximum distance from the bottom of the retro-reflective strip on the sign post to the paved travelway or shoulder surface. For wooden posts only, 4 ft of the post shall be placed in the sleeve. Other sign support post installation requirements shall be followed as per Section 645 of the Standard Specifications.

- 645.063 ***Installation of Breakaway Devices*** - Breakaway devices shall be installed at locations indicated on the Contract Plans by an approved method. Each sign and pole shall be carefully demounted for reinstallation at the same or at a new location. Manufacturer's installation information shall be provided on the Project.

If required, poles shall be cut in such a manner that no rough edges will remain. No flame cutting will be permitted. Cut edges on steel poles shall be painted in accordance with Section 645.07.

Existing foundations shall be modified for attachment of the breakaway device as shown on the Contract Plans or approved.

Breakaway devices shall be attached to new foundations in accordance with the recommendations of the breakaway device manufacturer and as approved.

- 645.064 ***Installation of Sign Mounted Beacon Array*** - Beacons installation shall conform to current MUTCD standards.

Battery and solar assembly shall be of sufficient size to power sign for 7 Days without solar charging. Batteries shall be gel cell or absorbed glass mat (AGM) batteries. Solar panel shall be installed facing true south and 60° from vertical.

Connections to service shall be in accordance with Section 643.09.

The cabinet should be positioned on the side of the pole farthest from traffic. Only aluminum and steel cabinets will be accepted. All exposed wiring shall be in accordance with Section 715.11.

All wiring shall be in accordance with Section 718.01-c.

Beacon Array shall meet testing requirements outlined in Sections 643.14 a, b, and e.

- 645.07 ***Demounting and Reinstalling Existing Signs and Poles*** - Signs and poles designated to be demounted and not designated to be reinstalled, except those designated to be demounted by others, shall be delivered to the Resident.

Existing sign panels, poles, foundations, and sign hardware, damaged because of the Contractor's operations shall be replaced or repaired by the Contractor to the satisfaction of the Resident.

New or relocated regulatory, warning, confirmation or route marker assembly signs shall be installed the same Working Day as the corresponding existing signs are demounted. All new or relocated guide signs shall be installed within 2 Working Days of the time the corresponding existing sign is demounted. Before the Contractor demounts any regulatory or warning sign, they shall erect a similar easel mounted sign at a designated location. The Contractor shall maintain this temporary sign in place until the permanent sign is installed.

Existing signs and poles shall be reinstalled in accordance with the applicable requirements for installing new signs and poles.

Relocated steel posts and clamps shall be field painted two coats after the posts have been erected. The first coat shall be a zinc-dust primer paint meeting Federal Specification TT-P-641B Type II. The second coat shall be bright aluminum paint, aluminum-dust Type II, Class 3 brightness, meeting Federal Specification TT-A-468 with a minimum of 2 lb/gal, with vehicle meeting or exceeding Federal Specification TT-V-109. Scratches shall be touched up after the erection of the sign panels. The touchup shall be with both primer and finish coat. Sign pole surfaces to be painted shall be cleaned and dry when the paint is

applied. No painting shall be done in damp weather nor when the air temperature is below 40°F.

- 645.08 **Method of Measurement** - Demount Signs, Demount Poles, Reinstall Signs, and Reinstall Poles will be measured by each unit.

Bridge-type, cantilever and butterfly-type Sign Support Structures, and sign panels, complete in place, as called for on the Contract Plans, will be measured by each unit.

Bridge-Mounted Guide Signs, including supports, will be measured by each unit in place.

Breakaway devices (1 per pole) shall be measured by the unit complete in place and accepted.

The area of roadside guide signs, regulatory, warning, confirmation and route marker assembly signs of the respective types, will be measured by the area in square feet, computed to nearest hundredth of a square foot, as determined by the overall height multiplied by the overall width.

Aluminum poles for roadside guide signs, Type I will be measured by the number of units of each diameter, complete in place. Steel H-beam poles will be measured for payment by the pound, determined from the nominal weight per foot for each size and the lengths as indicated on the Contract Plans.

Demountable reflectorized delineators will be measured by the number of units of each type in place.

All beacons installed on an individual post/pole shall constitute a single installation. Each installation will be measured for payment by the lump sum in place

- 645.09 **Basis of Payment** - The accepted demounted signs and demounted poles will be paid for at the Contract unit price each for the respective item specified. Such price will be full compensation for delivering signs and poles not to be reinstalled to a site designated by the Resident, and all other incidentals necessary to complete the work.

The accepted reinstalled signs or reinstalled poles will be paid for at the Contract unit price each. Such price will be full compensation for furnishing new hardware, when required, and all incidentals necessary to complete the installations. All signs or poles designated to be reinstalled that are damaged by the Contractor shall be replaced by the Contractor with new signs or poles conforming to the applicable Specifications at no additional cost to the State.

The accepted bridge-type, cantilever and butterfly-type Sign Support Structures will be paid for at the Contract lump sum price for the respective items. Such price will be full compensation for the signs, support structures, and incidentals necessary to complete the work, including design of the sign supports. Conduits, Junction Boxes, and Foundations will be paid for under Section 626.

The accepted guide signs-overpass mounted, will be paid for at the Contract lump sum price for the respective items, which price will be full compensation for the signs, supports and incidentals necessary to complete the work, including design of the sign supports.

The accepted roadside guide signs and regulatory, warning, confirmation, and route marker assembly signs will be paid for at the Contract unit price per square foot. Such payment will be full compensation for furnishing and installing signs, assembly hardware, and all incidentals necessary to complete the work, including design of the sign supports.

The accepted aluminum poles will be paid for at the Contract unit price each for the specified diameter, complete in place.

The accepted demountable reflectorized delineators will be paid for at the Contract unit price each for the type specified, which payment will be full compensation for delineator and post or bridge rail mounting, complete in place.

Payment for breakaway devices shall be full compensation for furnishing and installing the device, all required pole cutting, for adapting the pole to the breakaway device, for adapting the concrete base to the breakaway device and all other incidentals necessary to complete the work. Separate payment will be made at the respective Contract unit prices for demounting and reinstalling the signs and the poles at multi-pole installations. At single-pole installations, separate payment will be made at the respective Contract unit prices for demounting and reinstalling the poles only.

The accepted quantity of steel H-beam poles will be paid for at the Contract unit price per pound, complete in place as shown on the Contract Plans or as designated.

Furnishing and installing posts for Type II signs, including earth excavation and backfilling, furnishing and placing assembly hardware, backfilling material, loam, seed and other incidentals, will not be paid for directly but will be considered incidental to the cost of the signs they support.

Sign Mounted Beacon Arrays will be paid for at the Contract lump sum price, which payment will be full compensation for furnishing all materials including, but not limited to the LED-arrays, flasher, timer, controller cabinets, wiring, pedestrian push buttons, solar panels, batteries, radio devices, radar units, and all appurtenances and incidentals required for a complete and functioning installation and for furnishing all tools and labor necessary for completing the installation. Array must meet all testing and connection requirements of this section

All work, PVC Pipe, Aggregate for Untreated Surface Course and Leveling Course, Underdrain Backfill Material and other materials furnished to install, backfill around, and fill the sleeve in the island and place the sign post in the sleeve shall be incidental to the Section 645 Items.

Payment for excavation of solid bedrock for the placement of wood poles will be made under Item 206.07.

Payment will be made under (Table continues on next page):

Pay Item		Pay Unit
645.103	Demount Guide Sign	Each
645.106	Demount Regulatory, Warning, Confirmation and Route Marker Assembly Sign	Each
645.108	Demount Pole	Each
645.113	Reinstall Guide Sign	Each
645.116	Reinstall Regulatory, Warning, Confirmation and Route Marker Assembly Sign	Each
645.118	Reinstall Pole	Each
645.12	Overhead Guide Sign: (STA X + XXX)	Lump Sum
645.13	Bridge Overpass-Mounted Guide Sign: (STA X + XXX) (Left/Right XX)	Lump Sum
645.14	Special Work No.:	Lump Sum
645.15	Cantilever Guide Sign: (STA X + XXX)	Lump Sum
645.161	Breakaway Device Single Pole	Each
645.162	Breakaway Device Multi Pole	Each
645.251	Roadside Guide Signs, Type I	Square Foot
645.261	Bridge Guide Sign, Type I	Square Foot
645.271	Regulatory, Warning, Confirmation and Route Assembly Sign, Type I	Square Foot
645.281	5" Aluminum Pole	Each
645.282	6" Aluminum Pole	Each
645.283	7" Aluminum Pole	Each
645.284	8" Aluminum Pole	Each
645.285	10" Aluminum Pole	Each
645.286	12" Aluminum Pole	Each
645.289	Steel H-Beam Poles	Pound
645.291	Roadside Guide Signs Type II	Square Foot
645.292	Regulatory, Warning, Confirmation and Route Marker Assembly Signs Type II	Square Foot
645.301	Demountable Reflectorized Delineator, Single	Each
645.302	Demountable Reflectorized Delineator, Double	Each
645.305	Sign Mounted Beacon Array	Lump Sum

SECTIONS 646 to 651 - Vacant

SECTION 652 - MAINTENANCE OF TRAFFIC

- 652.1 **Description** - This work shall consist of furnishing, installing, maintaining and removing traffic control devices necessary to provide reasonable protection for motorists, pedestrians and construction workers in accordance with these Specifications and the applicable provisions of Section 105.4.5 – Maintenance of Existing Structures.

Traffic control devices include signs, signals, lighting devices, markings, barricades, channelizing, and hand signaling devices, traffic officers, and flaggers.

- 652.2 **Materials** - All traffic control devices shall conform to the requirements of Part VI of the latest edition of the MUTCD, and MASH 16 guidelines.

All signs shall be fabricated with high intensity fluorescent retroreflective sheeting conforming to ASTM D4956 - Type VIII, or Type IX (prismatic). All barricades, drums, and vertical panel markers shall be fabricated with high intensity orange and white fluorescent retroreflective sheeting conforming ASTM D4956 - Type VII, Type VIII, or Type IX (prismatic).

Construction signs shall be fabricated from materials that are flat, free from defects, retro-reflectorized, and of sufficient strength to withstand deflections using a wind speed of 80 miles per hour.

All barricades, cones, drums, and construction signs may be constructed from new or recycled plastic.

652.2.1 **Removed**

- 652.2.2 **Signs** - Only signs with symbol messages conforming to the design of the Manual of Uniform Traffic Control Devices shall be used unless the Resident approves the substitution of word messages.

- 652.2.3 **Flashing Arrow Boards** - Flashing Arrows must be of a type that has been submitted to AASHTO's Product Evaluation & Audit Solutions for evaluation.

Flashing Arrow Boards units shall meet requirements of the current Manual on Uniform Traffic Control Devices (MUTCD) for Type "C". Each Flashing Arrow Board shall have a matrix of a minimum of 15 low-glare, sealed beam, Par 46 elements capable of either flashing or sequential displays as well as the various operating modes as described in the MUTCD, Chapter 6-F. If a Flashing Arrow Board consisting of a bulb matrix is used, each element should be recess-mounted or equipped with an upper hood of not less than 180°. The color presented by the elements shall be yellow.

Flashing Arrow Board elements shall be capable of at least a 50% dimming from full brilliance. Full brilliance should be used for daytime

operations and the dimmed mode shall be used for nighttime operations. Flashing Arrow Boards shall be at least 96" x 48" and finished in non-reflective black. The Flashing Arrow Boards shall be interpretable for a distance not less than 1 mile.

Operating modes shall include, flashing arrow, sequential arrow, sequential chevron, flashing double arrow, and flashing caution. In the three arrow signals, the second light from the arrow point shall not operate.

The minimum element on-time shall be 50% for the flashing mode, with equal intervals of 25% for each sequential phase. The flashing rate shall be not less than 25 nor more than 40 flashes per minute. All on-board circuitry shall be solid state.

The primary power source shall be 12 volt solar with a battery back-up to provide continuous operation when failure of the primary power source occurs, up to 30 Days with fully charged batteries. Batteries must be capable of being charged from an onboard 110 volt AC power source and the unit shall be equipped with a cable for this purpose.

Controller and battery compartments shall be enclosed in lockable, weather-tight boxes.

The Flashing Arrow Boards shall be mounted on a pneumatic-tired trailer or other suitable support for hauling to various locations, as directed. The minimum mounting height of an arrow panel should be 7 ft from the roadway to the bottom of the Flashing Arrow Boards.

The face of the trailer shall be delineated on a permanent basis by affixing retro-reflective material, known as conspicuity material, in a continuous line as seen by oncoming drivers.

A portable changeable message sign may be used to simulate an arrow panel display.

652.2.4 **Other Devices** - Vertical panel markers shall be orange and white striped, 8" wide by 24" high. On the Interstate System, vertical panel markers shall be orange and white striped, 12" wide by 36" high.

Cones shall be orange in color, at least 28" high, and retro-reflectorized. Retro-reflection shall be provided by a white band of retro-reflective sheeting conforming to Section 719.01, 6" wide, no more than 3 to 4" from the top of the cone, and a 4" wide white band at least 2" below the 6" band.

Drums shall be of plastic or other yielding material, and shall be approximately 36" high and a minimum of 18" in diameter. There shall be at least two retro-reflectorized orange and at least two retro-

reflectorized white stripes at least 4" wide on each drum. Metal drums shall not be used.

Warning lights and battery operated flashing and steady burn lights shall conform to the requirements Section 712.23 - Flashing Lights.

Flaggers shall use a STOP / SLOW hand held paddle as the primary and preferred hand signaling device. Flags shall only be limited to emergencies.

STOP / SLOW paddles shall have high intensity prismatic retro reflective sheeting, have an octagonal shape on a rigid handle and shall be at least 18" wide with letters at least 6" high and shall be constructed from light semi-rigid material. The STOP (R1-1) face shall have white letters and a white border on a red background. The SLOW (W20-8) face shall have black letters and a black border on an orange background.

STOP / SLOW paddles shall also incorporate either white or red flashing lights on the STOP face and white or yellow flashing lights on the SLOW face of the paddle and always be in use.

Paddles must conform to any of the following patterns:

- A. Two white or red lights (colors shall be all white or all red), one centered vertically above and one centered vertically below the STOP legend; and/or two white or yellow lights (colors shall be all white or all yellow), one centered vertically above and one centered vertically below the SLOW legend.
- B. Two white or red lights (colors shall be all white or all red), one centered horizontally on each side of the STOP legend; and/or two white or yellow lights (colors shall be all white or all yellow), one centered horizontally on each side of the SLOW legend.
- C. One white or red light centered below the STOP legend; and/or one white or yellow light centered below the SLOW legend.
- D. A series of eight or more small all white or all red lights no larger than 1/4" in diameter along the outer edge of the paddle, arranged in an octagonal pattern at the eight corners of the border of the STOP face; and/or a series of eight or more small all white or all yellow lights no larger than 1/4" in diameter along the outer edge of the paddle, arranged in a diamond pattern along the border of the SLOW face.
- E. A series of white lights forming the shapes of the letters in the legend. Flashing light patterns shall be compliant with Section

6E.03 - Hand Signaling Devices in the most current version of the Manual on Uniform Traffic Control Devices.

All flashing light patterns on the STOP / SLOW paddle shall be visible from a minimum distance of 1,000 ft.

Type I barricades shall be 2 ft minimum, 8 ft maximum in length with an 8" wide rail mounted 3 ft minimum above the ground. Type II barricades shall be 2 ft in length with two 8" wide rails, and the top rail shall be mounted 3 ft minimum above the roadway. Type III barricades shall be 8 ft in length with three 8" wide rails, and the top rail shall be mounted 5 ft minimum above the roadway. The cross members of all barricades shall be of ½ or ⅝" thick plywood or other lightweight rigid material such as plastic, fiberglass or fiber wood as approved by the Resident. The predominant color for supports and other barricade components shall be white, except that unpainted galvanized metal or aluminum components may be used.

- 652.2.5 **Portable Changeable Message Sign** - Trailer mounted Portable Changeable Message Signs (PCMS) must be of a type that has been submitted to AASHTO's Product Evaluation & Audit Solutions for evaluation. The PCMS unit shall meet or exceed the current specifications of the Manual on Uniform Traffic Control Devices (MUTCD).

The front face of the sign should be covered with a low-glare protective material. The color of the LED elements shall be amber on a black background. The PCMS should be visible from a distance of 0.5 mile Day and night, and have a minimum 15° viewing angle. Characters must be legible from a distance of at least 650 ft.

The message panel should have adjustable display rates (minimum of 3 seconds per phase), so that the entire message can be read at least twice at the posted speed, the off-peak 85th percentile speed prior to work starting, or the anticipated operating speed. Each message shall consist of either one or two phases. A phase shall consist of up to eight characters per line. The unit must be capable of displaying at least three lines of text with eight characters per line. Each character shall be 18" high. Each character module shall use at least a five wide and seven high pixel matrix. The text of the messages shall not scroll or travel horizontally or vertically across the face of the sign.

Units shall automatically adjust their brightness under varying light conditions to maintain legibility.

The control system shall include a display screen upon which messages can be reviewed before being displayed on the message sign. The control system shall be capable of maintaining memory when power is unavailable. Messages must be changeable with either

a portable electronic device like a notebook computer or an on-board keypad. The controller shall have the capability to store a minimum of 200 user-defined and 200 pre-programmed messages. Controller and battery compartments shall be enclosed in lockable, weather-tight boxes. The cabinet shall be locked at all times that the Contractor is not actively changing the message. The Contractor shall change the password for the controller prior to stationing the PCMS and shall provide the password to the Resident. The password shall be unique per PCMS and secure and shall not be written anywhere in, on, around, or stored in the PCMS.

PCMS units shall have the capability of being made programmable by means of wireless communications. PCMS units shall also be fully capable of having an on-board radar system installed if required for a particular application.

The PCMS primary power source shall be solar with a battery back-up to provide continuous operation when failure of the primary power source occurs. Batteries must be capable of being charged from a 110 volt AC power source. The unit must also be capable of being operated solely from a 110 volt AC power source and be equipped with a cable for this purpose.

The PCMS shall be mounted on a trailer in such a way that the bottom of the message sign panel shall be a minimum of 7 ft above the roadway in urban areas and 5 ft above the roadway in rural areas when it is in the operating mode. PCMS trailers should be of a heavy-duty type with a 2" ball hitch and a minimum of four leveling jacks (one at each corner). The sign shall be capable of being rotated 360° relative to the trailer. The face of the trailer shall be delineated on a permanent basis by affixing retro-reflective material, known as conspicuity material, in a continuous line as seen by oncoming drivers.

652.2.6 **Device Crashworthiness** - MaineDOT is transitioning to MASH2016 criteria for Work Zone Traffic Control Devices on the following schedule:

- **Category 1** - Cones, Drums, Tubular Markers, Flexible Delineators, and similar devices that have little chance of causing windshield penetration, tire damage, or other significant effect on the control or trajectory of a vehicle
- All Category 1 devices will be manufacturer self-certified as MASH2016 by January 1, 2025.
- **Category 2** - Barricades, Portable Sign Supports, Category 1 devices with attachments, and similar devices that are not

expected to produce significant vehicular velocity change but may be otherwise hazardous.

- All Category 2 devices will be crash tested and/or evaluated to MASH2016 criteria by January 1, 2025.
- **Category 3** - Portable Concrete Barrier, Portable Crash Cushions, Truck Mounted Attenuators, Category 2 devices weighing more than 100 pounds, and similar devices that are expected to produce significant vehicular velocity change or other harmful reactions.
- All Category 3 devices will be crash tested and/or evaluated to MASH2016 criteria by January 1, 2030. Current Category 3 devices in useful serviceable condition that are successfully tested to NCHRP Report 350 or MASH2009 criteria may be utilized through December 31, 2029. (See Standard Specification 526 for additional Portable Concrete Barrier information).
- **Category 4** – Trailer Mounted Devices such as Arrow Boards, Temporary Traffic Control Signals, Area Lighting, Portable Changeable Message Signs, and other similar devices.
- All Category 4 devices will be crash tested and/or evaluated to MASH2016 criteria by January 1, 2030. Current Category 4 devices in useful serviceable condition that are successfully tested to NCHRP Report 350 or MASH2009 criteria may be utilized through December 31, 2029.

CONSTRUCTION REQUIREMENTS

652.3 Construction Requirements

- 652.3.1 **Responsibility of the Department** - The Department will provide Project traffic requirements such as allowable lane or road closures, minimum temporary lane widths, work zone speed limits, timing limitations, and allowable special detours and temporary structures. No revisions to these requirements will be permitted unless the Contractor can thoroughly demonstrate an overall benefit to the public and a Contract Modification is approved.
- 652.3.2 **Responsibility of the Contractor** - The Contractor shall provide continuous and effective traffic control and management for the Project that is appropriate to the construction means, methods, and sequencing allowed by the Contract and selected by the Contractor.

652.3.3 **Submittal of Traffic Control Plan** - The Contractor shall submit, at or before the Preconstruction Meeting, a Traffic Control Plan (TCP) that provides the following information to the Department:

- a. The name, telephone number, and other contact numbers (cell phone) of the Contractor's Traffic Control Supervisor (TCS). The TCS is the person with overall responsibility for ensuring the Contractor follows the TCP and who has received Work Zone Traffic Control Training commensurate with the level of responsibility shown in the requirements of the Contract, and who is empowered to immediately resolve any work zone traffic control deficiencies or issues. Provide documentation that the Traffic Control Supervisor has completed a Work Zone Traffic Control Training Course (AGC, ATSSA, or other industry-recognized training), and a Supervisory refresher training every 5 years thereafter. Submit training certificates or attendance rosters that include the course name, training entity, and date of training.

Traffic Control Training Course curriculum must be based on the standards and guidelines of the MUTCD and must include, at a minimum, the following:

1. Parts of Temporary Traffic Control Zone
2. Appropriate use and spacing of signs
3. Use and spacing of channelizing devices
4. Flagging basics
5. Typical examples and applications

The Traffic Control Supervisor, or designee directly overseeing physical installation, adjustment, and dismantling of work zone traffic control, will ensure all personnel performing those activities are trained to execute the work in a safe and proper manner, in accordance with their level of decision-making and responsibility.

- b. Proposed construction phasing or sequencing that reasonably minimizes traffic impacts. The Contractor shall conduct the Work such that traffic delays do not exceed 10 minutes unless longer periods are authorized by the Department. The Contractor shall provide advance signing to warn motorists of expected traffic backups or queues.
- c. A written narrative and/or plan explaining how traffic and pedestrians will be moved through the Project Limits, including transitions during the change from one phase of construction to the next, as applicable.

- d. Temporary traffic control treatments at all intersections with roads, rail crossings, businesses, parking lots, pedestrian ways, bike paths, trails, residences, garages, farms, and other access points, as applicable.
- e. A list of all Contractor or Subcontractor certified flaggers to be used on the Project, together with the number of flaggers which will be used for each type of operation that flagging is needed. If the Contractor is using a flagging Subcontractor, then the name and address of the Subcontractor may be provided instead of a list of flaggers.
- f. A procedure for notifying the Resident, local emergency officials, and local government officials (including the name and phone numbers of such officials) whenever significant traffic impacts are anticipated or occur and the plan for removing all lane restrictions in case of emergency or significant traffic impact. For a related provision, see Section 105.2.3 - Project Specific Emergency Planning.
- g. A description of any special detours including provisions for constructing, maintaining, signing, and removing the detour or detours, including all temporary bridges and accessory features and complete restoration of the impacted land.
- h. The maximum length of requested contiguous lane closure. The Contractor shall not close excessive lengths of traffic lane to avoid moving traffic control devices.
- i. The proposed temporary roadway surface conditions and treatments. The Contractor shall provide an adequate roadway surface at all times, taking into account traffic speed, volume, and duration.
- j. The coordination of appropriate temporary items (drainage, concrete barriers, barrier end treatments, impact attenuators, and traffic signals) with the TCP.
- k. The plan for unexpected nighttime work. The Contractor shall provide a list of emergency nighttime lighting equipment and safety personnel available onsite or have the ability to have them on site within an hour of the time of need.
- l. The plan for meeting any Project-specific requirements included in any Section 105 and/or 107 Special Provisions.
- m. The lighting plan if night work is anticipated.
- n. A security plan for any PCMS shall be included. The Contractor shall provide a plan for secure access to the PCMS

and protection from unauthorized users. The plan shall have details on securing the cabinets via a lock and password from unauthorized users, password changing protocols, and where the access information will be kept so it can be used in the event of emergency. The Contractor shall not identify or store passwords in the TCP.

The Department will review the TCP for completeness and conformity with Federal requirements, Contract provisions, the current edition of the MUTCD, and Department policy and procedures. The Department will review and provide comments to the Contractor within 14 Days of receipt of the TCP. No review or comment by the Department, or any failure to review or comment, shall relieve the Contractor of its responsibility to design and implement the plan in accordance with the Contract, or to shift any responsibility to the Department. If the TCP is determined by the Department to be operationally ineffective, the Contractor shall submit modifications of the TCP to the Department for review, and shall implement these changes at no additional cost to the Contract. Nothing in this Section shall negate the Contractor's obligations set forth in Section 110 - Indemnification, Bonding, and Insurance. The creation and modification of the TCP will be considered incidental to the related 652 items.

- 652.3.4 **General** - Prior to starting any work on any part of the Project adjacent to or being used by the traveling public, the Contractor shall install the appropriate traffic control devices in accordance with the plans, specifications and the latest edition of the Manual of Uniform Traffic Control Devices, Part VI. The Contractor shall continuously maintain the traffic control devices in their proper position, and they shall be kept clean, legible and in good repair throughout the duration of the work. If notified that the traffic control devices are not in place or not properly maintained, the Contractor may be ordered to immediately suspend work until all deficiencies are corrected.

No equipment or vehicles of the Contractor, their Subcontractors, or employees engaged in work on this Contract shall be parked or stopped on lanes carrying traffic, or on lanes or shoulders adjacent to lanes carrying traffic, at any time, except as required by ongoing work operations. Contractor equipment or vehicles shall never be used to stop, block, or channelize traffic, unless expressly allowed otherwise in the Contract.

The Contractor shall not store material or park equipment within 15 ft of the edge of the established travel lanes. Equipment parked overnight between 15 and 30 ft of the edge of the travel lane shall be placed behind positive barriers if feasible, or clearly marked by channelizing devices or other reflective devices.

Channelization devices shall include Vertical Panel Markers, Barricades, Cones, and Drums. These devices shall be installed and maintained at the spacing determined by the MUTCD through the work area.

Channelization devices consisting of barricades or drums, at a maximum spacing of 50 ft, shall be used in guardrail areas when neither the existing guardrail nor the new guardrail is in place.

The Contractor shall maintain existing guardrails and/or barriers until removal is necessary for construction. The Contractor shall use a portable barrier or appropriate channelizing devices while the guardrails and/or barriers are absent. Permanent guardrails and barriers shall be installed as soon as possible to minimize risk to the public.

All excavation areas adjacent to the roadway shall be channelized continuously in both directions for the length of the Project in all areas where the centerline strip is not effective in accordance with the latest edition of the MUTCD.

Where the roadway is adjacent to an area being excavated, a minimum 2 ft shoulder shall be maintained and the effective slope of the earth excavation beyond the 2 ft shoulder shall not be steeper than a 1½ horizontal to 1 vertical. The effective slope of rock excavation shall not be steeper than 1 horizontal to 1 vertical beyond the 2 ft shoulder. In the case of cuts over 5 ft deep, a portable concrete barrier or other approved barrier shall be placed between the travel lane and the excavated area.

In this instance, travel speeds shall be limited by specific advisory signing to 20 mph in all cases. When excavation does not leave sufficient usable widths to maintain two-way traffic as provided in Section 105.4 - Maintenance of Work, one-lane traffic controlled by a traffic signal or continuous flagging may be considered. Closely spaced vertical panels, drums or other channelizing devices shall be used on any of these types of areas that are left exposed for short durations.

When paving operations or shoulder grading leave a 3" or less exposed vertical face at the edge of the traveled way, channelization devices shall be placed 2 ft outside the edge of the pavement at intervals not exceeding 600 ft and a 48" by 48" W8-9 Low Shoulder sign shall be placed at a maximum spacing of ½ mile. When paving operations or shoulder grading leave greater than a 3" exposed vertical face at the edge of the traveled way, the Contractor shall place shoulder material for a width of at least 4 ft to meet the pavement grade, and place

channelizing devices as described above, before the lane is opened to traffic.

A temporary ramp shall be constructed with HMA at the ends of the roadway section paved or milled each Day. The use of millings or RAP will not be allowed, but cold patch may be temporarily utilized until HMA plants are open for the season. The maximum ramp change in elevation shall not exceed 4" vertical. For Interstate Highways or roadways with speed limits equaling or exceeding 50 mph, temporary ramps shall be constructed at a length of 8 ft per inch of transition depth. For roadways with speed limits less than 50 mph and greater than 25 mph, temporary ramps shall be constructed at a length of 4 ft per inch of transition depth. For roadways with speed limits of 25 mph or less, temporary ramps shall be constructed at a length of 2 ft per inch of transition depth. Materials, placement, maintenance, and removal of temporary ramps shall be considered incidental to related Contract items.

Special Detours and temporary structures, if used, shall meet applicable AASHTO standards, including curve radii and grade.

- 652.3.5 ***Installation of Traffic Control Devices*** - All traffic control devices shall be in conformance with NCHRP 350 requirements and installed as per manufacture's recommendations.

Portable signs shall be erected on temporary sign supports approved crashworthy devices so that the bottom of the sign is either 1) 12" or 2) greater than 5 ft above the traveled way. Post-mounted signs shall be erected so the bottom of the sign is no less than 5 ft above the traveled way, and 7 ft above the traveled way in business, commercial, and residential areas. Post-mounted signs must be erected so that the sign face is in a true vertical position. All signs shall be placed so that they are not obstructed in any manner and immediately modified to ensure proper visibility if obstructed. Signs may be mounted lower or higher to fit the situation when authorized by the Resident. Cones shall be either weighted or nailed. Tires will not be allowed as weights.

Vertical panel markers shall be mounted with the top at least 4 ft above the traveled way.

Drums shall not be weighted on the top. Drain holes shall be provided to prevent water from accumulating in the drums. Drums may be weighted with up to 6" of loose dry sand.

The Contractor shall operate and maintain the Flashing Arrow Board unit and trailer and shall continuously supply fuel and lubrication for dependable service during the life of the Contract. The units shall remain in continuous Night and Day service at locations designated

until the Resident authorizes the unit to be moved to a new location or authorizes discontinuance of service of the unit.

The Contractor shall maintain the devices in proper position and clean them as necessary. Maintenance shall include the covering and uncovering of all signs when no longer applicable (even if for a very short duration). The sign shall be considered adequately covered when no part of the sign face is visible either around or through the covering.

The Contractor shall replace damaged traffic control devices with devices of acceptable quality, as directed by the Resident.

- 652.3.6 **Traffic Control** - The Contractor shall provide a minimum roadway width of 22 ft for two-way traffic and 11 ft for one-way traffic. The existing travel way width shall be maintained to the maximum extent practical. Vertical panel markers, drums, cones, or striping shall be used to clearly delineate the roadway through the construction area. Two-way traffic operation shall be provided at all times that the Contractor is not working on the Project, unless otherwise allowed by the Contract. One-way traffic shall be controlled through work areas by flaggers, utilizing radios, field telephones, or other means of direct communication.

The traffic control devices shall be moved or removed as the work progresses to assure compatibility between the uses of the traffic control devices and the traffic flow. Traffic control devices that become unnecessary shall be immediately removed from use.

Pavement markings shall be altered as required to conform to the existing traffic flow pattern. Repainting of pavement marking line, if required to maintain the effectiveness of the line, as determined by the Resident, will be paid for under the appropriate Pay Items.

Inappropriate existing pavement markings shall be removed whenever traffic is rerouted, and temporary construction pavement markings shall be placed. Obliteration and removal of non-applicable markings and placement of temporary construction pavement markings will be paid for under the appropriate Pay Item. Traffic changes shall not be made unless there is sufficient time, equipment, materials, and personnel available to complete the change properly before the end of the workday. This provision will not be required when traffic is rerouted for brief periods during daylight hours and the route can be clearly defined by channelizing devices, or flaggers, or both.

- 652.4 **Flaggers** - The Contractor shall furnish flaggers as required by the TCP or as otherwise specified by the Resident. All flaggers must have successfully completed a flagger test approved by the Department and administered by a Department-approved Flagger-Certifier who is employing that flagger. All flaggers

must carry an official certification card with them while flagging that has been issued by their employer.

For daytime conditions, flaggers shall wear a top (vest, shirt or jacket) that is orange, yellow, yellow-green, or fluorescent versions of these colors meeting ANSI 107-2004, Class 2 or Class 3, along with a hardhat with 360° visible retro-reflectivity.

For nighttime conditions, flaggers shall wear all Class 3 apparel, meeting ANSI 107-2004, including a Class 3 top (vest, shirt or jacket) and a Class E bottom (pants or coveralls); flaggers shall also wear hardhats with 360° visible retro-reflectivity and shall be visible at a minimum distance of 1,000 ft. Flagger stations must be illuminated in nighttime conditions to assure visibility and will be specifically addressed in detail in the Contractor's TCP.

Flagger stations shall be located far enough in advance of the workspace so that approaching road users will have sufficient distance to stop at the intended stopping point. While flagging, the flagger should stand either on the shoulder adjacent to the traffic being controlled, or in the closed lane. At a spot obstruction with adequate sight distance, the flagger may stand on the shoulder opposite the closed sections to operate effectively. Under no circumstances shall the flagger stand in the lane being used by moving traffic or have their back to oncoming traffic. The flagger should be clearly visible to approaching traffic at all times and should have a clear escape route.

When conditions do not allow for proper approach sight distance of a flagger or storage space for waiting vehicles, additional flaggers shall be used at the rear of the backlogged traffic or at a point where approaching vehicles have adequate stopping sight distance to the rear of the backlogged traffic. All flagger stations shall be signed, even when in close proximity. The signs shall be removed or covered when flagger operations are not in place, even if it is for a very short duration.

Flaggers shall be provided a 10 minute break, minimum, every 2 hours and a 30 minute, minimum, lunch period away from the work station. Flaggers may only receive one unpaid break per day; all other breaks must be paid. Sufficient certified flaggers shall be available onsite to provide for continuous flagging operations during break periods. If the flaggers are receiving the appropriate breaks, breaker flagger(s) shall be paid starting 2 hours after the work begins and ending 2 hours before the work ends. A maximum of 1 breaker per 6 flaggers will be paid. (1 breaker flagger for 2 to 6 flaggers, 2 breaker flaggers for 7 to 12 flaggers, etc.) If a flagger station is manned for 10 hours or more, then ½ hour for lunch will be deducted from the billable breaker flagger hours.

652.4.1 **Traffic Officers** - Traffic officers will be uniformed police officers.

652.5 **Warning Lights** - Warning lights shall be installed at locations designated by the Resident before any work is done on the portions of roadway being used by

traffic. Upon installation, all warning lights shall remain in continuous operation during the life of the Project, unless otherwise authorized by the Resident.

When a suitable 120 volt AC power service source is available within 500 ft of the designated warning light location, power operated flashing lights shall be installed. Two alternately flashing lamps shall be mounted approximately 24" above the sign, spaced approximately 24" apart.

When a suitable 120 volt AC power service source is not available, battery operated flashing lights may be erected. Four flashing lamps shall be mounted approximately 6" above the sign, spaced approximately 12" apart.

The power service connections shall be installed to the satisfaction of both the power company and the Resident. The Contractor shall make all necessary arrangements for the power service connections and be responsible for all charges incurred thereby, including power charges. The Contractor shall also be responsible for all outstanding bills from the electric power company for preliminary work done by the electric company for the power service connection.

When batteries are required for battery operated flashing lights, they shall be provided and replaced by the Contractor as necessary.

652.5.1 **Rumble Strip Crossing** - When lane shifts or lane closures require traffic to cross a permanent longitudinal rumble strip for 7 Calendar Days or less, the Contractor shall install warning signs that read "RUMBLE STRIP CROSSING" with a supplemental Motorcycle Plaque, (W8-15P).

When lane shifts or lane closures require traffic to cross a permanent longitudinal rumble strip for more than 7 Calendar Days, the Contractor shall pave in the rumble strips in the area that traffic will cross, unless otherwise directed by the Resident. Rumble strips shall be replaced prior to the end of the Project, when it is no longer necessary to cross them.

652.6 **Removed**

652.6.1 **Daylight Work Times** - Unless otherwise described in the Contract, the Contractor is allowed to commence work and end work daily according to the Sunrise/Sunset times procured at: <https://www.sunrisesunset.com/usa/Maine/> . If the Project town is not listed, the closest town on the list will be used as agreed at the Preconstruction Meeting. Any work conducted before sunrise or after sunset will be considered Night Work.

652.6.2 **Night Work** - When Night Work occurs (either scheduled or unscheduled), the Contractor shall provide and maintain lighting on all equipment, at all work stations, and all flagger stations.

The lighting facilities shall be capable of providing light of sufficient intensity to permit good workmanship, safety and proper inspection at all times. The lighting shall be cut off and arranged on stanchions at a height that will provide perimeter lighting for each piece of equipment and will not interfere with traffic, including commercial vehicles, approaching the work site from either direction.

The Contractor shall have available portable floodlights for special areas.

The Contractor shall utilize padding, shielding or other insulation of mechanical and electrical equipment, if necessary, to minimize noise, and shall provide sufficient fuel, spare lamps, generators, etc. to maintain lighting of the work site.

The Contractor shall submit, as a subset of the Traffic Control Plan, a lighting plan at the Preconstruction Conference, showing the type and location of lights to be used for night work. The Resident may require modifications be made to the lighting set up in actual field conditions.

Prior to beginning any Night Work, the Contractor shall furnish a light meter for the Residents use that is capable of measuring the range of light levels from 5 to 20 foot-candles.

Horizontal illumination, for activities on the ground, shall be measured with the photometer parallel to the road surface. For purposes of roadway lighting, the photometer is placed on the pavement. Vertical illumination, for overhead activities, shall be measured with the photometer perpendicular to the road surface. Measurements shall be taken at the height and location of the overhead activity.

Night Work lighting requirements:

- **Mobile Operations** - For mobile-type operations, each piece of equipment (paver, roller, milling machine, etc.) will carry indirect (i.e. balloon type) lights capable of producing at least 10 foot-candles of lighting around the work area of the equipment.
- **Fixed Operations** - For fixed-type operations (flaggers, curb, bridge, pipes, etc.), direct (i.e. tower) lighting will be utilized capable of illuminating the work area with at least 10 foot-candles of light.
- **Hybrid Operations** - For hybrid-type operations (guardrail, sweeping, Inslope excavation, etc.), either direct or indirect lighting may be utilized. The chosen lights must be capable of producing at least 10 foot-candles of light around the work area of the equipment

- **Inspection Operations** - Areas required to be inspected by the Department will require a minimum of 5 foot-candles of lighting. This may be accomplished through direct or indirect means.

All workers shall wear safety apparel labeled as meeting the ANSI 107-2004 standard performance for Class 3 risk exposure.

The Contractor shall apply 2" wide retro-reflective tape, with alternating red and white segments, to outline the front back and sides of construction vehicles and equipment, to define their shape and size to the extent practicable. Pickup trucks and personal vehicles are exempt from this requirement. The Contractor shall furnish approved signs reading "Construction Vehicle - Keep Back" to be used on trucks hauling to the Project when such signs are deemed necessary by the Resident. The signs shall be a minimum of 30" by 60", Black and Orange, ASTM D4956 - Type VII, Type VIII, or Type IX (prismatic).

All vehicles used on the Project, including pickup trucks and personal vehicles, shall be equipped with amber flashing lights, visible from both front and rear, or by means of single, approved type, revolving, flashing or strobe lights mounted such that they are visible from 360°. The vehicle flashing system shall be in continuous operation while the vehicle is on any part of the Project.

The Resident or any other representative of the Department reserves the right to suspend the work at any time and request a meeting to discuss violations and remedies. The Department shall not be held responsible for any delay in the work due to any suspension under this item. Failure to follow the approved Lighting Plan will result in a Traffic Control violation.

Payment for lighting, vehicle mounted signs and other costs accrued because of night work will not be made directly but will be considered incidental to related Contract items.

652.7 **Method of Measurement** - Signs and panel markers will be measured by the square foot for all signs authorized and installed. Flashing Arrow Boards, portable-changeable message signs, and flashing and steady burn lights, will be measured by each unit authorized and installed on the Project. Barricades, drums, and cones will be measured by each unit authorized. No additional payment will be made for devices that require replacement due to poor condition or inadequate retro-reflectivity.

The accepted quantity of traffic officer and flagger time will be the number of hours the designated station is occupied. The number of hours authorized for payment will be measured to the nearest ¼ hour.

Maintenance of traffic control devices will be measured by the Calendar Day or as one lump sum for all authorized and installed traffic control devices.

Warning lights will be measured by the group of lights furnished.

- 652.8 ***Basis of Payment*** - The accepted quantity of signs and panel markers will be paid for at the Contract unit price per square foot. Such payment will be full compensation for furnishing and installing all signs, sign supports, and all incidentals necessary to complete the installation of the signs.

The accepted quantity of Flashing Arrow Boards, portable-changeable message signs, barricades, battery operated flashing and steady burn lights, drums, and cones will be paid for at the Contract unit price each for the actual number of devices authorized, furnished, and installed. Such payment shall be full compensation for all incidentals necessary to install and maintain the respective devices.

Failure by the Contractor to follow the Section 652 - Special Provisions and Standard Specification and/or the Manual on Uniform Traffic Control Devices (MUTCD) and/or the Contractors own Traffic Control Plan will result in a violation letter and result in a reduction in payment as shown in the schedule below. The Resident or any other representative of the Department reserves the right to suspend the work at any time and request a meeting to discuss violations and remedies. The Department shall not be held responsible for any delay in the work due to any suspension under this item. Any reduction in payment under this Special Provision will be in addition to forfeiting payment of maintenance of traffic control devices for that Day.

ORIGINAL CONTRACT AMOUNT		Amount of Penalty Damages per Violation		
From	Up to and Including	1 st	2 nd	3 rd & Subsequent
\$0	\$1,000,000	\$250	\$500	\$1,250
\$1,000,000	\$2,000,000	\$500	\$1,000	\$2,500
\$2,000,000	\$4,000,000	\$1,000	\$2,000	\$5,000
\$4,000,000	and more	\$2,000	\$4,000	\$10,000

652.8.1 ***Maintenance of Traffic Control Devices***

- 652.8.1.1 ***Payment by Calendar Day*** - Maintenance of Traffic Control Devices will be paid for at the Contract unit price per Calendar Day for each Calendar Day that the Contractor maintains traffic as specified herein. Such payment will be full compensation for moving devices as many times as necessary; for replacing devices damaged, lost, or stolen; and for cleaning, maintaining, and removing all devices used for traffic control.

The Contract unit price per Calendar Day for Maintenance of Traffic Control Devices shall be full payment each Day for such maintenance, encompassing all areas of the Contract, regardless of whether the work areas or Projects are geographically separated.

652.8.1.2 ***Payment by Lump Sum*** - Maintenance of Traffic Control Devices will be paid at the Contract lump sum price. Such payment will be full compensation for all Days that the Contractor maintains traffic as specified herein, and for moving devices as many times as necessary; for replacing devices damaged, lost, or stolen; and for cleaning, maintaining, and removing all devices used for traffic control.

The Contract lump sum price for Maintenance of Traffic Control Devices shall be full compensation for all Days for such maintenance, encompassing all areas of the Contract, regardless of whether the work areas or Projects are geographically separated.

652.8.2 ***Other Items***

The accepted quantities of flagger hours will be paid for at the Contract unit price per hour for each flagging station occupied excluding lunch breaks, and for each approved breaker flagger. Overtime hours, as reported on the certified payrolls, will be paid at an additional 30% of the bid price for Pay Item 652.38. The computation and additional payment for overtime hours will occur during the Project close-out process and will be paid as additional hours of 652.38 to the nearest ¼ hour. The Contract unit price shall be full compensation for hiring, transporting, equipping, supervising, and the payment of flaggers and all overhead and incidentals necessary to complete the work.

The accepted quantities of traffic officer hours will be paid for at the Contract unit price per hour for each station occupied, with no additional payment for overtime. This price shall be full compensation for supplying uniformed officers with police cruisers, and all incidentals necessary to complete the work, including transportation, equipment, and supervision.

The accepted quantities of warning lights will be paid for at the Contract unit price, per group, complete in place including the necessary power, and remaining in operation during active work of the Project or as otherwise directed. Upon completion of the work, the lamps, fixtures, and the framework required to properly mount the lamps shall remain the property of the Contractor.

Payment for temporary pavement marking lines, re-application of temporary pavement marking lines, and pavement marking removal will be made under the respective Pay Items in Section 627 - Pavement Markings.

Payment for temporary traffic signals will be made under Section 643 - Traffic Signals.

There will be no payment made under any 652 Pay Items after the expiration of the adjusted total Contract time.

Payment will be made under:

Pay Item		Pay Unit
652.30	Flashing Arrow	Each
652.31	Type I Barricade	Each
652.311	Type II Barricade	Each
652.312	Type III Barricades	Each
652.32	Battery Operated Light	Each
652.33	Drum	Each
652.34	Cone	Each
652.35	Construction Signs	Square Foot
652.36	Maintenance of Traffic Control Devices	Calendar Day
652.361	Maintenance of Traffic Control Devices	Lump Sum
652.37	Warning Lights	Group
652.38	Flaggers	Hour
652.381	Traffic Officers	Hour
652.41	Portable-Changeable Message Sign	Each

SECTION 653 - POLYSTYRENE PLASTIC INSULATION

653.01 **Description** - This work shall consist of furnishing and installing a polystyrene plastic insulating layer at locations designated on the plans in accordance with these specifications.

653.02 **General** - Insulating material shall be extruded polystyrene insulating board conforming to the requirements of AASHTO M 230.

Pegs shall be hard wood, approximately 6" by 1/4" round, pointed on one end.

653.03 **Preparation of Foundation** - The insulating boards shall be placed on a compacted layer of granular material graded to a tolerance of 1/2" above or below the required grade and cross section. The surface shall be free of rocks that would cause damage to the insulating boards. The type and thickness of the granular material will be as shown on the plans.

653.04 **Placing Insulating Boards** - The insulating boards shall be secured to the ground with pegs placed at each corner or where directed by the Resident, and driven

flush with the surface of the insulating board. Joints between the insulating boards shall be staggered. The openings in all joint shall be kept to a minimum.

- 653.05 **Placing Backfill** - After the insulating boards have been placed, granular material shall be placed using care to avoid pushing or puncturing the boards. The depth of the first layer of aggregate subbase sand shall not be less than 10" loose measure. The aggregate subbase sand shall be spread with a crawler type bulldozer of not more than 2,000 lb/ft² ground contact pressure or with other approved equipment but not supported directly on the insulating boards. Trucks and other heavy construction equipment shall not be operated directly on the insulating boards. The type and thickness of granular material will be shown on the plans.
- 653.06 **Compaction** - Compaction of the first layer of aggregate subbase sand shall be by vibratory methods to the satisfaction of the Resident. After the first layer has been compacted, normal construction practices may be followed providing no loads are placed on the area that produce more than 2,000 lb/ft² ground contact pressure.
- 653.07 **Protection of Polystyrene** - Since gasoline, oil, heat, and sunlight will damage polystyrene, all precautions shall be taken to prevent them from damaging the insulating board. The insulating boards shall not be stored in sunlight for more than 1 Day.
- 653.08 **Method of Measurement** - Polystyrene plastic insulation will be measured by the square yard in place.
- 653.09 **Basis of Payment** - The accepted quantities of polystyrene plastic insulation will be paid for at the Contract unit price per square yard complete in place. Payment shall be full compensation for and for furnishing and placing the insulating boards of pegs.

Payment will be made under:

Pay Item		Pay Unit
653.20	1" Polystyrene Plastic Insulation	Square Yard
653.21	1½" Polystyrene Plastic Insulation	Square Yard
653.22	2" Polystyrene Plastic Insulation	Square Yard
653.23	3" Polystyrene Plastic Insulation	Square Yard

SECTION 654 - INTELLIGENT TRANSPORTATION SYSTEMS - Reserved

SECTION 655 - ELECTRICAL WORK - Reserved

SECTION 656 - TEMPORARY SOIL EROSION AND WATER POLLUTION CONTROL

656.1 ***Responsibility of the Contractor - Prepare and Follow Plan*** - The Contractor shall provide continuous and effective temporary soil erosion and water pollution control for the Project that is appropriate to the construction means, methods and sequencing allowed by the Contract and selected by the Contractor. To do so, the Contractor shall prepare and submit a Soil Erosion and Water Pollution Control Plan (SEWPCP) and properly implement its approved SEWPCP. The Contractor shall have its SEWPCP approved, perform a preconstruction field review, and install and certify initial controls before commencing any Work, which could disturb soils or impact water quality. Failure by the Contractor to follow Standard Specification or Special Provision - Section 656 will result in a violation letter and a reduction in payment as shown in the schedule list in 656.5.1. The Department's Resident or any other representative of The Department reserves the right to suspend the work at any time and request a meeting to discuss violations and remedies. The Department shall not be held responsible for any delay in the work due to any suspension under this item.

If the Contractor properly implements its approved SEWPCP, then:

- (1) any Work required in excess of that required by the SEWPCP will be Extra Work,
- (2) any Delay resulting from any such excess Work will be analyzed in accordance with Section 109.5 - Adjustments for Delay, and
- (3) the Contractor will not be responsible for damages relating to insufficient soil erosion and water pollution control including the cost of all environmental enforcement actions, penalties, or monetary settlements assessed any environmental regulatory entity and all costs incurred by or through the Department.

If the Contractor fails to prepare, submit, or seek approval of a SEWPCP or fails to properly implement its approved SEWPCP, then:

- (1) the Department may suspend all Work,
- (2) the Department may withhold all Progress Payments or any portion thereof until the Contractor remedies all deficiencies;

- (3) the Department may remedy deficiencies with Departmental or contracted forces and deduct the cost thereof from payments otherwise due the Contractor;
- (4) any delay resulting from such failure or non-compliance will be a Non-excusable Delay; and
- (5) the Contractor will be responsible for all damages arising from or related to such failure or non-compliance including the cost of all environmental enforcement actions, penalties, or monetary settlements assessed by any environmental regulatory entity and all costs incurred by or through the Department including legal and consulting fees.

656.2 ***Submittal and Approval of the SEWPCP*** - Within 21 Calendar Days of Contract Execution, the Contractor must submit two copies of its SEWPCP to the Resident.

Within 14 Days of receipt, the Department will determine if the SEWPCP is in accordance with the Contract requirements and

- (1) notify the Contractor that the SEWPCP is approved or
- (2) return it for any needed revisions.

If returned for revision, the Contractor must resubmit two copies of its revised SEWPCP as provided above within 7 Days and the Department will have 7 Days from receipt of the revised plan to notify the Contractor whether its SEWPCP is approved or again requires revision. Additional iterations will occur in a like manner until the Department approves the Contractor's SEWPCP. The Contractor must have its SEWPCP approved and implemented before commencing any Work, which could disturb soils or impact water quality.

656.3 ***SEWPCP Requirements***

656.3.1 ***Qualifications of Preparer*** - The preparer of the SEWPCP must be knowledgeable and experienced in erosion and pollution control and must

- (1) be a "DEP Certified Contractor" as designated by the Maine Department of Environmental Protection (MDEP), or
- (2) be licensed in Maine as a Professional Engineer, Landscape Architect, or Soil Scientist.

656.3.2 ***Standards*** - The SEWPCP must be in accordance with all applicable laws, rules, regulations, permit requirements and conditions, this specification, all other contractual provisions, and the latest version of Department's "Best Management Practices for Erosion & Sedimentation Control" (the "BMP Manual"). In the event of conflicting provisions, the SEWPCP must utilize the more restrictive requirements.

656.3.3 **General SEWPCP Elements** - In addition to other requirements provided for or referenced in this specification, the SEWPCP must include the following elements.

- a. The name and qualifications of the person preparing the SEWPCP.
- b. The name of the on-site person, the “Environmental Coordinator,” responsible for implementation of the SEWPCP, who must be the Contractor's Superintendent or other supervisory employee with the authority to immediately remedy any deficient controls, with their phone number and emergency number (personal cellular phone or pager).
- c. The schedule and sequence of all activities that involve soil disturbance including work on sites outside the right-of-way such as borrow pit operations, haul roads, staging areas, equipment storage sites, mixing plants, and Waste Areas including expansion of existing sites.
- d. Incorporation of permanent erosion and sedimentation control features into the Project at the earliest practicable time.
- e. Identification of steep slopes and highly erodible soils, with the method and frequency of soil stabilization. Temporary slope stabilization is required on a daily basis. Permanent slope stabilization measures shall be applied within 1 week of the last soil disturbance.
- f. Emergency procedures for storms, including availability of Materials and procedures and time frames for corrective action if controls fail.
- g. If water is flowing within the drainage system, the water shall be diverted to a stable area or conduit and work shall be conducted in the dry. The Contractor's plan shall address when and where the diversions will be necessary
- h. Type and location of all temporary erosion and sedimentation control measures. Temporary winter stabilization must be used between November 1st and April 1st, or outside of said time period if the ground is frozen or snow covered. Temporary winter stabilization involves, at a minimum, covering all disturbed soils and seeded ground that is not “Acceptable Work” with an approved method other than using unanchored hay or straw mulch. Such other methods may include the use of Erosion Control Mix or other covers that are not susceptible to erosion or wind movement, as described within the “Winter

Stabilization” section of the most recent Department BMP Manual. If temporary winter stabilization practices are used, spring procedures for permanent stabilization shall also be described in the SEWPCP. Use of these methods for over-winter temporary erosion control will be incidental to the contract and be paid for as part of Pay Item 656.75

- i. Mulching type and frequency of application for disturbed soil areas. Newly disturbed earth shall be mulched by the end of each workday. Mulch shall be maintained on a daily basis. All disturbed ditches/slopes shall be stabilized by the end of each workday. Stabilization shall be maintained on a daily basis. Erosion control blanket shall be installed in the bottoms of all ditches except where a stone lining is planned or otherwise stated in the Contract document. Seed shall be applied prior to the placement of the blanket.
- j. Location and frequency of application of temporary seeding. Permanent seeding shall be performed in accordance with the most current 618 specification, unless otherwise stated in the Contract document.
- k. Description of all dust control procedures for roadways, haul roads, work areas, and all other Contractor activities.
- l. Location and method of temporary erosion and sediment control for existing and proposed catch basins and all other drainage inlet and outlet areas. Culvert inlet and outlet protection shall be installed within 48 hours of culvert installation, or prior to a storm event, whichever is sooner.
- m. Describe all in-stream work, with timing and plans for temporary stream diversions and cofferdams. Water flow must be maintained at all times unless otherwise stated in the Contract document.
- n. Describe the design, location, and plans for sedimentation basins used for dewatering cofferdams. If a cofferdam sedimentation basin is used, it shall be located in an upland area where the water can settle and sink into the ground or be released slowly to the resource in a manner that will not cause erosion. The location of such a cofferdam sedimentation basin shall be addressed in the SEWPCP.
- o. Inspection and maintenance schedules for all erosion and water pollution control measures - temporary and permanent - including the method, frequency and disposal location for sediment removal.

- p. Demolition debris (including debris from wearing surface removal, saw cut slurry, dust, concrete debris, etc.) shall be contained and shall not be allowed to discharge to any resource. All demolition debris shall be disposed of in accordance with Standard Specifications, Section 202.03 - Removing Existing Superstructure, Structural Concrete, Railings, Curbs, Sidewalks and Bridges. Containment and disposal of demolition debris shall be addressed in the Contractor's SEWPCP
- q. Procedures for removal of temporary erosion and pollution controls.

656.3.4 **Water Pollution Control Requirements** - In addition to other requirements provided for or referenced in this specification, the SEWPCP must include all of the following requirements applicable to water pollution control.

- a. The Contractor must comply with the applicable federal, state, and local laws, and regulations relating to prevention and abatement of water pollution.
- b. Except as allowed by an approved permit or otherwise authorized by the Department in writing, pollutants and construction debris including excavated material, aggregate, residue from cleaning, sandblasting, or painting, cement mixtures, chemicals, fuels, lubricants, bitumens, raw sewage, wood chips, and other debris shall not be discharged into waterbodies, wetlands, or natural or man-made channels leading thereto and such materials shall not be located alongside waterbodies, wetlands, or such channels such that it will be washed away by high water or runoff.
- c. Construction operations in waterbodies or wetlands shall be restricted to the construction limits shown on the plans and to those areas that must be entered for the construction of temporary or permanent structures, except as allowed by approved permit or otherwise authorized by the Department in writing.
- d. Mechanized equipment shall not be operated in waterbodies or wetlands, except as allowed by approved permit or otherwise authorized by the Department in writing.
- e. Upon completion of the work, waterbodies or wetlands shall be promptly cleared of all falsework, piling, debris or other obstructions caused by the construction operations, except as otherwise authorized by the Department in writing.

- f. Spill Prevention If the Work includes the handling, use, or storage of petroleum products or hazardous Matter/Substances including the onsite fueling of Equipment, the SEWPCP must include a Spill Prevention Control and Countermeasure Plan (SPCCP). At a minimum, the SPCCP must include:
1. The name and emergency response numbers (telephone number, cellular phone and pager numbers, if applicable) of the Contractor's representative responsible for spill prevention and response;
 2. General description and location of (1) handling, transfer, storage, and containment facilities of such products or hazardous Matter/Substances (“activities and facilities”) and (2) potential receptors of such products or hazardous Matter/Substances including oceans, lakes, ponds, rivers, streams, wetlands, and sand and gravel aquifers (“sensitive resources”) including the distances between said activities and facilities and said sensitive resources;
 - I. Description of preventative measures to be used to minimize the possibility of a spill including Equipment and/or Materials to be used to prevent discharges including containment and diversionary structures, inspections and personnel training;
 - II. A contingency response plan to be implemented if spill should occur including a list of emergency phone/pager numbers including the Contractor's representative, MDEP Spill Response, the National Response Center (if spill enters the water), the Resident, and local police and fire authorities, a list of emergency response equipment and locations and a description of the capabilities of the equipment, a description of the general response and clean up protocols by product or Matter/Substances and an overview of the verbal and written notification procedures for federal, state and local officials. For a related provision, see 105.2.2 – Project Specific Emergency Planning.
- g. Water withdrawals for dust control or moisture control for compaction is prohibited from waterbodies in Maine that have identified invasive plant infestations. For current information and a map of waterbodies where withdrawal is prohibited, visit the DEP website;

<https://www.maine.gov/dep/water/invasives/> . Under the heading, “Control” there is a link to infested waterbodies.

For a related provision, see Section 105.8.3 - Wetland and Waterbody Impacts.

656.3.5 **Material Requirements** - Unless otherwise approved by the Department, the Contractor must use temporary erosion control Materials contained on the Department's Preapproved List of Erosion Control Materials if such a list is established, the Department's latest BMP Manual, or Section 717 - Roadside Improvement Materials.

656.3.6 **Construction Requirements** - In addition to other requirements provided for or referenced in this specification, the SEWPCP must include all of the following requirements applicable during construction.

- a. The Contractor shall install and maintain all temporary erosion control Materials in accordance with the manufacturer's recommendations, or the Department's latest BMP's or Standard Specifications where applicable.
- b. The Contractor shall perform in-stream work during low flow conditions, except as allowed by a specific Permit requirement. During in-stream work, the Contractor shall maintain water flow at all times except in ponded water or where specifically authorized. The Contractor, to the maximum extent practicable, shall place pipes in dry conditions.
- c. The Contractor, to the maximum extent practicable, shall install temporary and permanent erosion control measures prior to conducting clearing and grubbing operations. Clearing shall be minimized as shown on the design plans (if provided). The Contractor shall not conduct clearing operations within any protected vegetative buffer area indicated in the plans, notes, or special provisions. The Contractor shall limit excavation, borrow and embankment operations commensurate with its capability and progress in keeping the finish grading, mulching, seeding, and other such temporary and permanent erosion control measures current in accordance with its schedule. Should seasonal limitations make such coordination impractical, temporary erosion control measures shall be provided immediately.
- d. The Contractor shall not work in a wetland, except as allowed by a specific permit provision. All equipment which must work in a wetland shall travel and work on platforms or mats that protect vegetation which the Department has designated to

remain. The Contractor shall not store or stockpile materials in a wetland. The Contractor shall contain and immediately remove from the wetland or waterbody any debris generated by the Work.

- e. The Contractor shall not place uncured concrete directly into a waterbody. The Contractor shall not wash tools, forms, or other items in or adjacent to a waterbody or wetland. Prior to release to a natural resource, any impounded water that has been in contact with concrete placed during construction must have a pH between 6.0 and 8.5, must be within one pH unit of the background pH level of the resource and shall have a turbidity no greater than the receiving resource. This requirement is applicable to concrete that is placed or spilled (including leakage from forms) as well as indirect contact via tools or equipment. Water not meeting release criteria shall be addressed in the SEWPCP. Discharging impounded water to the stream must take place in a manner that does not disturb the stream bottom or cause erosion. The Contractor shall be responsible for monitoring pH with a calibrated meter accurate to 0.1 units. A record of pH measurements shall be kept in the Environmental Coordinator's log.
- f. The Contractor shall contain all demolition debris (including debris from wearing surface removal, saw cut slurry, dust, etc.) and shall not allow it to discharge to any resource. All demolition debris shall be disposed of in accordance with Section 202.03 - Removing Existing Superstructure, Structural Concrete, Railings, Curbs, Sidewalks and Bridges. The Contractor shall dispose of debris in accordance with the Maine Solid Waste Law, Title 38 M.R.S.A., Section 1301 et. seq. Containment and disposal of demolition debris shall be addressed in the Contractor's SEWPCP.
- g. The Contractor shall air dry all treated lumber for at least 21 Days before use. All treated timber surfaces shall be exposed during air-drying.
- h. The Contractor shall place all permanent seeding in accordance with Section 618 - Seeding unless the Contract states otherwise. The Contractor shall state what additional measures they will employ for soil stabilization between November 1st and April 1st.
- i. The Contractor shall not remove rocks from below the normal high water line of any wetland, great pond, river, stream, or brook, except to the extent necessary for completion of the

Work and as allowed by environmental permits. The Contractor shall not work below the high water line of a great pond, river, stream, or brook during periods of elevated water, except as necessary to protect work in progress or for emergency flood control and as allowed by environmental permits.

- j. During periods of approved suspension, the Contractor shall inspect and maintain temporary and permanent erosion controls in accordance with its approved SEWPCP.
- k. All sites of disturbed soil outside the right-of-way such as haul roads, staging areas, Equipment storage sites, mixing plants, and waste disposal sites including expansion of existing sites shall be graded smooth, loamed, seeded, and mulched upon completion of the work. For a related provision, see Section 105.8.6 - Pit Requirements.

656.4 **Implementation of SEWPCP**

656.4.1 **Removed**

656.4.2 **Removed**

656.4.3 **Follow Plan** - Until Acceptance of the Work the Contractor must continuously provide soil erosion and water pollution controls in compliance with its approved SEWPCP as amended, if necessary, and in compliance with Section 656.4.5 - Additional Measures/Amendment of SEWPCP.

656.4.4 **Inspection and Record Keeping** - The Environmental Coordinator must inspect and monitor all controls for the duration of the Project and keep a written log. This log must include daily on-site precipitation and air temperature, as well as the performance, failure, and any corrective action for all controls in place. The log must be updated at least weekly and after all significant storm runoff and flood events. The Environmental Coordinator must make this log available to the Department upon request. The Contractor will retain the log for 3 years after the completion of the Project.

656.4.5 **Additional Measures/Amendment of SEWPCP** - If there exists observable evidence of erosion or sedimentation despite the installation of all controls in compliance with the Contractor's approved SEWPCP, then the Contractor must undertake such additional measures as are necessary to stop such erosion and prevent further erosion or sedimentation. Observable evidence of erosion or sedimentation includes visible sheet, rill, or gully erosion, discoloration of water by suspended particles, areas of sediment accumulation, slumping of banks, deposition of soil, and visible dust.

Such additional measures must be undertaken within 24 hours and completed within 48 hours from the time such evidence is observed, unless otherwise authorized by the Department. Within 7 Days of that time, the Contractor must submit an amendment to its SEWPCP setting forth the apparent cause of the erosion or sedimentation and the additional measures undertaken and that will continue to be undertaken. If the Contractor complies with the requirements of this Section, all additional measures and the amendment of the SEWPCP will be Extra Work and any Delay resulting from the additional measures will be analyzed in accordance with Section 109.5 - Adjustments for Delay.

- 656.4.6 ***Duration of Contractor's Responsibility*** - The Contractor shall provide temporary soil erosion and water pollution controls in compliance with its SEWPCP and maintain all permanent control features until Acceptance of the Work. Once final surface treatments are established, the Contractor is responsible for removal of all temporary sedimentation control practices such as silt fence. Notwithstanding the preceding sentence, all work needed to remedy damage to properly installed and maintained permanent control features caused by a weather-related Uncontrollable Event shall be Extra Work.

656.5 ***Payment***

- 656.5.1 ***If Pay Item 656.75 Provided*** - If the Schedule of Items contains Pay Item 656.75 for Temporary Soil Erosion and Water Pollution Control, payment will be made on a Lump Sum basis, payment of which will constitute full and complete compensation for all labor, equipment, materials, inspection, professional services, and incidentals necessary to prepare, submit, obtain approval of, and properly implement the Contractor's SEWPCP. The Lump Sum will be payable in installments as follows: 10% of the Lump Sum once the final SEWPCP is approved and the initial soil erosion and water pollution controls are in place and certified by the Contractor, with the 90% balance to be paid as the Work progresses at a rate proportional to the percentage completion of the Contract.

ORIGINAL CONTRACT AMOUNT

		Amount of Penalty Damages per Violation		
From More Than	Up to and Including	1 st	2 nd	3 rd & Subsequent
\$0	\$1,000,000	\$250	\$500	\$1,250
\$1,000,000	\$2,000,000	\$500	\$1,000	\$2,500
\$2,000,000	\$4,000,000	\$1,000	\$2,000	\$5,000
\$4,000,000	and more	\$2,000	\$4,000	\$10,000

Cofferdams and related temporary soil erosion and water pollution controls are incidental to the Pay Item 656.75, unless a specific pay item for cofferdams is included in the Schedule of Items. If a specific pay item for cofferdams is included, then related temporary soil erosion and water pollution controls, including inspection and maintenance, are incidental to the pay item for cofferdams.

- 656.5.2 **If No Pay Item** - If Pay Item 656.75 is not provided in the Schedule of Items, then the cost related thereto shall be Incidental to the Contract. Failure by the Contractor to follow Standard Specification or Special Provision - Section 656 and/or the Contractor's own Soil Erosion and Water Pollution Control Plan (SEWPCP) will result in a violation letter and a reduction in payment as shown in the schedule below. The Department's Resident or any other representative of The Department reserves the right to suspend the work at any time and request a meeting to discuss violations and remedies. The Department shall not be held responsible for any delay in the work due to any suspension under this item.

Payment will be made under:

Pay Item		Pay Unit
656.75	Temporary Soil Erosion and Water Pollution Control	Lump Sum

SECTION 657 - REHABILITATION OF PITS - Reserved

SECTION 658 - ACRYLIC LATEX COLOR FINISH

- 658.01 **Description** - This work shall consist of applying a color finish to asphaltic or Portland Cement concrete surfaces designated on the plans for median strips, islands, and certain crosswalks, color-coated with an acrylic latex finish system.
- 658.02 **Materials** - The color finish shall be a green acrylic latex emulsion type, containing only inert mineral pigment colorants, fade-resistant for exterior use. The color coating shall contain insoluble mineral fillers suitable for uniform application, tack free, and shall show no deterioration due to temperature, salts, moisture, and ultraviolet rays of sun for a period of at least 1 year.
- Only materials on the Qualified Products List of Acrylic Latex Color Finish shall be used.
- 658.03 **Surface Preparation** - The bituminous or Portland Cement concrete shall be carefully laid, free of depressions and ridges and at the pitch or grade shown on the plans to provide flow of water from the surface. The pavement shall be free of all loose dirt, dust particles, grease, oil, or any other contaminant. Grease and

oils shall be removed by a detergent wash, flushed with water, and followed by high-pressure water, air broom, or hand sweep.

The surface course of bituminous concrete pavement shall be a tight mix of thoroughly compacted material. The pavement shall be placed a minimum of 7 Days before the application of the coating.

The surface of Portland Cement concrete pavement shall be a medium broom finish. New concrete must cure a minimum of 30 Days before application of coating. The concrete surface shall be first washed with phosphoric acid solution [8 parts water to 1 part acid], then coated with a tie-coat before the green finish coat can be applied.

The surface shall be accepted by the Resident and the coating Subcontractor before the application of the color coating.

The Contractor shall add sand to the acrylic latex in the crosswalk area as directed by the Resident.

- 658.04 **Application of Color Coating** - The coating shall be applied according to the Manufacturer's recommendations, which can be found in the technical bulletin of the product.

The paint shall be stored in an area where freezing or overheating will not occur.

The acrylic coatings are waterborne and cannot cure in cold temperatures or when subject to moisture. Care shall be taken not to apply coatings when rain is forecast or sudden drop in temperature is expected.

Two coats shall be applied over the area in a thickness sufficient to give uniform texture, appearance, and color, per Manufacturer's recommendation. The second coat shall not be applied until the first coat is completely dried to touch and the Manufacturer's minimum time is requirement for top coating has elapsed.

No color coating shall be allowed to run, drop, or otherwise color adjacent areas.

If the Contractor elects to apply the coating after the above date, the Contractor is responsible for the performance of the coating. In this case, the payment will be withheld until the following spring.

- 658.05 **Method of Measurement** - Acrylic Latex Color Finish will be measured by the square yard of surface sealed, measured parallel to the surface. Furnishing and adding sand at designated locations will be incidental.

- 658.06 **Basis of Payment** - The accepted quantity of Acrylic Latex Color Finish will be paid for at the Contract unit price per square yard complete in place, including furnishing, and adding sand, where required.

Payment will be made under:

Pay Item		Pay Unit
658.20	Acrylic Latex Color Finish	Square Yard

SECTION 659 - MOBILIZATION

659.01 **Description** - When this item is listed as a Pay Item in the Bid, it shall consist of preparatory work and operations including, but not limited to those necessary to the movement of personnel, equipment, supplies and incidentals to the Project site; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the Project site.

659.02 **Basis of Payment** - Partial payments will be made in accordance with Section 108.2.3 – Mobilization.

The total sum of payments under this item shall not exceed the original Contract amount bid regardless of the fact that the Contractor may shut down their work on the Project or move equipment away from the Project and then back again.

Payment will be made under:

Pay Item		Pay Unit
659.10	Mobilization	Lump Sum

SECTION 660 - ON-THE-JOB TRAINING

660.01 **Description** - On-The-Job Training programs (OJT) are required as part of the Contractor's equal employment opportunity affirmative action program. The primary objective of on the job training shall be to train and upgrade women, minorities, and disadvantaged workers toward journey worker status in the type of trade or job classification involved.

660.02 **Requirements** - Contractors shall begin training in accordance with OJT Special Provision 660 as follows for all Projects with assigned trainee slots.

Total number of trainee slots required will be the amount listed in the Schedule of Items. All On-The-Job Training will be performed in accordance with 23 CFR 230, Subpart A, Appendix B and Department On-The-Job Training Program Manual. Training classifications shall be distributed among work classifications needed by the Contractor in the skilled and semi-skilled craft levels identified on the Letter of Intent. These classifications must be needed on that specific Project and have sufficient work hours available to meet the training plan activities and duration.

The Contractor shall receive credit for training hours only after, the Department, or its representative, has approved the program. For this reason, Contractors are

reminded to register candidates at the onset of Project work in order to guarantee the maximum training time for the enrollee to complete the OJT program. Contractors will be reimbursed for such approved trainee slots upon successful completion of the training.

The Contractor shall make every effort to enroll minority and women trainees (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield women, minorities, and disadvantaged trainees) to the extent that such persons are available within a reasonable area of recruitment. The Contractor shall be responsible for demonstrating to the Department the steps taken in pursuance thereof, before determination as to whether the Contractor is in compliance with this program. These semi-skilled and skilled craft employment goals set by this office of Federal Contractor Compliance Programs are as follows: 6.9% women and 0.05% minorities, and 10% for women, and 0.05% for minorities in un-skilled classes respectively statewide. For this reason, whether a Contractor meets these goals or not, the Department will require all Contractors to participate in the program until such time that the goals are met as a whole. If any Contractor falls below these standards, it shall immediately implement an Affirmative Action Program to increase the employment and retention of women, minorities and the disadvantaged.

Trainees shall not be enrolled in a classification in which they have successfully completed a training course leading to journey-level status, or for which they have held employment as a journey level worker. No Contractor shall enroll trainees who possess post-secondary degrees, certification, or diploma without first securing written approval from the Civil Rights Office. Only individuals with non-construction oriented credentials, except those who are upgraded will be considered. Upgrades from semi-skilled to skilled crafts is acceptable but must be approved by the Department or its representative.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by the Department. Nothing in this section limits a Contractor to only the curriculum found in the OJT Manual. The Department will consider a training curriculum if it meets the equal employment opportunity obligations that bring women, minorities, and the disadvantaged in to the industry and to retain them in the industry at the journey level of the classification of the training. Contractors are encouraged to examine training opportunities, which fit their needs for the Project and for the company.

The Contractor shall complete and forward to the Department's OJT or its representative, the Letter of Intent, the OJT Registration Form, and the Workforce Breakdown Form for approval by the Department. The Contractor shall maintain records of trainee activities and performance and furnish the department or its representative with documentation of each trainee's progress using the Weekly Evaluation Form. Requests for changes in the number of trainee's shall be handled as other bid items. The Contractor must submit a change order with

justification to the resident. The Resident will then forward that request to the Civil Rights Office for consideration.

Once an OJT is approved by the Department, The Contractor shall begin training at the onset of employment for the trade classification. Trainees are expected to remain in status as long as training opportunities exist in the work classification, or until the training program is completed.

Section 660 shall be included directly in all Contracts to Subcontractors. Subcontractors are expected to comply with craft goals. As with other Sections applied to a Subcontractor, the Contractor retains obligations accordingly.

- 660.03 ***Payment to the Trainee*** - Trainees will be paid at least 60% of the appropriate minimum journeyman's rate specified in the Contract for the first half of the training period, 75% for the third quarter of the training period, and 90% for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this Project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provision.

The Contractor shall furnish the trainee a copy of the program manual he will follow in providing the training. Once the Department has determined that the trainee has completed the required hours of training a certificate showing the type and length of training satisfactorily completed will be issued.

- 660.04 ***Submittals*** - The Contractor shall complete and forward to the Department's OJT and Contract Compliance Consultant, the Letter of Intent, the OJT Registration Form, and the Workforce Breakdown Form. The Contractor shall maintain records of trainee activities and performance and furnish the department or its representative with documentation of each trainee's progress using the Weekly Evaluation Form. Requests for changes in the number of trainee's shall be handled as other bid items. The Contractor must submit a change order with justification to the resident. The Resident will then forward that request to the Civil Rights Office for consideration.

- 660.05 ***Off-Site Training*** - Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training. The Contractor must forward a completed Off-Site OJT Request/Approval Form with a cover letter explaining the intent of the transfer to the Civil Rights Office.

Provided the Contractor has Department approval, training may be conducted off-site. Verification of training hours shall be determined for credit on off-site work by reviewing the Weekly OJT Evaluation Form.

- 660.06 ***Method of Measurement*** - The OJT item will be measured by the number of OJT hours by a trainee who has successfully completed an approved training program. A trainee will be considered successfully complete for purposes of

payment when the trainee receives a certificate of completion from the Department.

660.07 **Basis of Payment to the Contractor** - The OJT obligation shall be paid at the unit price of \$15.00 per hour once training of an OJT trainee in accordance with the terms of the Contract is successfully completed as provided below. Payment will be made even though the Contractor may have received additional training program funds from other sources, provided such other sources do not prohibit the Contractor from receiving other payment.

No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the Contractor and evidences a lack of reasonable efforts (as defined below) on the part of the Contractor in meeting the requirements of this Section.

A Contractor will have fulfilled its responsibilities under this Section if it has provided acceptable training to the number of trainees specified in the Contract.

The chart below illustrates the operation of the OJT program training requirements.

FOR EACH OJT CLASSIFICATION OF 1,000 HOURS

Stage	Hours Fulfilled	Are completed hours allowable?	Must remaining hours be fulfilled?
I.	0 - 499	N	Y
II.	500 - 750	Y	Y
III.	751 - 899	Y	Y
IV.	900 - 1000	Y	N

As an example, if the goal on the project is 1,000 hours and only one trainee reaches the 500 minimum threshold, then the Contractor will be reimbursed for the 500 hours obtained and must continue to train a new trainee for the remaining 500 hours.

However, if the OJT obligation on the project is 1,000 hours and the trainee receives less than the 500 hour minimum training, the Contractor will not receive reimbursement.

If a trainee quits the project voluntarily or is dismissed, then the Contractor is required to fill the trainee slot as soon as possible and shall be reimbursed according to this Section. The hours completed by the previous trainee will not be counted toward the new trainee if the original trainee has not obtained the 500 hours.

If the remaining number of hours needing to be fulfilled is 500 hours of a 1,000 requirement, the Contractor must make reasonable efforts to hire a trainee for a 500 hour training classification or extend the training to 1,000 hours. In that event, the Contractor will receive credit for the hours achieved.

The goal is for the OJT to achieve 1,000 hours of training, graduate from the OJT Program as a journey level worker, and be hired by the Contractor as a regular employee. However, if an OJT quits or is dismissed for any reason, the Contractor will be able to retain the number of hours over 500 hours per trainee. However, the Contractor must still fulfill the remaining hours of the OJT obligation.

The Contractor can hire a trainee for a specified 500 hour training. The trainee cannot be put into a 1,000 hour training, reach 500 hours, and be considered complete. The trainee either has to be enrolled in a specific 500 hour training or the Contractor can add 500 hours to bring on a new OJT for a 1,000 hour training. The Civil Rights Office will allow the addition of OJT hours for this purpose.

As used in this Section 660.07, “reasonable efforts” means taking fair, practical, and genuine steps to achieve an objective. “Reasonable efforts” may include one or more of the following: advertisements in area newspapers; social media postings; employee referrals; outreach recruitment with third-party entities; flyer postings at locations such as grocery stores, laundromats, and other community buildings accessible to the public; union or employment agency contacts; Maine CareerCenter contacts; and Job Fair attendance. Documentation of reasonable efforts must be submitted to the Department’s Civil Rights Office.

- 660.08 **Sanctions** - When the Department determines that the Contractor has not complied with Section 660.07, the Department will advise the Contractor in writing within 10 days of such determination that the Contractor must provide evidence that it has made reasonable efforts (as defined in Section 660.07 above) to comply. If, after reviewing such evidence, the Department determines that reasonable efforts were not made, sanctions will be imposed as follows:

The number of required training hours remaining to be completed will be multiplied by the prevailing wage plus fringe rate for that particular trainee’s classification. The resulting figure may be deducted from any monies due the Contractor. A corrective action plan may be developed in order to avoid similar future findings.

Payment will be made under:

Pay Item		Pay Unit
660.21	On-The-Job Training	Hour

SECTIONS 661 - 669 - Removed

SECTION 670 - GABION WALL - Reserved

SECTION 671 - DRY CAST SEGMENTAL BLOCK WALL - Reserved

SECTION 672 - PRECAST CONCRETE BLOCK GRAVITY WALL

672.01 **Description** - The work under this item shall consist of design, fabrication, furnishing and construction of a Precast Concrete Block Gravity Wall in accordance with these specifications and in close conformance with the lines and grades shown on the Plans, or established by the Resident. The Precast Concrete Block Gravity Wall shall consist of facing blocks made of wet cast concrete made from Portland Cement, water, chemical admixtures, and aggregates, supported on concrete leveling pads, and if required, geosynthetic-reinforced backfill.

Included in the scope of the precast gravity wall construction are:

- geotechnical design of any wall with a exposed height greater than 4.5 ft or as specified on the Plans,
- all grading necessary for wall construction,
- compaction of the wall foundation soil, backfill, piped drainage,
- construction of leveling pads,
- and block wall installation.

The top of the upper row of blocks shall be at or above the top of the face elevation shown on the Plans.

672.02 **Quality Assurance** - The wall system shall be one of the approved combinations of facing block and soil reinforcement systems noted in the Plans or on the Department’s Qualified Products List (QPL). Alternate wall systems will not be considered for this Item.

All design calculations and Shop Drawings shall be signed, checked, and sealed by a Professional Engineer licensed in the State of Maine.

The Contractor shall require the wall design-supplier to provide an on-site, qualified experienced technical representative to advise the Contractor concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Resident.

672.03 **Materials** - Materials for walls shall meet the requirements of the following Sections of Division 700:

Gravel Borrow	703.20
Crushed Stone ¾"	703.13
Underdrain Pipe	706.06 or 706.09
Reinforcing Steel	709.01
Reinforcement Geotextile	722.01
Drainage Geotextile	722.02

The Contractor is cautioned that all of the materials listed are not required for every Precast Concrete Block Gravity Wall. The Contractor shall furnish the Resident a Materials Certification Letter certifying that the applicable materials comply with this section of the specifications. Materials shall meet the following additional requirements:

672.031 **Concrete Units** - The Materials Certification Letter described above shall contain the date of concrete casting, a lot identification number, compressive strength results, and entrained air results.

All prefabricated concrete units shall conform to the requirements of Standard Specification Section 534 - Precast Structural Concrete, with the following exceptions:

- Modify Standard Specification Section 534.02 - Materials, as follows. Concrete shall be Class P3. Paragraph five is not applicable to this Section.
- Standard Specification Section 534.05 - Facilities for Inspection, is not applicable to this Section.
- Modify Standard Specification Section 534.1301 - Curing, as follows:
 - Replace the last paragraph that starts with “The forms shall remain...” with the following:
 - The forms shall remain in place until the concrete has gained sufficient strength such that removal of the forms and subsequent handling will not damage the units.
 - Add the following paragraph to the end of the section:
 - Face texture of the units shall be a formed finish on all exposed surfaces. Pigment shall be added during the casting process of the concrete unit to achieve a consistent shade of gray or other color as determined by the Resident.
- Modify Standard Specification Section 534.14 - Acceptance and Quality Control Testing of Concrete, as follows:
 - Replace paragraph two that starts with “At least once per...” with the following:
 - The Contractor shall make four cylinders for use by the Department to represent every 200 cy or fraction thereof.

- Replace paragraph five that starts with “The Contractor shall cast...” with the following:
 - The Contractor shall make and test at least one set of cylinders for every 50 cy of production concrete used to cast the concrete units.
- Replace Standard Specification Section 534.16 - Tolerances, with the following:
 - Maximum dimensional deviation of formed unit dimensions shall be ½" or 2% or the manufacturer's published tolerances, whichever is less. Units not meeting the specified tolerances will be rejected.

672.032 **Geosynthetic Reinforcement** - Geosynthetic reinforcement shall be as required by the proprietary wall system manufacturer or wall designer. Geosynthetic reinforcement shall consist of a geotextile or geogrid approved by the Geotechnical Engineer. Substitution of a geosynthetic other than that required by the proprietary wall system manufacturer shall not be allowed unless approved by the Geotechnical Engineer after submittal of shop drawings and pullout and interface friction test data.

- A. **Geotextiles and Thread for Sewing** - Woven or nonwoven geotextiles shall consist of long chain polymeric filaments or yarns formed into a stable network such that the filaments or yarns retain their position relative to each other during handling, placement, and design life. At least 95% by weight of the long chain polymer shall be polyolefin or polyester. The material shall be free of defects and tears. Geotextiles used for reinforcement shall conform as a minimum to the properties indicated for Section 722.01 - Stabilization/Reinforcement Geotextile and shall meet the requirements of part D and E below. Geotextiles shall have a minimum permeability greater or equal to that shown on the Shop Drawings and the reinforced soil permeability.
- B. **Geogrids** - The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. Geogrids shall conform as a minimum to the criteria specified in part D and E below.
- C. **Required Properties** - The specific geosynthetic materials shall be preapproved and shall have the ultimate tensile

strength (T_{ult}) shown on the approved Shop Drawings for the geosynthetic specified and for the fill type shown. T_{ult} shall be determined from wide width tests specified in ASTM D4595 for geotextiles and ASTM D6637 or GRI:GG1 for geogrids. The ultimate tensile strength value is based on the minimum average roll values (MARV) for the product.

- D. The geosynthetic shall conform to the following criteria:
1. **PP and HDPE** - Min. retained strength of 70% after 150 hours, per ASTM D4355.
 2. **HDPE** - Grade = E-4, E-5, E-8, E-9, E-10, E-11, J-3, J-4, or J-5, per ASTM D1248.
 3. **PET** - Molecular weight (M_n) > 25,000, per GRI:GG8 and ASTM D4603.
 4. **PET** - Carboxyl end group (CEG) <30 mmol/kg, GRI:GG7.
 5. **All polymers** - Minimum Weight per Unit Area of 8 oz/yd², per ASTM D5261.
 6. **All Polymers** - Maximum 0% post consumer recycled material by weight.
 7. A default total reduction factor for creep, durability, and installation damage of $RF = 7$ may be used in design, provided the criteria of 2 through 6 are satisfied and 1 is adjusted to 70% after 500 hours is satisfied.
- E. **Manufacturer Quality Control** - The geosynthetic reinforcements shall be manufactured with a high degree of quality control. The Manufacturer is responsible for establishing and maintaining a quality control program to ensure compliance with the requirements of the specification. The purpose of the QC testing program is to verify that the reinforcement geosynthetic being supplied to the Project is representative of the material used for performance testing and approval. Conformance testing shall be performed as part of the manufacturing process and may vary for each type of product. As a minimum the following index tests shall be considered as applicable for an acceptable QA/QC program:

Property	Test Procedure
1. Specific Gravity (HDPE only)	ASTM D1505
2. Ultimate Tensile Strength	ASTM D4595 GRI:GG1
3. Melt Flow (HDPE and PP only)	ASTM D1238
4. Intrinsic Viscosity (PET only)	ASTM D4603
5. Carboxyl End Group (PET only)	ASTM D2455

- F. **Sampling Testing and Acceptance** - Sampling and conformance testing shall be in accordance with ASTM

D4354. Conformance testing procedures are established above. Geosynthetic product acceptance shall be based on ASTM D4759. The quality control certificate shall include:

1. Roll numbers and identification
2. Sampling procedures
3. Results of quality control tests, including a description of test methods used.

G. **Certification** - The Contractor shall submit a manufacturer's certification that the geosynthetics supplied meet the respective index criteria set when the geosynthetic was approved, measured in full accordance with all test methods and standards specified, or referenced, in this specification.

The manufacturer's certificate shall state that the furnished geosynthetic meets the requirements of these specifications as evaluated by the manufacturer's quality control program. The values submitted shall be certified by a person having legal authority to bond the manufacturer. In case of dispute over validity of values, the Resident can require the Contractor to supply test data from an agency approved laboratory to support the values submitted, at the Contractor's cost.

672.033 **Geosynthetic Connection** - Reinforcing bar used in the geosynthetic connection shall be a minimum ½" diameter corrosion resistant reinforcing bar, coated on the ends and meeting the requirements of Section 503 - Reinforcing Steel. Installation shall be in accordance with manufacturer's recommendations.

672.034 **Concrete Leveling Pad** - Concrete for leveling pads shall be Fill Concrete conforming to the requirements of Section 502 - Structural Concrete. Leveling pad shall have a minimum thickness of 4". Unless otherwise specified, concrete for leveling pads shall be accepted under Method "C" requirements.

672.035 **Backfill Material** - Backfill material placed behind the concrete units shall meet the requirements of Section 703.20 - Gravel Borrow, except that the backfill material shall only contain particles that will pass the 3" square mesh sieve. The Contractor is required to submit a grain size distribution curve (ASTM D422) and a moisture-density relationship curve (AASHTO T 180) for acceptance of the proposed backfill material and determination of the appropriate installation damage reduction factor (RF_{ID}).

Walls with reinforced backfill require that the backfill material be subjected to pH testing to determine the appropriate durability

reduction factor (RF_D). Backfill materials shall meet the criteria in the following table:

Base Polymer	Property	Criteria	Test Method
Polyester (PET)	pH	$3 < \text{pH} < 9$	AASHTO T 289
Polyolefin (PP & HDPE)	pH	$\text{pH} > 3$	AASHTO T 289

Material between blocks must be Gravel Borrow, or Crushed Stone $\frac{3}{4}$ ".

672.036 **Materials Certification Letter** - The Contractor, or the supplier as his agent, shall furnish the Resident a Materials Certification Letter for the above materials, including the backfill material, in accordance with Section 700 of the Standard Specifications. A copy of all test results performed by the Contractor or his supplier necessary to assure Contract compliance shall also be furnished to the Resident. The Resident will base acceptance upon the materials Certificate Letter, accompanying test reports, and visual inspection.

672.04 **Design Requirements** - The wall shall be designed with a service life of not less than 75 years. The Precast Concrete Block Gravity Wall shall be designed and sealed by a Professional Engineer licensed in the State of Maine. The wall shall be designed in accordance with the following:

1. AASHTO LRFD Bridge Design Specifications, current edition.
2. FHWA-NHI-10-024 and FHWA-NHI-10-025, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Volumes I and II, current edition.
3. FHWA-NHI-09-087 Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, current edition.
4. The Contract Plans
5. The requirements specified herein
6. The manufacturer's requirements

Where conflicting requirements occur, the more stringent requirements shall govern.

Forty-five Days prior to beginning construction of the wall, the design computations shall be submitted to the Resident for review by the Geotechnical Engineer. Any additional design or costs arising as a result of rejection of a wall design by the Geotechnical Engineer shall be borne by the Contractor.

Design calculations that consist of computer program generated output shall be supplemented with at least one hand calculation and graphic demonstrating the design methodology used. Design calculations shall provide thorough documentation of the sources of equations used and material properties. The design by the wall system supplier shall consider the stability of the wall as outlined below and in the Contract Documents:

- A. **Failure Plane** - The theoretical failure plane within the reinforced soil mass shall be determined in accordance with AASHTO LRFD Bridge Design Specifications Article 11 and be analyzed so that the soil stabilizing components extend sufficiently beyond the failure plane within the reinforced soil mass to stabilize the material.
- B. **External Loads** - External loads which affect the internal and external stability such as those applied through traffic loadings, impact on traffic barrier posts, slope surcharge, hydrostatic, and seismic loads shall be accounted for in the design. Traffic surcharge and traffic impact loads shall be calculated and applied in compliance with AASHTO LRFD Bridge Design Specifications Section 11.
- C. **External Stability** - Loads and load combinations selected for design shall be consistent with AASHTO LRFD Bridge Design Specifications. Application of load factors shall be taken as specified in AASHTO LRFD Bridge Design Specifications Section 11. Sliding resistance factors and bearing resistance factors shall be consistent with AASHTO LRFD Bridge Design Specifications. Overturning and sliding provisions of AASHTO LRFD Bridge Design Specifications shall apply.
- D. **Internal Stability** - Evaluation of reinforcement pullout, reinforcement rupture and reinforcement/block connection pullout or rupture shall be consistent with AASHTO LRFD Bridge Design Specifications Section 11 and checked at each level. Loads, load combinations and load factors shall be as specified in AASHTO LRFD Bridge Design Specifications Section 11. Resistance factors for internal design are specified in AASHTO LRFD Bridge Design Specifications Section 11. Maximum reinforcement loads shall be calculated using the Simplified Method approach. Calculations for factored stresses and resistances shall be based upon assumed conditions at the end of the design life.
- a. **Geosynthetic Reinforcement Design Tensile Resistance** - The nominal long term reinforcement design strength (T_{al}) shall be determined by reducing T_{ult} by reduction factors (RF) in accordance with the documents referenced above. The designer shall procure and use the manufacturers tested and certified geosynthetic reinforcement reduction factors for creep (RF_{CR}), durability (RF_D), and installation damage (RF_{ID}) to determine T_{al} . In absence of manufacturers tested and certified reduction factors, a combined default reduction factor $RF = 7$ shall be used in accordance with the referenced documents. For RF_{ID} , the installation damage reduction factor shall be checked in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-09-087.
- b. **Reinforcement/Facing Connection Design Strength** - The nominal long-term connection strength between the geosynthetic

reinforcement and the concrete blocks shall be checked in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-10-024 and FHWA-NHI-10-025.

- c. **Reinforcement Pullout** - The pullout resistance factor (F^*) and scale effect correction factor (α) used in pullout design, shall be determined from Project specific pullout tests using the proposed geosynthetic in the specified Project backfill material or equivalent soil. The pullout resistance factors shall be determined in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-10-024 and FHWA-NHI-10-025. In the absence of test data, empirical relationships may be used to determine the pullout resistance factors, any empirical relationships used in design shall be referenced in the design calculations.
- E. **Backfill and Foundation Soils Parameters** - The friction angle of the backfill used in the reinforced fill zone for internal stability design shall be assumed have a friction angle of 34° unless specific Project select backfill is tested for frictional strength. The friction angle of the foundation soils and random backfill shall be assumed to be 30° unless otherwise shown on the plans.
- F. **Reinforcement Length** - The soil reinforcement shall be the same length from the bottom to the top of each wall section. The minimum length of the soil reinforcement shall be 8 ft, but shall not be less than 70% of the wall height, H , for walls with level surcharges, or 70% of H_1 for walls with a sloped surcharge or walls supporting an abutment. The mechanical wall height, H or H_1 , shall be the vertical difference between the top of the leveling footing and the elevation at which the failure surface, as described above, intercepts the ground surface supported by the wall.
- G. **Bearing Resistance** - The factored bearing pressures under the Precast Concrete Block Gravity Wall shall be clearly indicated on the Shop Drawings. Walls shall be dimensioned so that the factored bearing resistance of the foundation soils, as noted on the Plans, is not exceeded.
- H. **Facing Stability** - Stability - calculations for the concrete facing blocks shall be in accordance with AASHTO LRFD Bridge Design Specifications, and shall include an evaluation of the maximum vertical spacing between reinforcement layers.
- I. **Stability During Construction** - Walls shall be designed to resist failure by instability of temporary construction slope. Passive pressure in front of the wall mass shall be assumed to be zero for design purposes.
- J. **Design Life** - The wall design life shall be a minimum of 75 years.

- K. **Depth of Embedment** - The depth of embedment for frost protection and stability shall be at or below the elevation shown on the Plans and the approved Shop Drawings.
- L. **Drainage System** - Piped drainage shall be designed to collect and dispose of water from the base of the reinforced soil zone and backfill soil. This shall outlet into surrounding drainage systems or ditches.

672.05 **Submittals** - The Contractor shall supply wall design computations, wall details, dimensions, quantities, and cross sections necessary to construct the wall. A sample hand calculation including all equations, parameter values used, units, theory, free-body diagram, comparison to design requirements, etc. shall be provided. Spread sheet calculations alone are not acceptable.

Forty-five Days prior to beginning construction of the wall, four sets of the wall design computations and Shop Drawings shall be submitted to the Resident for review by the Geotechnical Engineer. Mix design information shall be submitted at the same time, including aggregate source, current gradation, aggregate quality information and concrete unit weight.

The Contractor shall also submit backfill material test results as part of the wall submittal package. Backfill material test results shall include grain size distribution curve, moisture-density relationship curve, and pH test results required for reinforced backfill only.

If geotechnical design is required, the fully detailed plans shall be prepared in conformance with Section 105 and shall include, but not be limited to the following items:

- A. A plan and elevation sheet or sheets for each wall, containing the following: elevations at the top of leveling pads, the distance along the face of the wall to all steps in the leveling pads, the location of the original and final ground line.
- B. All details for foundations and leveling pads, including details for steps in the leveling pads, as well as allowable and actual maximum bearing pressures shall be provided.
- C. Details for the barriers, posts, curbs and facing as required by the Project conditions.
- D. Design computations prepared and sealed by a licensed Professional Engineer.
- E. Prior to the beginning of construction, the Contractor shall supply the Resident with two copies of the design-supplier's Installation Manual. In addition, the Contractor shall have two copies of the Installation Manual on the Project site.

672.06 **Construction Requirements** - The Precast Concrete Block Gravity Wall shall have the following construction requirements:

- A. **Excavation** - The excavation and use as fill or disposal of all excavated material shall meet the requirements of Section 203 - Excavation and Embankment, except as modified herein.
- B. **Foundation** - The area upon which the prefabricated block gravity wall structure is to rest, and within the limits shown on the submitted plans, shall be graded for a width equal to, or exceeding, the length of the blocks. Prior to wall and leveling pad construction, this foundation material shall be compacted to at least 95% of maximum laboratory dry density (AASHTO T 180 Method C or D). Frozen and unsuitable soil shall be removed and replaced with gravel borrow compacted to 95% of AASHTO T 180.

A concrete leveling pad shall have a minimum thickness of 4" and shall be constructed as indicated on the plans. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Geotechnical Engineer. The leveling pad shall be cast to the design elevations as shown on the plans, or as required by the wall supplier upon written approval of the Geotechnical Engineer. The allowable elevation tolerances from the design elevations are +0.01 ft and -0.02 ft. Leveling pads which do not meet this requirement shall be repaired or replaced as directed by the Resident at no additional cost to the Department. Placement of wall units may begin after the strength of the concrete leveling pad reaches 1000 psi or is adequate to support the proposed loads. Contractor may begin placement of concrete block units after 12 hours at his own risk.

- C. **Method and Equipment** - Prior to erection of the prefabricated concrete block wall, the Contractor shall furnish the Resident with detailed information concerning the proposed construction method and equipment to be used. The erection procedure shall be in accordance with the manufacturer's instructions. Any units that are damaged due to handling will be replaced at the Contractor's expense.

- D. **Installation of Wall Units** - A field representative from the wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the Project. Horizontal joint fillers shall be installed as needed.

The maximum offset in any unit horizontal joint shall be ¼". The prefabricated wall blocks shall be installed to a tolerance of plus or minus ¾" in 10 ft in vertical alignment and horizontal alignment.

- E. **Backfill Placement** - Backfill placement shall closely follow the erection of each row of prefabricated wall units. The Contractor shall decrease the lift thickness if necessary to obtain the specified density. The maximum

lift thickness shall be 8" loose. Gravel borrow backfill shall be compacted in accordance with Section 203.12 except that the minimum required compaction shall be at least 92% of maximum density as determined by AASHTO T 180 Method C or D. Backfill compaction shall be accomplished without disturbance or displacement of the wall blocks. Sheepsfoot rollers will not be allowed. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved.

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D. At the end of the Day's operations, the Contractor shall shape the last level of backfill so as to direct runoff of rain water away from the wall face.

Material between blocks must be Gravel Borrow or Crushed Stone $\frac{3}{4}$ ", meeting the requirements of Section 703.13. If Gravel Borrow is used between blocks, 722.02 drainage geotextile shall be placed behind vertical joints to prevent loss of granular material between blocks. Compliance with the gradation requirements shall be the responsibility of the Contractor, who shall furnish a copy of the backfill test results prior to construction. If Crushed Stone $\frac{3}{4}$ " is used between blocks, no geotextile is required behind vertical joints.

672.07 **Method of Measurement** - Precast Concrete Block Gravity Wall will be measured by the square foot of front surface not to exceed the dimensions shown on the Contract Plans unless authorized by the Resident. Vertical and horizontal dimensions will be from the edges of the blocks. No field measurements for computations will be made unless the Resident specifies, in writing, a change in the limits indicated on the Plans.

672.08 **Basis of Payment** - The accepted quantity of Precast Concrete Block Gravity Wall will be paid for at the Contract unit price per square foot complete in place. Payment shall be full compensation for furnishing geotechnical design as required, all labor, equipment and materials including all precast concrete units, hardware, joint fillers, geosynthetics, reinforcing steel, drainage pipe, backfill materials and technical field representative. Excavation, foundation material and backfill material will all be incidental to the Precast Concrete Block Gravity Wall.

Cost of cast-in-place concrete for leveling pad will not be paid for separately, but will be considered incidental to the Precast Concrete Block Gravity Wall.

There will be no allowance for excavating and backfilling for the Precast Concrete Block Gravity Wall beyond the limits shown on the approved submitted plans, except for excavation required to remove unsuitable subsoil in preparation for the foundation. Payment for excavating unsuitable subsoil shall be full compensation for all costs of pumping, drainage, sheeting, bracing and incidentals for proper execution of the work, and will be paid as Common Excavation in accordance with Section 203.

Payment will be made under:

Pay Item		Pay Unit
672.10	Precast Concrete Block Gravity Wall	Square Foot

SECTION 673 - WET CAST SMALL LANDSCAPE BLOCK WALL

- 673.01 **Description** - The work under this item shall consist of the design, fabrication, furnishing and construction of a Wet Cast Small Landscape Block Wall in accordance with these specifications and in conformance with the lines and grades shown on the Plans, or established by the Resident. The Wet Cast Small Landscape Block Wall shall consist of blocks made of Structural Precast concrete made from Portland Cement, water, chemical admixtures, and aggregates, supported on concrete leveling pads, and if required, geosynthetic reinforced backfill. The concrete blocks used in this system should have dimensions 18" or less wide and 6.125" high at the face, with a pattern to simulate small stones or cobbles.

Included in the scope of the wall construction are:

- geotechnical design of any wall with an exposed height greater than 2.5 ft or as specified on the Plans,
- all grading necessary for wall construction,
- compaction of the wall foundation soil, backfill, piped drainage, construction of leveling pads, and
- concrete wall unit installation.

The top of the upper row of concrete wall units shall be at or above the top of the face elevation shown on the Plans.

- 673.02 **Quality Assurance** - The wall system shall be one of the approved combinations of facing block and soil reinforcement systems noted in the Plans or on the Department's Qualified Products List (QPL). Alternate wall systems will not be considered for this item.

All design calculations and Shop Drawings shall be signed, checked, and sealed by a Professional Engineer licensed in the State of Maine.

The Contractor shall require the wall design-supplier to provide an on-site, qualified experienced technical representative to advise the Contractor

concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Resident.

673.03 **Materials** - Materials for walls shall meet the requirements of the following Sections of Division 700:

Gravel Borrow	703.20
Crushed Stone $\frac{3}{4}$ "	703.13
Underdrain Pipe	706.06 or 706.09
Reinforcing Steel	709.01
Structural Precast Concrete Units	712.061
Reinforcement Geotextile	722.01
Drainage Geosynthetic	722.02

The Contractor is cautioned that all of the materials listed are not required for every Wet Cast Small Landscape Block Wall. The Contractor shall furnish the Resident a Materials Certification Letter certifying that the applicable materials comply with this section of the specifications. Materials shall meet the following additional requirements:

673.031 **Concrete Units** - The Materials Certification Letter described above shall contain the date of concrete casting, a lot identification number, compressive strength results, and entrained air results.

All prefabricated concrete units shall conform to the requirements of Standard Specification Section 534 - Precast Structural Concrete with the following exceptions:

- Modify Standard Specification Section 534.02 - Materials, as follows:
 - Concrete shall be Class P3. Paragraph five is not applicable to this Section.
 - Standard Specification Section 534.05 - Facilities for Inspection, is not applicable to this Section.
- Modify Standard Specification Section 534.1301 - Curing, as follows:
 - Replace the last paragraph that starts with "The forms shall remain..." with the following:
 - "The forms shall remain in place until the concrete has gained sufficient strength such that removal of the forms and subsequent handling will not damage the units."

- Add the following paragraph to the end of the section:
 - “Face texture of the units shall be a formed finish on all exposed surfaces. Pigment shall be added during the casting process of the concrete unit to achieve a consistent shade of gray or other color as determined by the Resident.”
- Modify Standard Specification Section 534.14 - Acceptance and Quality Control Testing of Concrete, as follows:
 - Replace paragraph two that starts with “At least once per...” with the following:
 - “ The Contractor shall make four cylinders for use by the Department to represent every 200 CY or fraction thereof.”
 - Replace paragraph five that starts with “The Contractor shall cast...” with the following:
 - “ The Contractor shall make and test at least one set of cylinders for every 50 CY of production concrete used to cast the concrete units.”
- Replace Standard Specification Section 534.16 - Tolerances, with the following:
 - “Maximum dimensional deviation of formed unit dimensions shall be ½" or 2% or the manufacturer’s published tolerances, whichever is less. Units not meeting the specified tolerances will be rejected.”

673.032 **Geosynthetic Reinforcement** - Geosynthetic Reinforcement shall be as required by the proprietary wall system manufacturer or wall designer. Geosynthetic reinforcement shall consist of a geotextile or geogrid approved by the Geotechnical Engineer. Substitution of a geosynthetic other than that required by the proprietary wall system manufacturer shall not be allowed unless approved by the Geotechnical Engineer after submittal of shop drawings and pullout and interface friction test data.

- A. **Geotextiles and Thread for Sewing** - Woven or nonwoven geotextiles shall consist of long chain polymeric filaments or yarns formed into a stable network such that the filaments or yarns retain their position relative to each other during handling, placement, and design life. At least 95% by weight of the long chain polymer shall be polyolefin or polyester. The

material shall be free of defects and tears. Geotextiles used for reinforcement shall conform as a minimum to the properties indicated for Section 722.01 -

Stabilization/Reinforcement Geotextile and shall meet the requirements of part D and E below. Geotextiles shall have a minimum permeability greater or equal to that shown on the Shop Drawings and the reinforced soil permeability.

- B. **Geogrids** - The geogrid shall be a regular network of integrally formed polymeric tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. Geogrids shall conform as a minimum to the criteria specified in part D and E below.
- C. **Required Properties** - The specific geosynthetic materials shall be preapproved and shall have the ultimate tensile strength (T_{ult}) shown on the approved Shop Drawings for the geosynthetic specified and for the fill type shown. T_{ult} shall be determined from wide width tests specified in ASTM D4595 for geotextiles and ASTM D6637 or GRI:GG1 for geogrids. The ultimate tensile strength value is based on the minimum average roll values (MARV) for the product.
- D. The geosynthetic shall conform to the following criteria:
 - 1. **PP and HDPE** - Min. retained strength of 70% after 150 hours, per ASTM D4355.
 - 2. **HDPE** - Grade = E-4, E-5, E-8, E-9, E-10, E-11, J-3, J-4, or J-5, per ASTM D1248.
 - 3. **PET** - Molecular weight (M_n) > 25,000, per GRI:GG8 and ASTM D4603.
 - 4. **PET** - Carboxyl end group (CEG) <30 mmol/kg, GRI:GG7.
 - 5. **All polymers** - Minimum Weight per Unit Area of 8 oz/yd², per ASTM D5261.
 - 6. **All Polymers** - Maximum 0% post consumer recycled material by weight.
 - 7. A default total reduction factor for creep, durability, and installation damage of $RF = 7$ may be used in design, provided the criteria of 2 through 6 are satisfied and 1 is adjusted to 70% after 500 hours is satisfied.
- E. **Manufacturer Quality Control** - The geosynthetic reinforcements shall be manufactured with a high degree of quality control. The Manufacturer is responsible for

establishing and maintaining a quality control program to ensure compliance with the requirements of the specification. The purpose of the QC testing program is to verify that the reinforcement geosynthetic being supplied to the Project is representative of the material used for performance testing and approval. Conformance testing shall be performed as part of the manufacturing process and may vary for each type of product. As a minimum the following index tests shall be considered as applicable for an acceptable QA/QC program:

Property	Test Procedure
1. Specific Gravity (HDPE only)	ASTM D1505
2. Ultimate Tensile Strength	ASTM D4595 GRI:GG1
3. Melt Flow (HDPE and PP only)	ASTM D1238
4. Intrinsic Viscosity (PET only)	ASTM D4603
5. Carboxyl End Group (PET only)	ASTM D2455

- E. **Sampling Testing and Acceptance** - Sampling and conformance testing shall be in accordance with ASTM D4354. Conformance testing procedures are established above. Geosynthetic product acceptance shall be based on ASTM D4759. The quality control certificate shall include:
1. Roll numbers and identification
 2. Sampling procedures
 3. Results of quality control tests, including a description of test methods used.

- G. **Certification** - The Contractor shall submit a manufacturer's certification that the geosynthetics supplied meet the respective index criteria set when the geosynthetic was approved, measured in full accordance with all test methods and standards specified, or referenced, in this specification.

The manufacturer's certificate shall state that the furnished geosynthetic meets the requirements of these specifications as evaluated by the manufacturer's quality control program. The values submitted shall be certified by a person having legal authority to bond the manufacturer. In case of dispute over validity of values, the Resident can require the Contractor to supply test data from an agency approved laboratory to support the values submitted, at the Contractor's cost.

- 673.033 **Concrete Leveling Pad** - Concrete for leveling pads shall be Fill Concrete conforming to the requirements of Section 502 - Structural Concrete. Leveling pad shall have a minimum thickness of 4". Unless

otherwise specified, concrete for leveling pads shall be accepted under Method "C" requirements.

673.034 **Drainage Stone Fill** - Concrete wall unit voids shall be filled with material that conforms to the requirements of Standard Specification Section 703.13 - Crushed Stone $\frac{3}{4}$ ". Compaction of the stone fill will be required before the block surfaces are cleaned to ensure good interface connection strength between geogrids and blocks.

673.035 **Backfill Material** - Backfill material placed behind the concrete wall units shall meet the requirements of Section 703.20 - Gravel Borrow, except that the backfill material shall only contain particles that will pass the 3" square mesh sieve. The Contractor is required to submit a grain size distribution curve (ASTM D422) and a moisture-density relationship curve (AASHTO T 180) for acceptance of the proposed backfill material and determination of the appropriate installation damage reduction factor (RF_D).

Walls with reinforced backfill also require that the backfill material be subjected to pH testing to determine the appropriate durability reduction factor (RF_D). Backfill materials shall meet the criteria in the following table:

Base Polymer	Property	Criteria	Test Method
Polyester (PET)	pH	3 < pH < 9	AASHTO T 289
Polyolefin (PP & HDPE)	pH	pH > 3	AASHTO T 289

673.036 **Materials Certificate Letter** - The Contractor, or the supplier as their agent, shall furnish the Resident a Materials Certificate Letter for the above materials, including the backfill material, in accordance with Section 700 of the Standard Specifications. A copy of all test results performed by the Contractor or their supplier necessary to assure Contract compliance shall also be furnished to the Resident. The Resident will base acceptance upon the materials Certificate Letter, accompanying test reports, and visual inspection.

673.04 **Design Requirements** - The wall shall be designed with a service life of not less than 75 years. The Wet Cast Small Landscape Block Wall shall be designed and sealed by a Professional Engineer licensed in the State of Maine. The wall shall be designed in accordance with the following:

1. AASHTO LRFD Bridge Design Specifications, current edition.
2. FHWA-NHI-10-024 and FHWA-NHI-10-025, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Volumes I and II, current edition.
3. FHWA-NHI-09-087 Corrosion/degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, current edition

4. The Contract Plans
5. The requirements specified herein
6. The manufacturer's requirements

Where conflicting requirements occur, the more stringent requirements shall govern.

Forty-five Days prior to beginning construction of the wall, the design computations shall be submitted to the Resident for review by the Geotechnical Engineer. Any additional design or costs arising as a result of rejection of a wall design by the Geotechnical Engineer shall be borne by the Contractor.

Design calculations that consist of computer program generated output shall be supplemented with at least one hand calculation and graphic demonstrating the design methodology used. Design calculations shall provide thorough documentation of the sources of equations used and material properties. The design by the wall system supplier shall consider the stability of the wall as outlined below and in the Contract Documents:

- A. **Failure Plane** - The theoretical failure plane within the reinforced soil mass shall be determined in accordance with AASHTO LRFD Bridge Design Specifications Article 11 and be analyzed so that the soil stabilizing components extend sufficiently beyond the failure plane within the reinforced soil mass to stabilize the material.
- B. **External Loads** - External loads which affect the internal and external stability such as those applied through traffic loadings, impact on traffic barrier posts, slope surcharge, hydrostatic, and seismic loads shall be accounted for in the design. Traffic surcharge and traffic impact loads shall be calculated and applied in compliance with AASHTO LRFD Bridge Design Specifications Section 11.
- C. **External Stability** - Loads and load combinations selected for design shall be consistent with AASHTO LRFD Bridge Design Specifications. Application of load factors shall be taken as specified in AASHTO LRFD Bridge Design Specifications Section 11. Sliding resistance factors and bearing resistance factors shall be consistent with AASHTO LRFD Bridge Design Specifications. Overturning and sliding provisions of AASHTO LRFD Bridge Design Specifications shall apply.
- D. **Internal Stability** - Evaluation of reinforcement pullout, reinforcement rupture and reinforcement/block connection pullout or rupture shall be consistent with AASHTO LRFD Bridge Design Specifications Section 11, and checked at each level. Loads, load combinations and load factors shall be as specified in AASHTO LRFD Bridge Design Specifications Section 11. Resistance factors for internal design are specified in AASHTO LRFD Bridge Design Specifications Section 11. Maximum reinforcement loads shall be calculated using the Simplified Method approach.

Calculations for factored stresses and resistances shall be based upon assumed conditions at the end of the design life.

- a. **Geosynthetic Reinforcement Design Tensile Resistance** - The nominal long term reinforcement design strength (T_{al}) shall be determined by reducing T_{ult} by reduction factors (RF) in accordance with the documents referenced above. The designer shall procure and use the manufacturers tested and certified geosynthetic reinforcement reduction factors for creep (RF_{CR}), durability (RF_D), and installation damage (RF_{ID}) to determine T_{al} . In absence of manufacturers tested and certified reduction factors, a combined default reduction factor $RF = 7$ shall be used in accordance with the referenced documents. For RF_{ID} , the installation damage reduction factor shall be checked in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-09-087.
- b. **Reinforcement/Facing Connection Design Strength** - The nominal long-term connection strength between the geosynthetic reinforcement and the concrete blocks shall be checked in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-10-024 and FHWA-NHI-10-025, Volumes 1 and 2.
- c. **Reinforcement Pullout** - The pullout resistance factor, (F^*), and scale effect correction factor (α) used in pullout design, shall be determined from Project specific pullout tests using the proposed geosynthetic in the specified Project backfill material or equivalent soil. The pullout resistance factors shall be determined in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-10-024 and FHWA-NHI-10-025, Volumes 1 and 2. In the absence of test data, empirical relationships may be used to determine the pullout resistance factors, any empirical relationships used in design shall be referenced in the design calculations.
- E. **Backfill and Foundation Soils Parameters** - The friction angle of the backfill used in the reinforced fill zone for internal stability design shall be assumed have a friction angle of 34° unless specific Project select backfill is tested for frictional strength. The friction angle of the foundation soils and random backfill shall be assumed to be 30° unless otherwise shown on the plans.
- F. **Reinforcement Length** - The soil reinforcement shall be the same length from the bottom to the top of each wall section. The reinforcement length defining the width of the entire reinforced soil mass may vary with wall height. The minimum length of the soil reinforcement shall be 5 ft, but shall not be less than 70% of the wall height, H , for walls with level surcharges, or 70% of H_1 for walls with a sloped surcharge. Reinforcement length will be determined by the geotechnical wall

designer. The mechanical wall height, H or H1, shall be the vertical difference between the top of the leveling footing and the elevation at which the failure surface, as described above, intercepts the ground surface supported by the wall.

- G. **Bearing Resistance** - The factored bearing pressures under the Wet Cast Small Landscape Block Wall shall be clearly indicated on the Shop Drawings. Walls shall be dimensioned so that the factored bearing resistance of the foundation soils, as noted on the Plans, is not exceeded.
- H. **Facing Stability** - Stability calculations for the concrete facing blocks shall be in accordance with AASHTO LRFD Bridge Design Specifications, and shall include an evaluation of the maximum vertical spacing between reinforcement layers.
- I. **Stability** - During Construction Walls shall be designed to resist failure by instability of temporary construction slope. Passive pressure in front of the wall mass shall be assumed to be zero for design purposes.
- J. **Design Life** - The wall design life shall be a minimum of 75 years.
- K. **Depth of Embedment** - The depth of embedment for frost protection and stability shall be at or below the elevation shown on the Plans and the approved Shop Drawings.
- L. **Drainage System** - Piped drainage shall be designed to collect and dispose of water from the base of the reinforced soil zone and backfill soil. This shall outlet into surrounding drainage systems or ditches.

673.05 **Submittals** - The Contractor shall supply wall design computations, wall details, dimensions, quantities, and cross sections necessary to construct the wall. A sample hand calculation including all equations, parameter values used, units, theory, free-body diagram, comparison to design requirements, etc. shall be provided. Spreadsheet calculations alone are not acceptable.

Forty-five Days prior to beginning construction of the wall, four sets of the wall design computations and Shop Drawings shall be submitted to the Resident for review by the Geotechnical Engineer. Mix design information shall be submitted at the same time, including aggregate source, current gradation, aggregate quality information and concrete unit weight.

The Contractor shall also submit backfill material test results as part of the wall submittal package. Backfill material test results shall include grain size distribution curve, moisture-density relationship curve, and pH test results required for reinforced backfill only.

If geotechnical design is required, the fully detailed plans shall be prepared in conformance with Section 105 and shall include, but not be limited to the following items:

- A. A plan and elevation sheet or sheets for each wall, containing the following: elevations at the top of leveling pads, the distance along the face of the wall to all steps in the leveling pads, the location of the original and final ground line.
- B. All details for foundations and leveling pads, including details for steps in the leveling pads, as well as allowable and actual maximum bearing pressures shall be provided.
- C. Details for the barriers, posts, curbs, steps and facing as required by the Project conditions.
- D. Design computations prepared, checked, and sealed by a licensed Professional Engineer.
- E. Prior to the beginning of construction, the Contractor shall supply the Resident with two copies of the design-supplier's Installation Manual. In addition, the Contractor shall have two copies of the Installation Manual on the Project site.

673.06 **Construction Requirements** - The Wet Cast Small Landscape Block Wall shall have the following construction requirements:

- A. **Excavation** - The excavation and use as fill of all excavated material shall meet the requirements of Section 203 - Excavation and Embankment, except as modified herein.
- B. **Foundation** - The area upon which the Wet Cast Small Landscape Block Wall structure is to rest, and within the limits shown on the submitted plans, shall be graded for a width equal to, or exceeding, the length of the blocks. Prior to wall and leveling pad construction, this foundation material shall be compacted to at least 95% of maximum laboratory dry density (AASHTO T 180 Method C or D). Frozen and unsuitable soil shall be removed and replaced with gravel borrow compacted to 95% of AASHTO T 180, or as shown on the plans.

A concrete leveling pad shall have a minimum thickness of 4" and shall be constructed a minimum width of 6" beyond the front and back of the concrete wall units, or as indicated on the plans. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Geotechnical Engineer. The leveling pad shall be cast to the design elevations as shown on the plans, or as required by the wall supplier upon written approval of the Geotechnical Engineer.

The allowable elevation tolerances from the design elevations are +0.01 ft and -0.02 ft. Leveling pads which do not meet this requirement shall be repaired or replaced as directed by the Resident at no additional cost to the Department. Placement of wall units may begin after the strength of the concrete leveling pad reaches 1,000 psi or is adequate to support the

proposed loads. Contractor may begin placement of concrete block units after 12 hours at their own risk.

- C. **Method and Equipment** - Prior to erection of the wall, the Contractor shall furnish the Resident with detailed information concerning the proposed construction method and equipment to be used. The erection procedure shall be in accordance with the manufacturer's instructions. Any units that are damaged due to handling will be replaced at the Contractor's expense.
- D. **Installation of Concrete Wall Units** - A field representative from the wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the Project.

The Contractor shall place the first course of wall units directly on the leveling pad and check for level and alignment. Adjacent units should be in contact. The prefabricated concrete wall units shall be installed to a tolerance of plus or minus $\frac{3}{4}$ " in 10 ft in vertical and horizontal alignment.

Fill all voids between and within the wall units with drainage stone as described in this specification. Stone infill shall be compacted by hand tamping with a rod. The drainage stone fill shall extend a minimum of 6" behind the tails of the wall units unless a geotextile filter is placed over the inside joint at the back of adjacent wall units. If used, the drainage geotextile shall conform to the requirements of Section 722.02.

Geogrid reinforcement, if required, shall be placed at the locations and elevations shown on the Plans on level fill compacted to the requirements of this Specification. Geogrid reinforcement shall not be visible at the finished face of the wall.

The top course of blocks and all coping units shall be installed using adhesive or other method of permanent attachment as recommended by the manufacturer.

- E. **Backfill Placement** - Backfill placement shall closely follow the erection of each row of prefabricated wall units. The maximum lift thickness shall be 8" loose. The Contractor shall decrease the lift thickness if necessary to obtain the specified density. The backfill shall be compacted in accordance with Section 203.12 except that the minimum required compaction shall be at least 92% of maximum density as determined by AASHTO T 180 Method C or D. Backfill compaction shall be accomplished without disturbance or displacement of the concrete wall units. Sheepsfoot rollers will not be allowed. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved.

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D. At the end of the Day's operations, the Contractor shall shape the last level of backfill so as to direct runoff of rainwater away from the wall face.

- F. **Construction Certification Letter** - The Contractor shall furnish the Resident a Construction Certification Letter describing how adequate compaction of the block infill material was accomplished and what QA/QC procedures were followed to ensure that this effort was continued throughout construction of the wall.

673.07 **Method of Measurement** - Wet Cast Small Landscape Block Wall will be measured by the square foot of front surface not to exceed the dimensions shown on the Contract Plans unless authorized by the Resident. Vertical and horizontal dimensions will be from the edges of the blocks. No field measurements for computations will be made unless the Resident specifies, in writing, a change in the limits indicated on the Plans.

673.08 **Basis of Payment** - The accepted quantity of Wet Cast Small Landscape Block Wall will be paid for at the Contract unit price per square foot complete in place. Payment shall be full compensation for furnishing geotechnical design as required, all labor, equipment and materials including all precast concrete units, aggregate fill, hardware, joint fillers, geosynthetic, drainage pipe, and technical field representative. Excavation, foundation material and backfill material will all be incidental to the Wet Cast Small Landscape Block Wall.

Cost of cast-in-place concrete for leveling pad will not be paid for separately, but will be considered incidental to the Wet Cast Small Landscape Block Wall.

There will be no allowance for excavating and backfilling for the Wet Cast Small Landscape Block Wall beyond the limits shown on the approved submitted plans, except for excavation required to remove unsuitable subsoil in preparation for the foundation. Payment for excavating unsuitable subsoil shall be full compensation for all costs of pumping, drainage, sheeting, bracing and incidentals for proper execution of the work, and will be paid as common excavation in accordance with Section 203.

Payment will be made under:

Pay Item		Pay Unit
673.10	Wet Cast Small Landscape Block Wall	Square Foot

SECTION 674 - PREFABRICATED CONCRETE MODULAR GRAVITY WALL

- 674.01 **Description** - This work shall consist of designing, fabricating, furnishing, and constructing a prefabricated modular reinforced concrete gravity wall in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the Plans, or established by the Resident.

Included in the scope of the Prefabricated Concrete Modular Gravity Wall construction are:

- all grading necessary for wall construction,
- excavation, compaction of the wall foundation,
- backfill, construction of leveling pads,
- placement of geotextile,
- segmental unit erection,
- and all incidentals necessary to complete the work.

The Prefabricated Concrete Modular Gravity Wall design shall follow the general dimensions of the wall envelope shown in the Contract plans. The top of the leveling pad shall be located at or below the theoretical leveling pad elevation. The minimum wall embedment shall be at or below the elevation shown on the plans. The top of the face panels shall be at or above the top of the panel elevation shown on the plans.

The Contractor shall require the design-supplier to supply an on-site, qualified experienced technical representative to advise the Contractor concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Resident. The work done by this representative is incidental.

- 674.02 **Materials** - Materials shall meet the requirements of the following subsections of Division 700 - Materials:

Gravel Borrow	703.20
Preformed Expansion Joint Material	705.01
Reinforcing Steel	709.01
Drainage Geotextile	722.02

The Contractor is cautioned that all of the materials listed are not required for every Prefabricated Concrete Modular Gravity Wall. The Contractor shall furnish the Resident a Certificate of Compliance certifying that the applicable materials comply with this section of the specifications.

Precast units shall be made per Standard Specification Section 534 - Precast Structural Concrete, modified as follows:

- Modify Standard Specification Section 534.02 - Materials, as follows:
 - Concrete shall be Class P2.
 - The minimum permeability of the concrete as indicated by Surface Resistivity shall be 17 KOhm-cm.
- Modify Standard Specification Section 534.16 - Tolerances, as follows:
 - Dimensional tolerances shall be in conformance with established industry standards and the following tolerances. If there is a conflict between established industry standards and the tolerances below, the stricter tolerance shall be followed. All units not meeting the listed tolerances will be rejected.
 1. All dimensions shall be within (edge to edge of concrete) $\pm 3/16$ ".
 2. **Squareness** - The length differences between the two diagonals shall not exceed $5/16$ ".
 3. **Surface Tolerances** - For steel formed surfaces, and other formed surface, any surface defects in excess of 0.08 in. in 4 ft will be rejected. For textured surfaces, any surface defects in excess of $5/16$ in. in 5 ft shall be rejected.

Joint Filler - (where applicable) Joints shall be filled with material approved by the Resident and supplied by the approved Prefabricated Concrete Modular Gravity Wall supplier. Four inch wide by $1/2$ " preformed expansion joint filler shall be placed in all horizontal joints between facing units. In all vertical joints, a space of $1/4$ " shall be provided. All Preformed Expansion Joint Material shall meet the requirements of subsection 502.03.

Woven Drainage Geotextile - Woven drainage geotextile 12" wide shall be bonded with an approved adhesive compound to the back face, covering all joints between units, including joints abutting concrete structures. Geotextile seam laps shall be 6" minimum. The fabric shall be secured to the concrete with an adhesive satisfactory to the Resident. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Resident.

Concrete Shear Keys - (where applicable) Shear keys shall have a thickness at least equal to the pre-cast concrete stem.

Concrete Leveling Pad - Cast-in-place concrete shall be Fill Concrete conforming to the requirements of Section 502 - Structural Concrete. Leveling pad shall have a minimum thickness of 4". The horizontal tolerance on the

surface of the pad shall be ¼" in 10 ft. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Resident.

Backfill and Bedding Material - Bedding and backfill material placed behind and within the reinforced concrete modules shall be gravel borrow conforming to the requirements of Subsection 703.20. The backfill materials shall conform to the following additional requirements: backfill and bedding material shall only contain particles that will pass the 3" square mesh sieve and the plasticity index (PI) as determined by AASHTO T90 shall not exceed 6. Compliance with the gradation and plasticity requirements shall be the responsibility of the Contractor, who shall furnish a copy of the backfill test results prior to construction.

Materials Certificate Letter - The Contractor, or the supplier as his agent, shall furnish the Resident a Materials Certificate Letter for the above materials, including the backfill material, in accordance with Section 700 of the Standard Specifications. A copy of all test results performed by the Contractor or his supplier necessary to assure Contract compliance shall also be furnished to the Resident. Acceptance will be based upon the materials Certificate Letter, accompanying test reports, and visual inspection by the Resident.

674.03 **Design Requirements** - The Prefabricated Concrete Modular Gravity Wall shall be designed and sealed by a Professional Engineer licensed in the State of Maine. The design to be performed by the wall system supplier shall be in accordance with AASHTO LRFD Bridge Design Specifications, current edition, except as required herein. Design calculations that consist of computer generated output shall be supplemented with at least one hand calculation and graphic demonstrating the design methodology used. Design calculations shall provide thorough documentation of the sources of equations used and material properties. The design by the wall system supplier shall consider the stability of the wall as outlined below:

- A. **Stability Analyses** - Wall systems shall be investigated for bearing resistance failure, lateral sliding and overturning failure in accordance with AASHTO LRFD Bridge Design Specifications.

Pullout resistance shall be investigated at every module level using nominal resistances and forces in accordance with Paragraph C., below. The ratio of the sum of the nominal resistances to the sum of the nominal forces shall be greater than, or equal to, 1.5.

Traffic impact loads transmitted to the wall through guardrail posts shall be calculated and applied in compliance with AASHTO LRFD Bridge Design Specifications with the exception that Article 11.10.10.2 is modified such that the upper 3.5 ft of concrete modular units shall be designed for an additional horizontal load of γ_{PH1} , where $\gamma_{PH1}=300$ lb per linear ft of wall.

- B. **Backfill and Wall Unit Soil Parameters** - For overturning and sliding stability calculations, earth pressure shall be assumed acting on a vertical plane rising from the back of the lowest wall stem. For overturning, the unit weight of the backfill within the wall units shall be limited to 96 pcf. For sliding analyses, the unit weight of the backfill within the wall units can be assumed to be 120 pcf. Both analyses may assume a friction angle of 34° for backfill within the wall units.

These unit weights and friction angles are based on a wall unit backfill meeting the requirements for select backfill in this specification. Backfill behind the wall units shall be assumed to have a unit weight of 120 pcf and a friction angle of 30° . The friction angle of the foundation soils shall be assumed to be 30° unless otherwise noted on the plans.

Internal Stability Internal stability of the wall shall be demonstrated using accepted methods, such as Elias' Method, 1991. Shear keys shall not contribute to pullout resistance. Soil-to-soil frictional component along stem shall not contribute to pullout resistance. The failure plane used to determine pullout resistance shall be found by the Rankine theory only for vertical walls with level backfills. When walls are battered or with backslopes greater than 0° are considered, the angle of the failure plane shall be per Jumikis Method. For computation of pullout force, the width of the backface of each unit shall be no greater than $4\frac{1}{2}$ ft. A unit weight of the soil inside the units shall be assumed no greater than 120 pcf when computing pullout. Coulomb theory may be used.

- D. **Safety against Structural Failure** - Prefabricated units shall be designed for all strength and reinforcement requirements in accordance with AASHTO LRFD Bridge Design Specifications.
- E. External loads which affect the internal stability such as those applied through piling, bridge footings, traffic, slope surcharge, hydrostatic and seismic loads shall be accounted for in the design.
- F. **Stability During Construction** - Stability during construction shall be considered during design, and shall meet the requirements of the AASHTO LRFD Bridge Design Specifications, Extreme Limit State.
- G. **Hydrostatic forces** - Unless specified otherwise, when a design high water surface is shown on the plans at the face of the wall, the design stresses calculated from that elevation to the bottom of wall must include a 3 ft minimum differential head of saturated backfill. In addition, the buoyant weight of saturated soil shall be used in the calculation of pullout resistance.
- H. Not more than two vertically consecutive units shall have the same stem length, or the same unit depth. Walls with units with extended height curbs shall be designed for the added earth pressure. A separate

computation for pullout of each unit with extended height curbs, or extended height coping, shall be prepared and submitted in the design package described above.

674.04 **Submittals** - The Contractor shall supply wall design computations, wall details, dimensions, quantities, and cross sections necessary to construct the wall. Thirty Days prior to beginning construction of the wall, the design computations and wall details shall be submitted to the Resident for review by the Department. The fully detailed plans shall be prepared in conformance with Subsection 105.7 of the Standard Specifications and shall include, but not be limited to the following items:

- A. A plan and elevation sheet or sheets for each wall, containing the following: elevations at the top of leveling pads, the distance along the face of the wall to all steps in the leveling pads, the designation as to the type of prefabricated module, the distance along the face of the wall to where changes in length of the units occur, the location of the original and final ground line.
- B. All details, including reinforcing bar bending details, shall be provided. Bar bending details shall be in accordance with Department standards.
- C. All details for foundations and leveling pads, including details for steps in the leveling pads shall be provided. The maximum calculated factored bearing pressure under the Prefabricated Concrete Modular Gravity wall shall be indicated on the wall plans.
- D. All prefabricated modules shall be detailed. The details shall show all dimensions necessary to construct the element, and all reinforcing steel in the element.
- E. The wall plans shall be prepared and stamped by a Professional Engineer.
- F. Four weeks prior to the beginning of construction, the Contractor shall supply the Resident with two copies of the design-supplier's Installation Manual. In addition, the Contractor shall have two copies of the Installation Manual on the Project site.

674.05 **Construction Requirements**

Excavation - The excavation and use as fill or disposal of all excavated material shall meet the requirements of Section 203 - Excavation and Embankment, except as modified herein.

Foundation - The area upon which the modular gravity wall structure is to rest, and within the limits shown on the submitted plans, shall be graded for a width equal to, or exceeding, the length of the module. Prior to wall and leveling pad construction, this foundation material shall be compacted to at least 95% of maximum laboratory dry density, determined using AASHTO T 180, Method C or

D. Frozen soils and soils unsuitable or incapable of sustaining the required compaction, shall be removed and replaced.

A concrete leveling pad shall have a minimum thickness of 4" and shall be constructed as indicated on the plans. The leveling pad shall be cast to the design elevations as shown on the plans, or as required by the wall supplier upon written approval of the Resident. Allowable elevation tolerances are +0.01 ft and -0.02 ft from the design elevations. Leveling pads which do not meet this requirement shall be repaired or replaced as directed by the Resident at no additional cost to the Department. Placement of wall units may begin after 24 hours curing time of the concrete leveling pad.

Method and Equipment - Prior to erection of the Prefabricated Concrete Modular Gravity Wall, the Contractor shall furnish the Resident with detailed information concerning the proposed construction method and equipment to be used. The erection procedure shall be in accordance with the manufacturer's instructions. Any pre-cast units that are damaged due to handling will be replaced at the Contractor's expense.

Installation of Wall Units - A field representative from the wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the Department. Vertical and horizontal joint fillers shall be installed as shown on the plans.

The maximum offset in any unit joint shall be $\frac{3}{4}$ ". The overall vertical tolerance of the wall, plumb from top to bottom, shall not exceed $\frac{1}{2}$ " per 10 ft of wall height. The prefabricated wall units shall be installed to a tolerance of plus or minus $\frac{3}{4}$ " in 10 ft in vertical alignment and horizontal alignment.

Select Backfill Placement - Backfill placement in the interior of the wall units and behind the wall shall progress simultaneously following the erection of each row of prefabricated wall units. The maximum lift thickness shall be 8", loose measure, and be thoroughly compacted by mechanical or vibratory compactors. The Contractor shall decrease the lift thickness if necessary to obtain the specified density. Gravel borrow backfill shall be compacted in accordance with Subsection 203.12 except that the minimum required compaction shall be 92% of maximum density as determined by AASHTO T 180 Method C or D. Backfill compaction shall be accomplished without disturbance or displacement of the wall units. Sheepsfoot rollers will not be allowed. Puddling for compaction will not be allowed. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved.

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be

determined in accordance with AASHTO T 180, Method C or D. At the end of the Day's operations, the Contractor shall shape the last level of backfill so as to direct runoff of rain water away from the wall face.

674.06 **Method of Measurement** - Prefabricated Concrete Modular Gravity Wall will be measured by the square foot of front surface not to exceed the dimensions shown on the Contract plans or authorized by the Resident. Vertical and horizontal dimensions will be from the edges of the facing units. No field measurements for computations will be made unless the Resident specifies, in writing, a change in the limits indicated on the plans.

674.07 **Basis of Payment** - The accepted quantity of Prefabricated Concrete Modular Gravity Retaining Wall will be paid for at the Contract unit price per square foot complete in place. Payment shall be full compensation for furnishing all labor, equipment, materials, professional services, and incidentals necessary for designing, fabricating, furnishing and installing the prefabricated concrete modular gravity wall and accessories. Cast-in-place concrete leveling pad, pre-cast concrete units, backfill, bedding material, hardware, joint fillers, woven drainage geotextile, cast-in-place coping, traffic barrier, and technical field representative will not be measured and paid for separately, but will be incidental to the square foot pay item.

There will be no allowance for excavating and backfilling for the Prefabricated Concrete Modular Gravity Wall beyond the limits shown on the approved submitted plans, except for excavation required to remove unsuitable subsoil in preparation for the foundation, Payment for excavating unsuitable material shall be full compensation for all costs of pumping, drainage, sheeting, bracing and incidentals for proper execution of the work, and will be paid as common excavation in accordance with Section 203.

Payment will be made under:

Pay Item		Pay Unit
674.10	Prefabricated Concrete Modular Gravity Wall	Square Foot

SECTION 675 - SOIL NAIL WALL - Reserved

SECTION 676 - SOLDIER PILE AND LAGGING WALL - Reserved

SECTION 677 - MECHANICALLY STABILIZED EARTH RETAINING WALL

677.01 **Description** - The work under this item shall consist of design, fabrication, furnishing, transportation, and erection of Mechanically Stabilized Earth (MSE)

retaining wall system of the required type, including miscellaneous items necessary for a complete installation.

The MSE retaining walls shall consist of reinforcing strips or reinforcing mesh earth wall systems utilizing architectural precast concrete facing panels supported on cast-in-place concrete leveling pads. All reinforcing strips or mesh material shall consist of galvanized steel. The wall structures shall be dimensioned to achieve the design criteria shown on the plans and specified herein.

The MSE retaining walls shall be constructed in accordance with these specifications and in conformity with the lines, grades, design criteria, and dimensions shown on the plans or established by the Geotechnical Engineer.

677.02 **Quality Assurance** - The MSE retaining wall system shall be one of the approved wall systems noted in the Plans or on the Department's Qualified Product List (QPL).

All necessary materials, except backfill and cast in-place concrete shall be obtained from the approved system designer.

Mechanically Stabilized Earth (MSE) - retaining walls shall be designed and constructed as specified herein. The design shall be subject to review and acceptance by the Geotechnical Engineer. The acceptability of a MSE retaining wall design shall be at the sole discretion of the Geotechnical Engineer. Any additional design, construction or other costs arising as a result of rejection of a retaining wall design by the Geotechnical Engineer shall be borne by the Contractor.

Precast facing panels shall be manufactured in a concrete products plant with approved facilities. Before proceeding with production, precast sample units shall be provided for the Resident's acceptance. These samples shall be kept at the plant to be used for comparison purposes during production.

All calculations and Shop Drawings shall be signed and sealed by a licensed Professional Engineer registered in accordance with the laws of the State of Maine and specializing in geotechnical construction.

The Contractor installing the MSE retaining walls shall have demonstrated experience constructing MSE walls and shall use personnel having demonstrated experience in the installation procedures recommended by the manufacturer and as specified herein.

All MSE walls shall be built in accordance with the plans and accepted shop drawings for the proposed wall systems.

A qualified representative from the wall design-supplier shall be present during construction of the MSE walls. The services of the qualified representative shall be at no additional cost to the Project. The qualified experienced technical

representative will advise the Contractor and the Resident concerning proper installation procedures.

The vendor's representative shall specify the required back-batter so that the final position of the wall is vertical. Furthermore, footing berms shall be placed in front of the first three levels of panels erected, to maintain verticality.

677.03 **Design Requirements** - The MSE retaining walls shall be designed to provide the grade separation shown on the plans with a service life of not less than 100 years.

The MSE wall system shall be designed in accordance with:

1. The manufacturer's requirements
2. The Contract Plans
3. The requirements specified herein
4. AASHTO LRFD Bridge Design Specifications, current edition
5. AASHTO LRFD Bridge Construction Specifications, current edition
6. FHWA-NHI-10-024, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Volume I, current edition.
7. FHWA-NHI-10-025, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Volume II, current edition.
8. FHWA-NHI-09-087 Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, current edition

Where conflicting requirements occur, the more stringent requirements shall govern.

The MSE wall design shall follow the general dimensions of the wall envelope shown on the plans. Base of footing elevation shall be as shown on the plans, or may be lower. All wall elements shall be within the right-of-way limits shown on the plans. The panels shall be placed so as not to interfere with drainage or other utilities, or other potential obstructions.

All appurtenances behind in front of, under, mounted upon, or passing through the wall such as drainage structures, utilities, fences, concrete parapet wall or other appurtenances shown on the plans shall be accounted for in the stability design of the wall.

Facing panels shall have tongue and groove, ship lap or similar approved connections along all joints, both vertical and horizontal. Where foundation conditions indicate large differential settlements, vertical full-height slip joints shall be provided. The shape of the panels shall be such that adjacent panels will have continuous, vertical joints, or as noted on the plans.

MSE facing panels shall be installed on cast-in-place concrete leveling pads. The top of the leveling pad shall be located at or below the theoretical leveling pad elevation. The minimum wall embedment shall be 4.0 ft as measured to the top of the leveling pad, or as shown on the plans, whichever is greater. The top of the

face panels shall be at or above the top of the panel elevation shown on the plans. Where coping or barrier is used, the wall face shall extend up into the coping or barrier a minimum of 2".

The MSE walls shall be dimensioned so that the factored bearing pressure resistance of the foundation soils, as noted on the plans, is not exceeded. Requirements for over excavation of native foundation soils and replacement with compacted structural fill are detailed on the plans.

The design by the wall system supplier shall consider the stability of the wall as outlined below and in the Contract Documents:

(a) **Failure Plane** - The theoretical failure plane within the reinforced soil mass shall be determined per AASHTO LRFD Bridge Design Specifications Section 11 and be analyzed so that the soil stabilizing components extend sufficiently beyond the failure plane within the reinforced soil mass to stabilize the material. External loads which affect the internal stability such as those applied through piling, bridge footings, traffic, slope surcharge, hydrostatic, and seismic loads shall be accounted for in the design.

(b) **External Stability - Load and Resistance Factors** - Loads and load combinations selected for design shall be consistent with AASHTO LRFD Bridge Design Specifications. Application of load factors shall be taken as specified in AASHTO LRFD Bridge Design Specifications. Sliding resistance factors and bearing resistance factors shall be consistent with AASHTO LRFD Bridge Design Specifications Section 10. Overturning provisions of AASHTO LRFD Bridge Design Specifications Section 11 shall apply.

MSE walls shall be designed to resist failure by instability of temporary construction slope. Passive pressure in front of the wall mass shall be assumed to be zero for design purposes. The factored applied bearing pressures under the MSE mass for each reinforced length shall be clearly indicated on the design drawing.

(c) **Internal Stability - Load and Resistance Factors** - Evaluation of reinforcement pullout, reinforcement rupture and panel connection pullout or rupture shall be consistent with AASHTO LRFD Bridge Design Specifications Section 11. Loads, load combinations and load factors shall be as specified in AASHTO LRFD Bridge Design Specifications Article 11. Resistance factors for internal design shall be consistent with AASHTO LRFD Bridge Design Specifications Article 11. Maximum reinforcement loads shall be calculated using the Simplified Method approach. Calculations for factored stresses and resistances shall be based upon assumed conditions at the end of the design life. The design life of steel soil reinforcements shall comply with AASHTO LRFD Bridge Design Specifications Section 11.

- (d) **Backfill and Foundation Soils Parameters** - The friction angle of the select backfill used in the reinforced fill zone for the internal stability design of the wall shall be assumed to be 34° unless noted otherwise. The friction angle of the foundation soils and random backfill shall be assumed to be 30° unless otherwise shown on the plans.
- (e) **Reinforcement Length** - The soil reinforcement shall be the same length from the bottom to the top of each wall section. The reinforcement length defining the width of the entire reinforced soil mass may vary with wall height. The minimum length of the soil reinforcement shall be 8 ft, but shall not be less than 70% of the wall height, H, for walls with level surcharges. The wall height, H, shall be the vertical difference between the top of the leveling pad and the elevation at the top of the wall, or as shown on the Plans. For walls with sloped backfills the initial minimum length of soil reinforcement shall not be less than 90% of the wall height, H, and the length verified as part of the design process. For walls supporting abutments, the initial minimum length of soil reinforcement shall be not less than 100% of the wall height, H, and the length verified as part of the design process.
- (f) **Steel Reinforcement** - For steel reinforcements, all structural connections, tie strips and loop inserts, the following galvanization and carbon steel loss rates shall be assumed:
- Mil./year/side
 - Zinc galvanizing (first 2 years) - 0.58
 - Zinc galvanizing (subsequent years to depletion) - 0.16
 - Carbon Steel (after zinc depletion to 100 years) - 0.47

Calculations for factored stresses and resistances in steel reinforcements and connections, including tie-strips and loop inserts, shall be based upon assumed conditions at the end of the design life. (or: The nominal long-term design strength in steel reinforcements and connections, including tie-strips and loop inserts shall be determined at the end of the service life.) The applied factored reinforcement loads shall be calculated in accordance with AASHTO LRFD Bridge Design Specifications Section 11.10.6.2, and shall be checked against the nominal tensile strength multiplied by a resistance factor per AASHTO LRFD Bridge Design Specifications Table 11.5.7-1. Transverse and longitudinal grid members shall be sized in accordance with ASTM A185.

When the expected differential settlement normal to the wall exceeds 3", the lower level reinforcement facing connections shall be designed to accommodate the increased tensile forces due to settlement.

(g) **Facing Panel Requirements**

1. Facing panels shall be designed to resist compaction stresses that occur during wall erection.
2. The minimum thickness for concrete panels in the zone of embedded connections shall be 5½" and 3½" elsewhere. The minimum concrete cover shall be 1½". Facing panels shall meet the design requirements of AASHTO LRFD Bridge Design Specifications 11.10.2.3
3. The wall facing shall be designed to accommodate differential settlements of 1/100 ft.
4. The minimum spacing between adjacent panels shall be ¾" in order to accommodate differential settlements without impairing the appearance of the facing or compromising the structural integrity of the individual panels. Joints between panels shall be no more than ¾". Joint between panels shall have a ship lap configuration or tongue and groove connection. There shall be no openings through the wall facing, except for utilities to pass through the wall. Slip joints to accommodate differential settlement shall be included where shown on the plans.
5. Where wall or wall sections intersect with an angle of 130° or less, a special vertical corner element panel shall be used. The corner element panel shall cover the joint of the panels that abut the corner and allow for independent movement of the abutting panels. Corner elements shall not be formed by connecting standard facing panels that abut the acute corner.

677.04 **Materials** - The Contractor shall be responsible for the purchase or manufacture of the precast concrete facing panels, reinforcing mesh or strips, panel/reinforcement connections, bearing pads, joint filler, and all other necessary components. The Contractor shall furnish to the Resident the appropriate Certificates of Compliance certifying that the applicable wall materials meet the requirements of the Project specifications. All materials used in the construction of the MSE retaining walls shall meet the requirements specified in the following subsections of the Maine Standard Specifications and as specified herein.

Materials not conforming to this section of the specifications, or from sources not listed in the Contract documents, shall not be used without written consent from the Resident.

677.041 **Reinforced Concrete Facing Panels** - Reinforced concrete facing panels shall meet the requirements specified in the following subsections:

Precast Structural Concrete	534
Drainage Geotextile	722.02

Concrete for reinforced concrete facing panels shall be Class P1. Tolerances and surface finish requirements shall be per Section 677.042 below.

- 677.042 **Precast Panel Tolerances and Surface Finish** - Concrete surface for the front face shall have a smooth steel formed finish, or as noted on the plans. The rear face shall have an unformed surface finish. The rear face of the panel shall be roughly screeded to eliminate open pockets of aggregate and surface distortions in excess of $\frac{1}{4}$ ". All uncoated steel Projecting from the panel unit shall be galvanized in accordance with ASTM A123 (AASHTO M 111) with a minimum coating thickness of 2 oz/ft².

Precast panel tolerances shall comply with the following; units that do not meet the listed tolerances will be rejected.

1. Panel dimensions (edge to edge of concrete) within $\pm \frac{3}{16}$ ".
2. Panel thickness: $\pm \frac{1}{4}$ ".
3. Squareness The length difference between the two diagonals shall not exceed $\frac{1}{2}$ ".
4. Distance between the centerline of dowel and dowel sleeve, and to centerline of reinforcing steel shall be $\pm \frac{1}{8}$ ".
5. Face of panel to centerline of dowel and dowel sleeve, and to centerline of reinforcing steel shall be $\pm \frac{1}{8}$ ".
6. Position of panel connection devices (Tie Strip) shall be ± 1 ".
7. Location of Coil and loop Imbeds shall be $\pm \frac{1}{8}$ ".
8. Warping of the exposed panel face shall not exceed $\frac{1}{4}$ " in 5 ft.
9. Surface defects on smooth-formed surfaces measured over a length of 5 ft shall not exceed $\frac{1}{8}$ ". Surface defects on textured-finished surfaces measured over a length of 5 ft shall not exceed $\frac{5}{16}$ ".

- 677.043 **Reinforcing** - All reinforcing, tie strips, and attachment devices shall be carefully inspected to insure they are true to size and free from defects that may impair their strength and durability.

- A. **Reinforcing Mesh** - shall be shop fabricated from cold drawn steel wire conforming to the requirements of AASHTO M 32 (ASTM A82-97) yield strength minimum of 65 ksi and shall be welded into the finished mesh fabric in accordance with AASHTO M 55 (ASTM A185). Galvanizing shall be in accordance with AASHTO M 111 (ASTM A123/A123M) after fabrication. The minimum coating thickness shall be 2 oz/ft². Any damage done to the mesh galvanization prior to the installation shall be repaired in an acceptable manner and provide a minimum galvanized coating of 2 oz/ft².

- B. **Reinforcing Strips** - shall be fabricated from hot rolled bars to the required shape and dimensions. Their physical and mechanical properties shall conform to AASHTO M 223 (ASTM A572/A572M) Grade 65, or approved equal. Reinforcing strips shall be hot dipped galvanized in accordance with AASHTO M 111 (ASTM A123/A123M) after fabrication. The minimum galvanization coating thickness shall be 2 oz/ft². Any damage done to the mesh galvanization prior to the installation shall be repaired 2 oz/ft².
- C. **Tie Strips** - shall be fabricated of hot rolled steel conforming to ASTM A1011/A1011M, Grade 50 or equivalent. Tie strips shall be hot dipped galvanized in accordance with AASHTO M 111 (ASTM A123/A123M) after fabrication. The minimum coating thickness shall be 2 oz/ft².
- D. The tie strips and reinforcing strips shall be cut to lengths and tolerances shown on the submitted plans. Holes for bolts shall be punched in the locations shown.

677.044 **Attachment Devices**

- A. **Steel clevis loop embeds** - shall be fabricated of cold drawn steel wire conforming to ASTM A510, UNS G 10350 or AASHTO M 32 (ASTM A82). Loop embeds shall be welded in accordance with AASHTO M 55 (ASTM A185). Both shall have electrodeposited coatings of zinc applied in accordance with ASTM B633.
- B. **Fasteners** - shall consist of hexagonal cap screw bolts and nuts, which are galvanized and conform to the requirements of AASHTO M 164 (ASTM A325) or equivalent.
- C. **Connector pins and mat bars** - shall be fabricated from AASHTO M 183 (ASTM A36/A36M) steel and welded to the soil reinforcement mats as shown on the plans. Galvanization shall conform to AASHTO M 111 (ASTM A123/A123M) with a minimum coating thickness of 2 oz/ft². Connector bars shall be fabricated of cold drawn steel wire conforming to the requirements of ASTM A82 (AASHTO M 32) and galvanized in accordance with ASTM A123/A123M.
- D. **Structural plate connectors and fasteners** - used for yokes to connect reinforcements to wall panels around pile or utility conflicts shall conform to the material requirements for reinforcing strips and fasteners in 677.042 (c).

- 677.045 **Joint Materials** - Joint material shall be installed to the dimensions and thicknesses specified below, or in accordance with the plans or approved shop drawings.
- A. Provide flexible foam strips for filler for vertical joints between panels, and in horizontal joints where pads are used.
 - B. Provide in horizontal joints between panels either preformed EPDM rubber pads conforming to ASTM D2000 for 4AA, or 812 rubbers or neoprene elastomeric pads having a Durometer Hardness of 55 ± 5 , or high density polyethylene pads with a minimum density of 0.946 g/cm^3 in accordance with ASTM D1505.
- 677.046 **Nonwoven Drainage Geotextile** - Cover all joints between panels on the back side of the wall with a geotextile fabric meeting the minimum requirements of 722.02 Class 2. Slit film and multifilament woven and resin bonded woven geotextile fabrics are not allowed for this application. The minimum width of the fabric shall be 18" Lap fabric at least 18" where splices are required. Nonwoven Drainage Geotextile shall be bonded with an approved adhesive compound to the back face covering all joints between panels. Adhesives used to hold the geotextile filter fabric material to the rear of the facing panels prior to backfill placement shall be supplied by the wall supplier and approved by the Resident.
- 677.047 **Concrete Leveling Pad** - The cast-in-place leveling pad shall be constructed of Class A concrete conforming to the requirements of Section 502 - Structural Concrete. Leveling pad shall have minimum dimensions of 6" thickness and 12" width and be placed at the design elevation shown on the shop drawings within a $\frac{1}{8}$ " tolerance.
- 677.048 **Backfill Materials** - All backfill materials used in the MSE Walls shall conform to Gravel Borrow conforming to the requirements of Section 703.20, with the following additional requirements:
- A. The maximum aggregate size is limited to 4" (U.S Sieve Size - 102 mm).
 - B. **Soundness** - The material shall be substantially free of shale or other soft, poor durability particles. The materials shall have a magnesium sulfate soundness loss, as determined by AASHTO T 104 (ASTM C88), of less than 30% after four cycles.

- C. **Electrochemical Requirements** - The backfill materials shall meet the following criteria:

Requirements		Test Methods
Resistivity	>3,000 ohm-centimeters	AASHTO T 288
pH between	Between 5 and 10, inclusive	AASHTO T 289
Chlorides	<100 parts per million	AASHTO T 291
Sulfates	<200 parts per million	AASHTO T 290
Organic Content	<1%	AASHTO T 267-86

- D. The plasticity index (PI) as determined by AASHTO T 90 shall not exceed 6.
- E. The select backfill material shall exhibit a peak angle of internal friction of not less than 34°, as determined by the standard Direct Shear Test, AASHTO T 236 (ASTM D3080-72), on the portion finer than the 2 mm [#10 sieve], compacted to 95% of AASHTO T 99, Methods C or D (with oversized correction as outlined in Note 7) at optimum moisture content. No testing is required for backfills where 80% of sizes are greater than ¾". Before construction begins, the borrow material selected shall be subject to show conformance with this frictional requirement. Compliance with the test requirements shall be the responsibility of the Contractor, who shall furnish a copy of the backfill test results prior to construction.

677.050 **Crushed Stone for Abutment Foundation** - Crushed stone for use in the foundation layer below the abutment shall be crushed stone conforming to the requirements of MaineDOT Standard Specification Section 703.13 - Crushed Stone ¾".

677.051 **Impervious Membrane** - An impervious geomembrane shall be installed near the top of the reinforced backfill to reduce the chance of water infiltrating into the reinforced backfill. The geomembrane shall be bonded to the inside face of the wall panels and extend perpendicularly from the wall face into the fill, while being parallel to the top of the wall. The membrane should be sloped to drain away from the facing and outlet beyond the reinforcing zone. The impervious geomembrane shall extend into the fill a distance of 1 ft beyond the MSE reinforcement. The geomembrane shall have a minimum thickness of 0.76 mm, 30 mil (0.03", 1/32").

The geomembrane shall have both sides textured with a rough finish to improve resistance against sliding. The texture shall be approved by the Resident before installation. The geomembrane shall be shown on the design drawings of the MSE submittal of the Contractor.

677.052 **Acceptance of Material** - The Contractor shall furnish to the Resident a Certificate of Compliance certifying that the above materials comply with the applicable Contract specifications including the backfill material, in accordance with Section 700. A copy of all test results performed by the Contractor necessary to assure Contract compliance shall also be furnished to the Resident. Acceptance will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Resident.

677.06 **Submittals**

- A. Design computations demonstrating compliance with the criteria specified herein and shown on the plans, shall be prepared, signed and stamped by a licensed Professional Engineer licensed in the State of Maine and specializing in geotechnical engineering. Design calculations that consist of computer generated output shall be supplemented with at least one hand calculation and graphic demonstrating the design methodology used. Design calculations shall provide thorough documentation of the sources of equations used and material properties.
- The design calculations shall include:
1. Statement of all assumptions made and copies of all references used in the calculations.
 2. Analyses demonstrating compliance with all applicable earth, water, surcharges, seismic, or other loads, as specified herein and required by AASHTO LRFD Bridge Design Specifications.
 3. Analyses or studies demonstrating durability and corrosion resistance of retaining wall systems for the proposed location and environment. The designer shall provide all corrosion protection devices necessary for the retaining wall to have a minimum service life of 100 years in the proposed location and environment.
- B. A detailed resume of the wall designer listing similar Projects with references, and demonstrating necessary experience to perform the MSE retaining wall design, including a brief description of each Project that is similar in scope.
- C. A detailed listing of MSE walls that the Contractor has constructed including a brief description of each Project and a listing of personnel who will construct the walls demonstrating their experience in construction of MSE retaining walls. A reference shall be included for each Project listed. As a minimum, the reference shall include an individual's name, address and current phone number.
- D. Manufacturer's product data for the MSE wall system, including material, manufacture and erection specifications, all specified erection equipment necessary, details of buried MSE wall elements, special details

required of reinforcing layout around drainage structures and sign foundations, structures design properties, type of backfill and details for connections between facing panels.

- E. Details of precast yard and concrete mix design.
- F. Shop drawing showing the configuration and all details, dimensions, quantities and cross sections necessary to construct the MSE wall, including but not limited to the following:
 - 1. A plan view of the wall, which shall include Contract limits, stations and offsets, and the face of wall line shown on the plans.
 - 2. An elevation view of the wall which shall include the elevation at the top of the wall at all horizontal and vertical break points and at least every 50 ft along the face of the wall, all steps in the leveling pads, the designation as to the type of retaining wall system(s), and an indication of the final ground line and calculated factored bearing pressures. The face of wall shown on the plans shall be indicated.
 - 3. A typical cross section or cross sections showing the elevation relationship between existing ground conditions and proposed grades, and the proposed wall configuration, including details for the proposed methods for connecting to existing conditions. The sections shall also indicate the location of the face of wall shown on the plans.
 - 4. General notes pertaining to design criteria and wall construction.
 - 5. A listing of material quantities for each wall.
 - 6. Details of sleeves and pipes and other embedded items to be installed through the walls.
 - 7. Clearly indicated details for construction of walls or reinforcing elements around drainage, foundations, utilities or any other potential obstructions.
 - 8. Details of the architectural treatment of facing panels.
 - 9. Drainage design detail and design scheme.
 - 10. Location of utilities.
 - 11. Sequence and schedule of construction, including overall construction schedule.
 - 12. Methods of excavation and backfill.
 - 13. Method of maintaining stability of excavated trenches.
 - 14. Method of monitoring plumbness and deviation of wall.
 - 15. Excavation support system, if any.
 - 16. Any acceptance testing and frequency.

17. Details and location of all necessary construction and expansion joints along the wall.
18. Connection details at the interface of the wall and any adjacent proposed cast in place retaining wall or abutment structure.
19. Details of impermeable membrane connection to abutment in roadway runoff collection system.

677.07 ***Delivery, Storage and Handling***

- A. Contractor shall check the material upon delivery to assure that the proper material has been received. A product certification should be provided with each shipment.
- B. Material shall be stored above -20°F.
- C. Contractor shall prevent excessive mud, wet cement, epoxy and like substances which may affix themselves to the material from coming in contact with the material.
- D. Material may be laid flat and stored outside for 30 Days. For extended storage, material shall be stored in or beneath a trailer or covered with a colored tarpaulin to prevent long-term exposure.

677.08 ***Wall Excavation*** - The excavation and use as fill disposal of all excavated material shall meet the requirements of Section 203 - Excavation and Embankment, except as modified herein. Temporary excavation support as required shall be the responsibility of the Contractor.

677.09 ***Foundation Preparation*** - The foundation for the structure shall be graded level for a width equal to the length of reinforcement elements plus 5 ft, or as shown on the plans. Prior to wall construction the foundation shall be compacted with at least 10 passes of a smooth wheel vibratory roller weighing at least 10,000 lb. Any foundation soils found to be unsuitable or incapable of sustaining the required compaction shall be removed and replaced with Special Borrow Material. The foundation for the structure shall be approved by the Resident before erection is started.

A concrete leveling pad shall be constructed as indicated on the submitted plans. The leveling pad shall be cast to the design elevations as shown on the plans. Allowable elevation tolerances are +0.01 ft and -0.02 ft from the design elevations. Placement of wall panels may begin after 24 hours curing time of the concrete leveling pad.

677.10 ***Wall Erection*** - A field representative from the proprietary wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the Project.

Precast concrete panels shall be placed so that their final position is vertical or battered as shown on the plans. The vendor representative shall specify the

required back-batter so that the final position of the wall is vertical. Earth berms at the footing shall be placed to maintain the desired position of panels. For erection, panels are handled by means of lifting devices connected to the upper edge of the panel. Panels should be placed in successive horizontal lifts in the sequence shown on the approved shop drawings as backfill placement proceeds. As backfill material is placed behind the panels, the panels shall be maintained in position by means of temporary wedges or bracing according to the wall supplier's recommendations.

Concrete facing vertical tolerances and horizontal alignment tolerances shall not exceed $\frac{3}{4}$ " when measured with a 10 ft straightedge ($\frac{1}{4}$ "/yd). During construction, the maximum allowable offset in any panel joint shall be $\frac{3}{4}$ ". The overall vertical tolerance of the wall (from top to bottom) shall not exceed $\frac{1}{2}$ " per 10 ft of wall height.

- 677.11 **Backfill Placement** - Backfill shall not be placed between November 1st and April 1st. Backfill placement shall closely follow erection of each course of panels. Backfill shall be placed and compacted in such a manner as to avoid any damage or disturbance of the wall materials or misalignment of the facing panels or reinforcing elements. Any wall materials which become damaged during backfill placement shall be removed and replaced at the Contractor's expense. Any misalignment or distortion of the wall facing panels due to placement of backfill outside the limits of this specification shall be corrected by the Contractor at his expense. Prior to the placement of the soil reinforcement, the backfill elevation after compaction shall be at the required elevation of the reinforcements. At each reinforcement level, the backfill shall be placed to the level of the connection. Backfill placement methods near the panels shall assure that no voids exist directly beneath the reinforcing element.

Gravel borrow backfill shall be compacted in accordance with Subsection 203.12 except that the minimum required compaction shall be 95% of maximum density as determined by AASHTO T 180, Method C or D (with oversize correction, as outlined in Note 7 of that test). If 30% or more of the backfill material is greater than $\frac{3}{4}$ " in size, AASHTO T 180 is not applicable, and the acceptance criterion for control of compaction shall be either a minimum of 70% of the relative density of the material as determined by ASTM D4253 and D4254, or a method of compaction consisting of at least four passes by a heavy roller.

Where spread footings support bridge or other structural loads, the top 5 ft below the bottom of footing elevation shall be compacted to 98% of the maximum density as determined by AASHTO T 180, Method C or D (with oversize correction, as outlined in Note 7 of that test).

The moisture content (determined in accordance with AASHTO T 180, Method C or D) of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall have be placed at a moisture content not more than 2 percentage points less than or equal to the

optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

At each reinforcing level, backfill shall be leveled before placing and bolting the reinforcing. The maximum lift thickness after compaction shall not exceed 12". The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

Heavy compaction equipment shall not be used to compact backfill within 3 ft of the wall face. Compaction within 3 ft of the back face of the wall shall be achieved by at least three passes of lightweight mechanical tamper, lightweight roller, or vibratory system. The specified lift thickness shall be adjusted as warranted by the type of compaction equipment actually used. No vehicular equipment shall be operated within 3 ft of the panels.

The frequency of sampling of the backfill material necessary to assure gradation control throughout construction shall be as directed by the Resident.

At the end of each Day's operation, the Contractor shall slope the last level of the backfill away from the wall facing to rapidly direct runoff away from the wall face. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

- 677.12 **Reinforcement Placement** - Prior to placing the first layer of reinforcements (strips, mats or grids), backfill shall be placed and compacted in accordance with Subsection 677.11 - Backfill Placement.

Bending of reinforcements in the horizontal plane resulting in a permanent deformation in their alignment shall not be allowed. Gradual bending in the vertical direction that does not result in permanent deformations is allowable.

Cutting of longitudinal or transverse reinforcement bars to avoid conflicts with utility obstructions or piles will not be allowed. A structural connection (yokes) from the wall panel to the reinforcement shall be used whenever it is necessary to avoid cutting or excessive skewing of reinforcement due to pile or utility conflicts.

Soil reinforcements shall be placed normal to the face of the wall, unless otherwise shown on the plans or directed by the Resident. If skewing of the soil reinforcements is required due to obstructions in the reinforced fill, rotatable bolted connections shall be used and the maximum skew angle shall not exceed 15° from the normal position except in the case of acute corner where redundant reinforcements are used. The tensile capacity of splayed reinforcement shall be reduced by the cosine of the splay angle.

- 677.13 **Method of Measurement** - Mechanically Stabilized Earth Retaining Wall will be measured by the square foot of face area computed using the plan dimensions. No adjustment in the pay quantity will be made if the computed quantity, based on the working drawings, varies from the plan quantity.

Vertical dimension limits will be from the top of leveling pad to the top of the wall, including the coping, as shown on the plans. The horizontal dimension limits will be from the edges of the facing units at each end of a wall, as shown on the plans. No field measurements will be made unless the Resident specifies, in writing, a change to the limits indicated on the plans.

The wall surface area, as shown on the plans, includes the copings, the surface area of nominal panel joint openings and wall penetrations such as pipes and other utilities.

677.14 **Basis of Payment** - The accepted quantity of Mechanically Stabilized Earth Retaining Wall will be paid for at the Contract unit price per square foot. Payment for Mechanically Stabilized Earth Retaining Wall shall be full compensation for:

1. All design work, preparation of written submittals and plans, revision of submittals, sample submittals and any other necessary preliminary work prior to and after acceptance of the retaining wall by the Resident.
2. All materials, including transportation, for the MSE walls, including facing panels, fasteners, reinforcing mesh, reinforcing straps, tie strips, hardware, bearing blocks, shims, joint materials, copings, vertical corner elements, concrete masonry, cast-in-place leveling pads, woven drainage geotextile, impervious membrane, crushed stone under abutments, crushed stone pads under leveling slabs, select granular backfill and incidentals.
3. All labor and equipment required to excavate and prepare the wall foundation, fabricate the wall panels, form and cast the leveling pad, erect the MSE wall to the lines and grades shown on the plans, place and compact backfill, place and compact the drainage layer, provide a technical field representative and construct any other items necessary to complete the MSE wall.
4. All temporary sheeting, temporary excavation, and temporary dewatering necessary to perform the other work in this section.

Excavation, including extra excavation due to unsuitable foundation material, will be measured and paid for under Item 203.20 - Common Excavation. Foundation material and select backfill material will be considered incidental to the Mechanically Stabilized Earth Retaining Walls.

There will be no allowance for excavating and backfilling for the Mechanically Stabilized Earth Retaining Wall beyond the limits shown on the Plans, except for excavation required to remove unsuitable subsoil in preparation for the foundation.

Payment will be made under:

Pay Item		Pay Unit
677.20	Mechanically Stabilized Earth Retaining Wall	Square Foot

SECTION 678 - GEOSYNTHETIC REINFORCED MECHANICALLY STABILIZED
EARTH RETAINING WALL - Reserved

SECTION 679 - FIELDSTONE RETAINING WALL

679.01 **Description** - This work shall consist of supplying material for and constructing a Fieldstone Retaining Wall (FSRW) in accordance with these Specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the Plans and Special Details or as directed by the Resident.

An FSRW will consist of the following components:

- **Foundation Soils** - Native soil mass supporting the FSRW
- **Drainage System** - 6" underdrain pipe
- **Crushed Stone Leveling Pad** - 8" thick bed of Crushed Stone
- **Wall Stones** - Hard, durable, flat fieldstones or quarried stones with flat faces in a mixture of sizes to be stacked in a compact and stable mass
- **Crushed Stone Drainage Layer** - 12" vertical layer directly behind the FSRW
- **Geotextile** - Drainage Geotextile meeting the requirements of Standard Specification 722
- **Backfill** - Soil placed behind the FSRW

Included in the scope of the FSRW construction are:

- all materials necessary for wall construction, all grading necessary for wall construction, compaction of the wall foundation soil, drainage system, Crushed Stone Drainage Layer, geotextile, backfill, construction of leveling pad, and FSRW installation.
- The top of the upper row of fieldstones shall be at or above the top of the face elevation shown on the Plans.

679.02 **Materials** - Materials for FSRW shall meet the requirements of the following Sections of Division 700:

Crushed Stone ¾"	703.13
Gravel Borrow	703.20
Underdrain Pipe	706.06 or
	706.09
Drainage Geotextile	722.02

The Contractor is cautioned that all the materials listed are not required for every FSRW. Materials shall meet the following additional requirements:

679.021 **Drainage System** - A positive Drainage System to drain water from behind the wall shall be included in the FSRW.

679.022 **Wall Stones** - The wall stones shall be cleaned of paint, dirt and other debris prior to use for wall construction.

679.023 **Drainage Geotextile** - A Drainage Geotextile shall be placed between the FSRW and the Backfill material as shown on Plans and Special Details in the Contract Documents. Drainage Geotextile shall consist of a geotextile approved by the Geotechnical Engineer.

679.024 **Backfill** - Backfill material placed behind the FSRW shall meet the requirements of Section 703.20 - Gravel Borrow, except that the backfill material shall only contain particles that pass the 3" square mesh sieve.

679.03 **FSRW Requirements** - The FSRW layout is shown on the Plans and Special Details in the Contract Documents. The design life of the FSRW shall be 50 years unless otherwise noted on the plans.

The top of the Crushed Stone Leveling Pad shall be constructed so that the embedment depth of the FSRW is adequate to maintain stability. The minimum embedment depth to the top of the Crushed Stone Leveling Pad shall be 12".

A vertical Crushed Stone Drainage Layer shall be placed between the back of the FSRW stones and the backfill to promote drainage and minimize ice damage to the FSRW.

679.04 **Submittals** - The Contractor shall submit to the Resident a Materials Certification Letter certifying that the applicable materials for construction of the FSRW comply with this Special Provision with Section 700 of the Standard Specifications. The Contractor is required to submit a grain size distribution curve (ASTM D422) and a moisture-density relationship curve (AASHTO T 180) for acceptance of the proposed Backfill material. A copy of all test results performed by the Contractor or his supplier necessary to assure Contract compliance shall also be furnished to the Resident. The Resident will base acceptance upon the Materials Certificate Letter, accompanying test reports, and visual inspection.

No less than 2 weeks prior to commencing construction of the FSRW, the Contractor shall submit Shop Drawings showing the details of the FSRW including plan and elevation views of the wall containing elevations at the top of the leveling pad, the distance along the face of the wall to all steps in the leveling pad, the location of the original and final ground lines, details of any steps needed, and details of the fencing at the top of the wall, if needed. All Shop Drawings shall be signed and sealed by a Professional Engineer licensed in the State of Maine.

The Contractor shall submit the manufacturer's information for the proposed Drainage Geotextile material to the Resident for approval by the Geotechnical Engineer. Drainage Geotextile material and placement shall be in conformance with the requirements of Section 620 – Geotextiles.

The Contractor shall furnish the Resident a Certificate of Compliance certifying that the applicable materials comply with this Section of the Specifications.

- 679.05 **FSRW Approval** - The FSRW shall be in accordance with these Specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the Plans and Special Details, or as directed by the Resident. Construction of the FSRW shall not begin until the Contactor's Shop Drawing have been approved by the Geotechnical Engineer.
- 679.06 **Construction** - The FSRW shall be built by a skilled mason experienced in this type of wall construction. The FSRW shall have the following construction requirements:
1. **Excavation** - The excavation and use as fill or disposal of all excavated material shall meet the requirements of Standard Specification Section 203 - Excavation and Embankment, except as modified herein.
 2. **Foundation Soils** - The native soils for supporting the FSRW shall have sufficient strength to maintain global stability of the FSRW. Foundation soils shall be brought to the desired grade as required for the FSRW dimensions shown on the Plans and Special Details in the Contract Documents or as directed by the Resident. Prior to placement of the Crushed Stone Leveling Pad, the foundation soils shall be proof-rolled with multiple passes of a static roller to identify loose or weaving areas that require over-excavation and replacement and to achieve a firm and stable surface. Any loose soils or soft or unsuitable materials encountered at the bearing elevation shall be removed and replaced with Crushed Stone $\frac{3}{4}$ ".
 3. **Underdrain** - A 6" diameter positive Drainage System in accordance with Standard Specification Section 706.06 or 706.09 shall be installed behind the FSRW as shown on the Plans and Special Details in the Contract Documents or as directed by the Resident.
 4. **Crushed Stone Leveling Pad** - The 8" thick Crushed Stone Leveling Pad shall be constructed as shown on the Plans and Special Details in the Contract Documents. The Crushed Stone shall meet the requirements of Standard Specification Section 703.13. The Crushed Stone Leveling Pad shall be proof-rolled with multiple passes of a static roller to achieve a firm and stable surface. The Crushed Stone Leveling Pad shall extend at least 3" beyond the wall stones in all directions. Steps in the Crushed Stone Leveling Pad shall have a minimum overlap of 8". The allowable elevation tolerances from the design elevations are +0.01 ft and -0.02 ft.
 5. **Construction of FSRW** - The FSRW shall be constructed of hand fitted fieldstones or quarried stones. The stones shall be placed such that a minimum of 1.5 tons of stone is used for each cubic yard of wall. Joints shall be level and horizontal. Only short vertical joints will be allowed and no more than two vertical joints may be stacked above each other. Stones

shall be stacked in a manner such that diagonal joints are kept to a minimum. Joint size in the face of the wall should be kept to a minimum and should not exceed 1.5". The top of the wall should be at least 16" wide. The width of the base should be approximately $\frac{2}{3}$ of the wall height, with a gradual taper from the base to the top of the wall. Stones shall be placed so the face of the wall has a minimum batter of 1H:12V. The exposed faces of each stone shall have a true plane with no Projections or depressions on those surfaces greater than $\frac{1}{2}$ ". A hand fitted course of cap stones shall be placed on top of the wall. The top surface of the FSRW shall be levelled transversely, perpendicular to the wall face. This shall be constructed of stones of similar size and thickness. Each stone in the cap shall be of sufficient size to withstand accidental movement. Shims shall be placed as necessary for levelling, but shall not provide primary support for the overlying stones. Shims shall not be movable by hand. Shims shall be stone or another approved durable material and shall not be visible on the exposed face.

6. **Crushed Stone Drainage Layer** - A 12" vertical Crushed Stone Drainage Layer shall be constructed directly behind the FSRW. The Crushed Stone shall meet the requirements of Standard Specification Section 703.13. Crushed Stone Drainage Layer placement shall closely follow the erection of the FSRW.
7. **Drainage Geotextile Placement** - Drainage Geotextile placement shall closely follow the erection of the FSRW. Drainage Geotextile shall be placed in accordance with Standard Specification Section 620 between the native soils and the leveling pad and backfill. Drainage Geotextile seam overlaps shall be 6" minimum.
8. **Backfill Placement** - Backfill placement shall closely follow the erection of the FSRW. The backfill used behind the FSRW shall meet the requirements of Gravel Borrow, Section 703.20. Backfill shall be placed, spread, and compacted from the back of the Crushed Stone Drainage Layer toward the limits of the excavation. Backfill shall be placed in lifts not to exceed 8" loose and compacted with lightweight, hand operated compaction equipment. Backfill beyond 3 ft from the back of the Crushed Stone Drainage Layer shall be compacted to 95% of the maximum density as determined by AASHTO T 180, Method C or D. Backfill compaction shall be accomplished without disturbance or displacement of the FSRW stones. Compaction adjacent to the FSRW shall be performed using hand-operated compaction equipment. Sheepsfoot rollers will not be allowed. Full size, ride on compaction equipment will not be allowed within 5 ft of the back of the FSRW. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each

layer and shall be within 2 percentage points dry of optimum. At the end of the Day's operations, the Contractor shall shape the last level of backfill so as to direct runoff of rain water away from the FSRW face.

679.07 **Method of Measurement** - FSRW shall be measured by the Square Foot of front surface not to exceed the measurements shown on the Contact Plans or as authorized by the Resident. Vertical dimension limits will be from the top of the Crushed Stone Leveling Pad to the top of the cap stone layer. Horizontal dimension limits will be from each end of the wall.

679.08 **Basis of Payment** - The accepted quantity of FSRW will be paid for at the Contract unit price per Square Foot complete, cleaned of debris and accepted in place. Payment shall be full compensation for wall construction, compaction of the wall foundation soil, Crushed Stone Drainage Layer, backfill, drainage system, geotextile, construction of leveling pad, and FSRW installation, and other incidentals.

There will be no allowance for excavating and backfilling for the FSRW beyond the limits shown on the Plans and Special Details in the Contract Documents, except for excavation required to remove unsuitable subsoil in preparation for the foundation. Payment for excavating unsuitable subsoil shall be full compensation for all costs of pumping, drainage, sheeting, bracing and incidentals for proper execution of the work and will be paid as Common Excavation in accordance with Standard Specification Section 203.

Payment will be made under:

Pay Item		Pay Unit
679.10	Field Stone Retaining Wall	Square Foot

SECTION 680 - ROCKERY WALL - Reserved

SECTION 681 - PRECAST AGGREGATE-FILLED, CONCRETE BLOCK GRAVITY WALL

681.01 **Description** - The work under this item shall consist of the design, fabrication, furnishing and construction of a Precast Aggregate-filled Concrete Block Gravity Wall in accordance with these specifications and in conformance with the lines and grades shown on the Plans, or established by the Resident. The Precast Aggregate-filled Concrete Block Gravity Wall shall consist of blocks made of Structural Precast concrete made from Portland Cement, water, chemical admixtures, and aggregates, supported on concrete leveling pads, and if required, geosynthetic reinforced backfill.

Included in the scope of the precast gravity wall construction are: geotechnical design of any wall with an exposed height greater than 4.5 ft or as specified on

the Plans, all grading necessary for wall construction, compaction of the wall foundation soil, backfill, piped drainage, construction of leveling pads, and concrete wall unit installation. The top of the upper row of concrete wall units shall be at or above the top of the face elevation shown on the Plans.

- 681.02 **Quality Assurance** - The wall system shall be one of the approved combinations of facing block and soil reinforcement systems noted in the Plans or on the Department's Qualified Products List (QPL). Alternate wall systems will not be considered for this Item.

All design calculations and Shop Drawings shall be signed, checked, and sealed by a Professional Engineer licensed in the State of Maine.

The Contractor shall require the wall design-supplier to provide an on-site, qualified experienced technical representative to advise the Contractor concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Resident.

- 681.03 **Materials** - Materials for walls shall meet the requirements of the following Sections of Division 700:

Gravel Borrow	703.20
Crushed Stone $\frac{3}{4}$ "	703.13
Underdrain Pipe	706.06 or 706.09
Reinforcing Steel	709.01
Structural Precast Concrete Units	712.061
Reinforcement Geotextile	722.01
Drainage Geosynthetic	722.02

The Contractor is cautioned that all of the materials listed are not required for every Precast Aggregate-filled Concrete Block Gravity Wall. The Contractor shall furnish the Resident a Materials Certification Letter certifying that the applicable materials comply with this Section of the specifications. Materials shall meet the following additional requirements:

- 681.031 **Concrete Units** - The Materials Certification Letter described above shall contain the date of concrete casting, a lot identification number, compressive strength results, and entrained air results.

All prefabricated concrete units shall conform to the requirements of Standard Specification Section 534 - Precast Structural Concrete, with the following exceptions:

- Modify Standard Specification Section 534.02 - Materials, as follows:
 - "Concrete shall be Class P3. Paragraph five is not applicable to this Section."

- Standard Specification Section 534.05 - Facilities for Inspection, is not applicable to this Section.
- Modify Standard Specification Section 534.1301 - Curing, as follows:
 - Replace the last paragraph that starts with “The forms shall remain...” with the following:
 - “The forms shall remain in place until the concrete has gained sufficient strength such that removal of the forms and subsequent handling will not damage the units.”
 - Add the following paragraph to the end of the section:
 - “Face texture of the units shall be a formed finish on all exposed surfaces. Pigment shall be added during the casting process of the concrete unit to achieve a consistent shade of gray or other color as determined by the Resident.”
- Modify Standard Specification Section 534.14 - Acceptance and Quality Control Testing of Concrete, as follows.
 - Replace paragraph two that starts with “At least once per...” with the following:
 - “The Contractor shall make four cylinders for use by the Department to represent every 200 cy or fraction thereof.”
 - Replace paragraph five that starts with “The Contractor shall cast...” with the following:
 - “The Contractor shall make and test at least one set of cylinders for every 50 cy of production concrete used to cast the concrete units.”
- Replace Standard Specification Section 534.16 - Tolerances, with the following:
 - “Maximum dimensional deviation of formed unit dimensions shall be ½" or 2% or the manufacturer’s published tolerances, whichever is less. Units not meeting the specified tolerances will be rejected.”

681.032 **Geosynthetic Reinforcement** - Geosynthetic Reinforcement shall be as required by the proprietary wall system manufacturer or wall designer. Geosynthetic reinforcement shall consist of a geotextile or

geogrid approved by the Geotechnical Engineer. Substitution of a geosynthetic other than that required by the proprietary wall system manufacturer shall not be allowed unless approved by the Geotechnical Engineer after submittal of shop drawings and pullout and interface friction test data.

- A. **Geotextiles and Thread for Sewing** - Woven or nonwoven geotextiles shall consist of long chain polymeric filaments or yarns formed into a stable network such that the filaments or yarns retain their position relative to each other during handling, placement, and design life. At least 95% by weight of the long chain polymer shall be polyolefin or polyester. The material shall be free of defects and tears. Geotextiles used for reinforcement shall conform as a minimum to the properties indicated for Section 722.01 - Stabilization/Reinforcement Geotextile and shall meet the requirements of part D and E below. Geotextiles shall have a minimum permeability greater or equal to that shown on the Shop Drawings and the reinforced soil permeability.
- B. **Geogrids** - The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. Geogrids shall conform as a minimum to the criteria specified in part D and E below.
- C. **Required Properties** - The specific geosynthetic materials shall be preapproved and shall have the ultimate tensile strength (T_{ult}) shown on the approved Shop Drawings for the geosynthetic specified and for the fill type shown. T_{ult} shall be determined from wide width tests specified in ASTM D4595 for geotextiles and ASTM D6637 or GRI:GG1 for geogrids. The ultimate tensile strength value is based on the minimum average roll values (MARV) for the product.
- D. The geosynthetic shall conform to the following criteria:
 - 1. **PP and HDPE** - Min. retained strength of 70% after 150 hours, per ASTM D4355.
 - 2. **HDPE** - Grade = E-4, E-5, E-8, E-9, E-10, E-11, J-3, J-4, or J-5, per ASTM D1248.
 - 3. **PET** - Molecular weight (M_n) > 25,000, per GRI:GG8 and ASTM D4603.
 - 4. **PET** - Carboxyl end group (CEG) <30 mmol/kg, GRI:GG7.

5. **All polymers** - Minimum Weight per Unit Area of 8 oz/yd², per ASTM D5261.
6. **All Polymers** - Maximum 0% post consumer recycled material by weight.
7. A default total reduction factor for creep, durability, and installation damage of RF = 7 may be used in design, provided the criteria of 2 through 6 are satisfied and 1 is adjusted to 70% after 500 hours is satisfied.

- E. **Manufacturer Quality Control** - The geosynthetic reinforcements shall be manufactured with a high degree of quality control. The Manufacturer is responsible for establishing and maintaining a quality control program to ensure compliance with the requirements of the specification. The purpose of the QC testing program is to verify that the reinforcement geosynthetic being supplied to the Project is representative of the material used for performance testing and approval. Conformance testing shall be performed as part of the manufacturing process and may vary for each type of product. As a minimum the following index tests shall be considered as applicable for an acceptable QA/QC program:

Property	Test Procedure
1. Specific Gravity (HDPE only)	ASTM D1505
2. Ultimate Tensile Strength	ASTM D4595 GRI:GG1
3. Melt Flow (HDPE and PP only)	ASTM D1238
4. Intrinsic Viscosity (PET only)	ASTM D4603
5. Carboxyl End Group (PET only)	ASTM D2455

- F. **Sampling Testing and Acceptance** - Sampling and conformance testing shall be in accordance with ASTM D4354. Conformance testing procedures are established above. Geosynthetic product acceptance shall be based on ASTM D4759. The quality control certificate shall include:
1. Roll numbers and identification
 2. Sampling procedures
 3. Results of quality control tests, including a description of test methods used.
- G. **Certification** - The Contractor shall submit a manufacturer's certification that the geosynthetics supplied meet the respective index criteria set when the geosynthetic was approved, measured in full accordance with all test methods and standards specified, or referenced, in this specification.

The manufacturer's certificate shall state that the furnished geosynthetic meets the requirements of these specifications as evaluated by the manufacturer's quality control program. The values submitted shall be certified by a person having legal authority to bond the manufacturer. In case of dispute over validity of values, the Resident can require the Contractor to supply test data from an agency approved laboratory to support the values submitted, at the Contractor's cost.

681.033 **Concrete Leveling Pad** - Concrete for leveling pads shall be Fill Concrete conforming to the requirements of Section 502 - Structural Concrete. Unless otherwise specified, concrete for leveling pads shall be accepted under Method "C" requirements.

681.034 **Drainage Stone Fill** - Concrete wall unit voids shall be filled with drainage stone material that conforms to the requirements of Section 703.13 - Crushed Stone $\frac{3}{4}$ ".

681.035 **Backfill Material** - Backfill material placed behind the concrete wall units shall meet the requirements of Section 703.20 - Gravel Borrow, except that the backfill material shall only contain particles that will pass the 3" square mesh sieve. The Contractor is required to submit a grain size distribution curve (ASTM D422) and a moisture-density relationship curve (AASHTO T 180) for acceptance of the proposed backfill material and determination of the appropriate installation damage reduction factor (RF_{ID}).

Walls with reinforced backfill also require that the backfill material be subjected to pH testing to determine the appropriate durability reduction factor (RF_D). Backfill materials shall meet the criteria in the following table:

Base Polymer	Property	Criteria	Test Method
Polyester (PET)	pH	$3 < \text{pH} < 9$	AASHTO T 289
Polyolefin (PP & HDPE)	pH	$\text{pH} > 3$	AASHTO T 289

681.036 **Materials Certificate Letter** - The Contractor, or the supplier as their agent, shall furnish the Resident a Materials Certificate Letter for the above materials, including the backfill material, in accordance with Section 700 of the Standard Specifications. A copy of all test results performed by the Contractor or their supplier necessary to assure Contract compliance shall also be furnished to the Resident. The Resident will base acceptance upon the materials Certificate Letter, accompanying test reports, and visual inspection.

681.04 **Design Requirements** - The wall shall be designed with a service life of not less than 75 years. The Precast Aggregate-filled Concrete Block Gravity Wall shall be

designed and sealed by a Professional Engineer licensed in the State of Maine. The wall shall be designed in accordance with the following:

1. AASHTO LRFD Bridge Design Specifications, current edition
2. FHWA-NHI-10-024 and FHWA-NHI-10-025 Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Volumes I and II, current edition.
3. FHWA-NHI-09-087, Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, current edition.
4. The Contract Plans
5. The requirements specified herein
6. The manufacturer's requirements

Where conflicting requirements occur, the more stringent requirements shall govern.

Forty-five Days prior to beginning construction of the wall, the design computations shall be submitted to the Resident for review by the Geotechnical Engineer. Any additional design or costs arising as a result of rejection of a wall design by the Geotechnical Engineer shall be borne by the Contractor.

Design calculations that consist of computer program generated output shall be supplemented with at least one hand calculation and graphic demonstrating the design methodology used. Design calculations shall provide thorough documentation of the sources of equations used and material properties. The design by the wall system supplier shall consider the stability of the wall as outlined below and in the Contract Documents:

- A. **Failure Plane** - The theoretical failure plane within the reinforced soil mass shall be determined in accordance with AASHTO LRFD Bridge Design Specifications Article 11 and be analyzed so that the soil stabilizing components extend sufficiently beyond the failure plane within the reinforced soil mass to stabilize the material.
- B. **External Loads** - External loads which affect the internal and external stability such as those applied through traffic loadings, impact on traffic barrier posts, slope surcharge, hydrostatic, and seismic loads shall be accounted for in the design. Traffic surcharge and traffic impact loads shall be calculated and applied in compliance with AASHTO LRFD Bridge Design Specifications Section 11.
- C. **External Stability** - Loads and load combinations selected for design shall be consistent with AASHTO LRFD Bridge Design Specifications. Application of load factors shall be taken as specified in AASHTO LRFD Bridge Design Specifications Section 11. Sliding resistance factors and bearing resistance factors shall be consistent with AASHTO LRFD Bridge Design Specifications. Overturning and sliding provisions of AASHTO LRFD Bridge Design Specifications shall apply.

- D. **Internal Stability** - Evaluation of reinforcement pullout, reinforcement rupture and reinforcement/block connection pullout or rupture shall be consistent with AASHTO LRFD Bridge Design Specifications Section 11, and checked at each level. Loads, load combinations and load factors shall be as specified in AASHTO LRFD Bridge Design Specifications Section 11. Resistance factors for internal design are specified in AASHTO LRFD Bridge Design Specifications Section 11. Maximum reinforcement loads shall be calculated using the Simplified Method approach. Calculations for factored stresses and resistances shall be based upon assumed conditions at the end of the design life.
- a. **Geosynthetic Reinforcement Design Tensile Resistance** - The nominal long term reinforcement design strength (T_{al}) shall be determined by reducing T_{ult} by reduction factors (RF) in accordance with the documents referenced above. The designer shall procure and use the manufacturers tested and certified geosynthetic reinforcement reduction factors for creep (RF_{CR}), durability (RF_D), and installation damage (RF_{ID}) to determine T_{al} . In absence of manufacturers tested and certified reduction factors, a combined default reduction factor $RF = 7$ shall be used in accordance with the referenced documents. For RF_{ID} , the installation damage reduction factor shall be checked in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-09-087.
- b. **Reinforcement/Facing Connection Design Strength** - The nominal long-term connection strength between the geosynthetic reinforcement and the concrete blocks shall be checked in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-10-024 and FHWA-NHI-0-025.
- c. **Reinforcement Pullout** - The pullout resistance factor (F^*) and scale effect correction factor (α) used in pullout design, shall be determined from Project specific pullout tests using the proposed geosynthetic in the specified Project backfill material or equivalent soil. The pullout resistance factors shall be determined in accordance with AASHTO LRFD Bridge Design Specifications and FHWA-NHI-10-024 and FHWA-NHI-10-025. In the absence of test data, empirical relationships may be used to determine the pullout resistance factors, any empirical relationships used in design shall be referenced in the design calculations.
- E. **Backfill and Foundation Soils Parameters** - The friction angle of the backfill used in the reinforced fill zone for internal stability design shall be assumed have a friction angle of 34° unless specific Project select backfill is tested for frictional strength. The friction angle of the foundation soils and random backfill shall be assumed to be 30° unless otherwise shown on the Plans.

- F. **Reinforcement Length** - The soil reinforcement shall be the same length from the bottom to the top of each wall section. The reinforcement length defining the width of the entire reinforced soil mass may vary with wall height. The minimum length of the soil reinforcement shall be 8 ft, but shall not be less than 70% of the wall height, H, for walls with level surcharges, or 70% of H1 for walls with a sloped surcharge or walls supporting an abutment. The mechanical wall height, H or H1, shall be the vertical difference between the top of the leveling footing and the elevation at which the failure surface, as described above, intercepts the ground surface supported by the wall.
- G. **Bearing Resistance** - The factored bearing pressures under the Precast Aggregate-filled Concrete Block Gravity Wall shall be clearly indicated on the Shop Drawings. Walls shall be dimensioned so that the factored bearing resistance of the foundation soils, as noted on the Plans, is not exceeded.
- H. **Facing Stability** - Stability calculations for the concrete facing blocks shall be in accordance with FHWA, and shall include an evaluation of the maximum vertical spacing between reinforcement layers.
- I. **Stability During Construction** - Walls shall be designed to resist failure by instability of temporary construction slope. Passive pressure in front of the wall mass shall be assumed to be zero for design purposes.
- J. **Design Life** - The wall design life shall be a minimum of 75 years.
- K. **Depth of Embedment** - The depth of embedment for frost protection and stability shall be at or below the elevation shown on the Plans and the approved Shop Drawings.
- L. **Drainage System** - Piped drainage shall be designed to collect and dispose of water from the base of the reinforced soil zone and backfill soil. This shall outlet into surrounding drainage systems or ditches.

681.05 **Submittals** - The Contractor shall supply wall design computations, wall details, dimensions, quantities, and cross sections necessary to construct the wall. A sample hand calculation including all equations, parameter values used, units, theory, free-body diagram, comparison to design requirements, etc. shall be provided. Spreadsheet calculations alone are not acceptable.

Forty-five Days prior to beginning construction of the wall, four sets of the wall design computations and Shop Drawings shall be submitted to the Resident for review by the Geotechnical Engineer. Mix design information shall be submitted at the same time, including aggregate source, current gradation, aggregate quality information and concrete unit weight.

The Contractor shall also submit backfill material test results as part of the wall submittal package. Backfill material test results shall include grain size

distribution curve, moisture-density relationship curve, and pH test results required for reinforced backfill only.

If geotechnical design is required, the fully detailed Plans shall be prepared in conformance with Section 105 and shall include, but not be limited to the following items:

- A. A plan and elevation sheet or sheets for each wall, containing the following: elevations at the top of leveling pads, the distance along the face of the wall to all steps in the leveling pads, the location of the original and final ground line.
- B. All details for foundations and leveling pads, including details for steps in the leveling pads, as well as allowable and actual maximum bearing pressures shall be provided.
- C. Details for the barriers, posts, curbs and facing as required by the Project conditions.
- D. Design computations prepared and sealed by a licensed Professional Engineer.
- E. Prior to the beginning of construction, the Contractor shall supply the Resident with two copies of the design-supplier's Installation Manual. In addition, the Contractor shall have two copies of the Installation Manual on the Project site.

681.06 **Construction Requirements** - The Precast Aggregate-Filled Concrete Block Gravity Wall shall have the following construction requirements:

- A. **Excavation** - The excavation and use as fill or disposal of all excavated material shall meet the requirements of Section 203 - Excavation and Embankment, except as modified herein.
- B. **Foundation** - The area upon which the prefabricated, aggregate-filled concrete block gravity wall structure is to rest, and within the limits shown on the submitted Plans, shall be graded for a width equal to, or exceeding, the length of the blocks. Prior to wall and leveling pad construction, this foundation material shall be compacted to at least 95% of maximum laboratory dry density (AASHTO T 180 Method C or D). Frozen and unsuitable soil shall be removed and replaced with gravel borrow compacted to 95% of AASHTO T 180, or as shown on the Plans.

A concrete leveling pad shall be constructed a minimum of 6" beyond the front and back of the concrete wall units, or as indicated on the Plans. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Geotechnical Engineer. The leveling pad shall be cast to the design elevations as shown on the Plans, or as required by the wall supplier upon written approval of the Geotechnical Engineer.

The allowable elevation tolerances from the design elevations are +0.01 ft and -0.02 ft. Leveling pads which do not meet this requirement shall be repaired or replaced as directed by the Resident at no additional cost to the Department. Placement of wall units may begin after the strength of the concrete leveling pad reaches 1000 psi or is adequate to support the proposed loads. Contractor may begin placement of concrete block units after 12 hours at their own risk.

- C. **Method and Equipment** - Prior to erection of the wall, the Contractor shall furnish the Resident with detailed information concerning the proposed construction method and equipment to be used. The erection procedure shall be in accordance with the manufacturer's instructions. Any units that are damaged due to handling will be replaced at the Contractor's expense.
- D. **Installation of Concrete Wall Units** - A field representative from the wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the Project.

The Contractor shall place the first course of wall units directly on the leveling pad and check for level and alignment. Adjacent units should be in contact. The prefabricated concrete wall units shall be installed to a tolerance of plus or minus $\frac{3}{4}$ " in 10 ft in vertical and horizontal alignment.

Fill all voids between and within the wall units with drainage stone as described in this specification. The drainage stone fill shall extend a minimum of 6" behind the tails of the wall units unless a geotextile filter is placed over the inside joint at the back of adjacent wall units. If used, the drainage geotextile shall conform to the requirements of Section 722.02.

- E. **Backfill Placement** - Backfill placement shall closely follow the erection of each row of prefabricated wall units. The maximum lift thickness shall be 8" loose. The Contractor shall decrease the lift thickness if necessary to obtain the specified density. The backfill shall be compacted in accordance with Section 203.12 except that the minimum required compaction shall be at least 92% of maximum density as determined by AASHTO T 180 Method C or D. Backfill compaction shall be accomplished without disturbance or displacement of the concrete wall units. Sheepfoot rollers will not be allowed. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved.

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with placement moisture content in excess of the optimum moisture content shall be removed and reworked

until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D. At the end of the Day's operations, the Contractor shall shape the last level of backfill so as to direct runoff of rainwater away from the wall face.

681.07 **Method of Measurement** - Precast Aggregate-filled Concrete Block Gravity Wall will be measured by the Square Foot of front surface not to exceed the dimensions shown on the Contract Plans unless authorized by the Resident. Vertical and horizontal dimensions will be from the edges of the blocks. No field measurements for computations will be made unless the Resident specifies, in writing, a change in the limits indicated on the Plans.

681.08 **Basis of Payment** - The accepted quantity of Precast Aggregate-Filled Concrete Block Gravity Wall will be paid for at the Contract unit price per Square Foot complete in place. Payment shall be full compensation for furnishing geotechnical design as required, all labor, equipment and materials including all precast concrete units, hardware, joint fillers, geosynthetic, drainage pipe, and technical field representative. Excavation, foundation material and backfill material will all be incidental to the Precast Aggregate-Filled Concrete Block Gravity Wall.

Cost of cast-in-place concrete for leveling pad will not be paid for separately, but will be considered incidental to the Precast Aggregate-Filled Concrete Block Gravity Wall.

There will be no allowance for excavating and backfilling for the Precast Aggregate-Filled Concrete Block Gravity Wall beyond the limits shown on the approved submitted Plans, except for excavation required to remove unsuitable subsoil in preparation for the foundation. Payment for excavating unsuitable subsoil shall be full compensation for all costs of pumping, drainage, sheeting, bracing and incidentals for proper execution of the work, and will be paid as common excavation in accordance with Section 203.

Payment will be made under:

Pay Item		Pay Unit
681.10	Precast Aggregate-Filled Concrete Block Gravity Wall	Square Foot

DIVISION 700 - MATERIALS

GENERAL STATEMENT MATERIALS CERTIFICATION LETTER

For all materials used in the work for which there is no specified acceptance testing by the Project Inspectors or the Laboratory, the Contractor shall submit a Materials Certification Letter similar to the following, prior to acceptance as specified in Section 107.9.4.

Company Letterhead

Mr./Mrs. _____ (Resident) Date _____
Address _____ Project No. _____
Town _____

This is to certify that all materials incorporated into the Project for which there is no specified acceptance testing by Project inspectors or the laboratory, comply with the pertinent specified material requirements of the Contract. Processing, Project testing, and inspection control of raw materials shall be in conformity with the applicable drawings and/or standards for all articles furnished.

All records and documents pertinent to this letter and not submitted herewith will be maintained and will be available by the undersigned for a period of not less than 3 years from the date of completion of the Project.

The Materials Certification letter must be signed by a person having legal authority to bind the Contractor.

Materials listed in the above Certificate may be subject to random sampling and testing by the Department at any time. When random verification samples are obtained from the Project, they shall be provided by the Contractor at no cost to the Department. Certified materials, which fail to meet specification requirements, may not be accepted and may require replacement with materials that do meet the specifications.

The Contractor may be required to submit to the Resident, for inclusion in the Project records, certification and other data from the Manufacturer pertaining to materials used on the Project.

The Certificate shall include the actual test results of the material in storage from which the shipments are being made. Certificates shall be supplied for each lot, batch, or blend of each type and grade of material. A new certificate shall be issued at least every 30 Days or upon receiving or manufacture of a new material.

The Contractor shall give the supplier sufficient advance notice of orders to permit testing. Material not represented by tests will not be accepted for use on the work.

Deliveries of asphalt materials shall be accompanied by a loading invoice, delivery ticket, or slip, as required under Section 108.1.3 f. The Loading Invoice shall include the applicable certificate number and shall include a printed or stamped statement such as the following:

“THIS IS TO CERTIFY THAT THE ASPHALT MATERIAL REPRESENTED BY THIS LOADING INVOICE CONFORMS TO THE SPECIFICATIONS OF THE PURCHASER FOR THE MATERIAL TYPE AND GRADE STATED THEREON.”

In the event an intermediate hauler of the asphalt material is involved, a copy of their own delivery slip shall be furnished, as well as a copy of the supplier's loading invoice. The hauler's delivery slip and the supplier's loading invoice shall be cross-referenced by use of their respective serial numbers.

All test procedures shall conform to the requirements of AASHTO unless otherwise noted. Gradation tests shall be completed in accordance with AASHTO T 27 except that the sample may be separated on the ½" screen. Testing as specified in AASHTO T 11 shall be performed on any materials for which there is a specification limit on the amount of material passing a No. 200 sieve.

The Department may require the Contractor to submit, for inclusion into the Project records, certification that new Work Zone Category 1 and Category 2 Devices meet National Cooperative Highway Research Program (NCHRP) Report 350 guidelines. Work Zone Category 1 Devices include plastic drums, cones, and tubular markers. Work Zone Category 2 Devices include portable sign stands (with signs), Type I, Type II, and Type III barricades, vertical panels, intrusion alarms, and other work zone devices under 100 lb. All Work Zone Category 1 and Category 2 Devices shall meet NCHRP Report 350 and MUTCD guidelines.

Vendors/Contractors will be allowed to self-certify Work Zone Category 1 Devices with a letter of self-certification. A letter of self-certification shall contain at a minimum:

- a. A title e.g., “Certificate of Crashworthiness”,
- b. Name and Address of the Vendor making certification,
- c. Unique identification of the certificate (such as a serial number) and of each page and the total number of pages,
- d. Description and unambiguous identification of the item tested,
- e. Identification of the basis for the self-certification process used and to what test level of NCHRP 350,
- f. Signature and title of person(s) accepting responsibility for the content of the certificate and date of issue, and
- g. A statement that the certificate shall not be reproduced except in full.

Crash test information is available on the FHWA Office of Highway Safety’s Homepage: http://safety.fhwa.gov/programs/roadside_hardware.htm.

SECTION 701 - STRUCTURAL CONCRETE RELATED MATERIAL

- 701.01 ***Portland Cement and Blended Hydraulic Cement*** - Portland Cement for Cast-in-place concrete shall conform to the requirements of AASHTO M 85, Type II. Blended hydraulic cement for cast-in-place concrete shall conform to the requirements of AASHTO M 240, Type IS, Type IP, Type IL, or Type IT. Blended

hydraulic cement special property (HE), high early strength, will not be allowed for cast-in-place concrete.

Portland Cement for precast prestressed concrete shall conform to the requirements of AASHTO M 85, Type I, Type II, or Type III. Blended hydraulic cement for precast concrete shall conform to the requirements of AASHTO M 240, Type IS, Type IP, Type IL, or Type IT. Blended hydraulic cement special property (HE), high early strength, will be allowed for precast concrete.

Portland Cement for precast concrete shall conform to the requirements of AASHTO M 85, Type I, Type II, or Type III. Blended hydraulic cement for precast concrete shall conform to the requirements of AASHTO M 240, Type IS, Type IP, Type IL, or Type IT. Blended hydraulic cement special property (HE), high early strength, will be allowed for precast concrete.

Portland Cement - A hydraulic cement produced by pulverizing Portland Cement clinker, and usually containing calcium sulfate.

Blended Hydraulic Cement - A hydraulic cement consisting of two or more inorganic constituents (at least one of which is not Portland Cement or Portland Cement clinker) which separately or in combination contribute to the strength-gaining properties of the cement (made with or without other constituents, processing additions and functional additions, by intergrinding or other blending).

Only one brand of cement shall be used on any one Contract unless otherwise permitted, in writing, by the Resident. The cement shall be completely protected from rain and moisture during storage. Partially set cement or cement that contains caked lumps shall not be used.

The Contractor shall arrange for the cement supplier to provide a Manufacturer's Certification (Mill Test Report) for all cement materials furnished for use on the Project. Reports shall include all mandatory and optional requirements specified in AASHTO M 85 or AASHTO M 240 including any processing additions. Reports shall represent the cement incorporated into the Project and reports shall be supplied, at a minimum, on a monthly basis. Reports shall be submitted to the Department's Materials Testing Engineer.

- 701.02 **Water** - Water used in mixing or curing concrete shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetation, or substances injurious to the finished product. If required by the Resident, it shall be tested in accordance with the requirements of AASHTO T 26. Water known to be of potable quality may be used without testing. Where the source of water is relatively shallow, the intake shall be so enclosed as to exclude silt, mud, grass, or other foreign materials.
- 701.03 **Air-Entraining Chemical Admixtures** - Air-entraining admixtures shall be tested by AASHTO Product Evaluation & Audit Solutions and conform to the requirements of AASHTO M 154.

The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.

- 701.04 **Water Reducing Chemical Admixtures** - Water reducing admixtures shall be tested by AASHTO Product Evaluation & Audit Solutions and conform to the requirements of AASHTO M 194, Type A.

The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.

- 701.0401 **High Range, Water Reducing, Chemical Admixture** - High range, water-reducing admixture, commonly referred to as both high range-water-reducers and/or superplasticizers, shall be AASHTO Product Evaluation & Audit Solutions tested and conform to the requirements of AASHTO M 194, Type F.

The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.

- 701.05 **Set-retarding Chemical Admixtures** - Set-retarding admixtures shall be tested by AASHTO Product Evaluation & Audit Solutions and conform to the requirements of AASHTO M 194, Types B or D or G.

The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.

- 701.0501 **Accelerating, Chemical Admixtures** - Accelerating admixtures shall be tested by AASHTO Product Evaluation & Audit Solutions and conform to the requirements of AASHTO M 194, Types C or E.

The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.

- 701.06 **Curing Materials** - Sheet materials for curing concrete shall conform to the requirements of AASHTO M 171. Burlap cloth shall conform to the requirements of AASHTO M 182 Class 3, 10 oz/yd. Liquid membrane-forming compounds shall conform to the requirements of AASHTO M 148 and shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.

The two types of approved liquid membrane-forming compounds are:

- (1) Type 1-D, clear or translucent with fugitive dye which must be readily distinguishable for at least 4 hours and must be inconspicuous in 7 Days and
- (2) Type 2, white pigmented.

- 701.07 **Waterstops** - Waterstops shall be polyvinylchloride and conform to the requirements of US Army Corps of Engineers Specification CRD C-572.

- 701.08 **Smooth Surfaced Asphalt Roll Roofing (formerly called Heavy Roofing Felt)** - Wherever heavy roofing is called for on the plans an approved standard brand of smooth surface asphalt roofing (organic felt) conforming to ASTM D224 Type I.

- 701.10 **Coal Ash and Natural Pozzolans** - Coal Ash shall conform to the chemical and physical requirements of AASHTO M 295, Class F or Class C coal ash.
- Natural pozzolans shall conform to the chemical and physical requirements of AASHTO M 295, Class N.
- Coal ash and natural pozzolans shall be stored in weather tight silos. All silos shall be completely empty and clean before material is deposited therein, unless the silo already contains material of the same type and properties.
- 701.11 **Calcium Nitrite Solution, Chemical Admixture** - Calcium nitrite solutions shall be tested by AASHTO Product Evaluation & Audit Solutions and conform to the requirements of ASTM C1582. An approved calcium nitrite based corrosion inhibitor shall be added to the concrete mix as an aqueous solution.
- The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.
- 701.12 **Silica Fume** - The silica fume material for use in Portland Cement Concrete shall conform to the chemical and physical requirements of AASHTO M 307 and be one of the products listed on the Maine Department of Transportation's Qualified Products List.
- The Contractor shall arrange for the silica fume supplier to provide a Manufacturer's Certification (Mill Test Report) for all silica fume materials furnished for use on the Project. Reports shall include all mandatory and optional requirements specified in AASHTO M 307. Reports shall represent the silica fume incorporated into the Project and reports shall be supplied, at a minimum, on a monthly basis. Reports shall be submitted to the Department's Materials Testing Engineer.
- 701.13 **Slag Cement** - Slag cement shall conform to the chemical and physical requirements for Grade 100 or 120 as listed in AASHTO M 302.
- Slag cement shall be stored in weather tight silos. All silos shall be completely empty and clean before material is deposited therein, unless the silo already contains material of the same type and properties.
- The Contractor shall arrange for the slag cement supplier to provide a Manufacturer's Certification (Mill Test Report) for all slag cement materials furnished for use on the Project. Reports shall include all mandatory and optional requirements specified in AASHTO M 302 including any processing additions. Reports shall represent the slag cement incorporated into the Project and reports shall be supplied, at a minimum, on a monthly basis. Reports shall be submitted to the Department's Materials Testing Engineer.

SECTION 702 - BITUMINOUS MATERIAL

- 702.01 **Asphalt Cement** - Performance-Graded Asphalt Binder (PGAB) that has not been modified with polymer shall conform to the requirements of AASHTO M 320. Polymer modified binder shall meet the requirements of AASHTO M 332 and AASHTO R 92. Performance-Graded Asphalt Binder shall not contain re-refined engine oil bottoms (REOB).

The Contractor shall arrange for the Supplier to furnish the following items to the Department's Asphalt Pavement Engineer:

- a. A Quality Control Plan that conforms to the requirements of AASHTO R 26 "Certifying Suppliers of Performance-Graded Asphalt Binders" and
- b. A CERTIFICATE OF ANALYSIS for all asphalt materials furnished for use on the Project. The Certificate shall include the actual test results of the material in storage from which the shipments are being made. Certificates shall be supplied for each lot, batch, or blend of each type and grade of material. A new certificate shall be issued at least every 30 Days or upon receiving or manufacture of a new material. The original of each Certificate of Analysis shall be mailed to the Departments Asphalt Pavement Engineer.

The Contractor shall give the supplier sufficient notice of orders to permit testing and certification. Material not certified will not be accepted for use.

Deliveries of asphalt materials shall be accompanied by a Bill of Lading containing the information required under Section 108.1.3 f. The Bill of Lading shall include the applicable certificate number and shall include a printed or stamped statement such as the following:

"THIS IS TO CERTIFY THAT THE ASPHALT MATERIAL REPRESENTED BY THIS LOADING INVOICE CONFORMS TO THE SPECIFICATIONS OF THE PURCHASER FOR THE MATERIAL TYPE AND GRADE STATED THEREON."

In the event an intermediate hauler of the asphalt material is involved, a copy of their own delivery slip shall be furnished, as well as a copy of the supplier's loading invoice. The hauler's delivery slip and the supplier's loading invoice shall be cross-referenced by use of their respective serial numbers.

All non-bituminous components added to the binder prior to the sampling point for binder certification shall be included on the asphalt binder Certificate of Analysis identifying their presence. All non-bituminous components added after the certification sampling point and prior to transport shall be included on the Bill of Lading. All non-bituminous components added to the binder at the HMA plant shall be identified on

the mix plant documentation and accompanied by test results and certification showing the effect of the additives introduced, if any.

- 702.04 **Emulsified Asphalt** - Emulsified Asphalt shall conform to the requirements of AASHTO M 140. Cationic emulsified asphalt shall conform to the requirements of AASHTO M 208. Anionic emulsified asphalt Grade RS-1h shall conform to the requirements in the following table:

Type	Rapid-Setting	
Grade	RS-1h	
Tests on Emulsions	min	max
Viscosity, Saybolt Furol at 25°C SFS	20	100
Storage Stability test, 24-h, % ^A	-	1.0
Demulsibility, 35 ml, 0.02 N CaCl ₂ , %	60	-
Sieve Test, % ^A	-	0.10
Residue by distillation, %	55	-
Tests on Residue from Distillation Test	min	max
Penetration, 25°C 100g, 5 s	40	90
Ductility, 25°C 5 cm/min, cm	40	-
Solubility in trichloroethylene or n-propyl bromide, %	97.5	-
^A This requirement is waived if successful application of material has been achieved in the field.		

Use of all emulsified asphalt shall comply with all Department of Environmental Protection (DEP) regulations regarding maximum amount of oil distillate, seasonal limitations, etc.

For emulsified asphalts, the Contractor shall arrange for the Supplier to furnish the following item to the Department's Materials Testing Engineer.

A CERTIFICATE OF ANALYSIS for all asphalt emulsion materials furnished for use on the Project. The Certificate shall include the actual test results of the material in storage from which the shipments are being made. Certificates shall be supplied for each lot or batch for each grade/type of emulsion. A new certificate shall be issued at least every 30 Days or upon receiving or manufacture of a new material. The original of each Certificate of Analysis shall be mailed to the Department's Materials Testing Engineer.

Deliveries of emulsion materials shall be accompanied by a loading invoice, delivery ticket, or slip, as required under Section 108.1.3 f. The Loading Invoice shall include the applicable certificate number and shall include a printed or stamped statement such as the following:

"THIS IS TO CERTIFY THAT THE ASPHALT MATERIAL REPRESENTED BY THIS LOADING INVOICE CONFORMS TO THE SPECIFICATIONS OF THE PURCHASER FOR THE MATERIAL TYPE AND GRADE STATED THEREON."

In the event an intermediate hauler of the asphalt material is involved, a copy of their own delivery slip shall be furnished, as well as a copy of the supplier's loading invoice. The hauler's delivery slip and the supplier's loading invoice shall be cross-referenced by use of their respective serial numbers.

702.05 ***Temperature Application Range, °F***

Type and Grade	Spray	Mix
RS-1	50 to 125	50 to 125
RC 70	80 to 150	80 to 150
RC 250	82 to 175	80 to 150
RC 800	160 to 225	135 to 185
RC 3000	200 to 275	185 to 225
MC 30	50 to 120	50 to 120
MC 70	80 to 150	80 to 150
MC 250	100 to 200	100 to 210
MC 800	185 to 260	200 to 250
MC 3000	230 to 275	200 to 250
All emulsions	50 to 160	50 to 160
Performance-Graded Asphalt Binder (all grades).	As required to achieve a viscosity of 0.15 to 0.31 PA-s.	

702.06 **Temperature - Volume Correction Tables** - All asphalt material shall be corrected for volume by use of the following multipliers to reduce the volume at the observed temperature to the volume at 60°F.

Emulsified Asphalts	Asphalts (ASTM D1250)								
All Types And Grades	Temp °F	Sp. Gr. 0.966+	Sp. Gr. 0.850	Temp °F	Sp. Gr. 0.966+	Sp. Gr. 0.850	Temp °F	Sp. Gr. 0.966+	Sp. Gr. 0.850
1	50	1.0035	1.0040	150	.9689	.9647	250	.9352	.9268
1	55	1.0017	1.0020	155	.9672	.9628	255	.9336	.9249
1.0000	60	1.0000	1.0000	160	.9655	.9609	260	.9319	.9231
.9988	65	.9983	.9980	165	.9638	.9589	265	.9302	.9212
.9975	70	.9965	.9960	170	.9621	.9570	270	.9286	.9194
.9962	75	.9948	.9940	175	.9604	.9551	275	.9269	.9175
.9950	80	.9930	.9921	180	.9587	.9532	280	.9253	.9157
.9938	85	.9913	.9901	185	.9570	.9513	285	.9236	.9138
.9925	90	.9896	.9881	190	.9553	.9494	290	.9220	.9120
.9912	95	.9878	.9861	195	.9536	.9475	295	.9204	.9102
.9900	100	.9861	.9842	200	.9520	.9456	300	.9187	.9083
.9988	105	.9844	.9822	205	.9503	.9437	305	.9171	.9065
.9875	110	.9826	.9803	210	.9486	.9418	310	.9154	.9047
.9862	115	.9809	.9783	215	.9469	.9399	315	.9138	.9029
.9850	120	.9792	.9763	220	.9452	.9380	320	.9122	.9010
.9338	125	.9775	.9744	225	.9436	.9361	325	.9105	.8992
.9825	130	.9758	.9725	230	.9419	.9343	330	.9089	.8974
.9812	135	.9740	.9705	235	.9402	.9324	335	.9073	.8956
.9800	140	.9723	.9686	240	.9385	.9305	340	.9057	.8938
.9788	145	.9706	.9666	245	.9369	.9286	345	.9040	.8920
.9775	150	.9689	.9647	250	.9352	.9268	350	.9024	.8902

702.07 **Removed**

702.08 **Removed**

702.09 **Asphalt Filler for Structural Plate Arches** - Asphalt for filling spaces between the structural plates and the substructure metal connectors of the arch shall conform to the requirements for bituminous material of AASHTO M 190 or of AASHTO M 320, Table 1, for PG 64-28 or PG 58-28.

702.10 **Removed**

702.11 **Removed**

702.12 **Emulsified Asphalt Sealing Compound** - Emulsified asphalt sealing compound shall be an approved commercially prepared product manufactured for specific

protective coating, colored as required. It shall contain fillers, pigments and sand or fibrous materials suspended in a suitable emulsified asphalt or tar. It shall be of such consistency that it can be applied at atmospheric temperatures and capable of being easily diluted with the addition of water and mixed by hand stirring at the site of application.

SECTION 703 - AGGREGATES

- 703.01 ***Fine Aggregate for Concrete*** - Fine aggregate for concrete shall consist of natural sand or, when approved by the Resident, other inert materials with similar characteristics or combinations thereof, having strong, durable particles. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of construction or mix without permission of the Resident.

All fine aggregate shall be tested for qualities in Table 1. Fine aggregate unable to meet quality requirements of Table 1 shall be rejected or take corrective actions to meet quality requirements.

TABLE 1

Description	Test Method	Specification Limit
Organic Impurities	AASHTO T 21	Laboratory Designation Plate III, max
Sand Equivalent	AASHTO T 176	75, min.
Gradation	AASHTO T 27 & T 11	Table 2 below
Fineness Modulus	*	2.26 to 3.14
Absorption	AASHTO T 84	2.3%, max
ASR, no mitigation	Standard Specification 703.0201	
ASR, with mitigation (When applicable)	Standard Specification 703.0201	
* The fineness modulus of fine aggregate shall be determined by adding the cumulative percentages of material by weight retained on the following sieves: Nos. 4, 8, 16, 30, 50, 100 and dividing by 100.		

TABLE 2

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10
No. 200	0-5.0

703.02 **Coarse Aggregate for Concrete** - Coarse aggregate for concrete shall consist of crushed stone or gravel having hard, strong, durable pieces, free from adherent coatings. Each pile of a designated coarse aggregate grading, size, or blended material, shall be stored in separate stockpiles and not be mixed with adjacent stockpiles.

All coarse aggregate for concrete shall be tested for qualities in Table 1. Coarse aggregate unable to meet quality requirements of Table 1 shall be rejected or take corrective actions to meet quality requirements. (See Table 2 on next page.)

TABLE 1

Description	Test Method	Specification Limit
Flat, Elongated, or Flat & Elongated Particles*	ASTM D4791 (Dimensional Ratio 1:5)	15%, max (by weight)
Micro-Deval or LA Wear	AASHTO T 327 or AASHTO T 96	18.0%, max or 40%, max
Gradation**	AASHTO T 27 & T 11	Table 2 below
Absorption	AASHTO T 85 (modified for sample weight)	2.0% (by weight)
ASR, no mitigation	Standard Specification 703.0201	
ASR, with mitigation (When applicable)	Standard Specification 703.0201	
*	Samples shall represent the composite blend, of the proposed mix design, retained on the 3/8" sieve.	
**	Gradations shall conform to specified grading designation and shall be well graded between the limits specified.	

TABLE 2

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves						
Grading	S	A	AA	SP-1-7	SP-1-78	SP-2-8	SP-2-89
Aggregate Size	1½"	1"	¾"	½"	½"	⅜"	⅜"
2"	100						
1½"	95-100	95-100					
1"	-	-	100				
¾"	35-70	-	90-100	100	100		
½"	-	25-60	-	90-100	90-100	100	100
⅜"	10-30	-	20-55	40-70	40-75	85-100	90-100
No. 4	0-5	0-10	0-10	0-15	5-25	10-30	20-55
No. 8	-	0-5	0-5	0-5	0-10	0-10	5-30
No. 16	-	-	-	-	0-5	0-5	0-10
No. 50	-	-	-	-	-	-	0-5
No. 200*	0-1.5	0-1.5	0-1.5	0-1.5	0-1.5	0-1.5	0-1.5
* This limit will be 0-2.0 for Department production samples. Yearly quality samples will be held to 0-1.5.							

703.0201 **Alkali Silica Reactive Aggregates** - All coarse and fine aggregates proposed for use in concrete shall be tested for Alkali Silica Reactivity (ASR) potential. All coarse and fine aggregates shall meet the specification limits of at least one test method below in Table 1.

TABLE 1

Test Method & Duration	Specification Limit	Minimum Testing Frequency
AASHTO T 303 (ASTM C1260), 16 Days from casting	0.06%, max	Every 5 years
ASTM C1567, 16 Days from casting	0.06%, max	Every 5 years
ASTM C1293, 1 year	0.04%, max	Every 6 years
AASHTO TP 144, 21 Days	Nonreactive	Every 5 years

Acceptable pozzolans and chemical admixtures that may be used when an aggregate is classified as potentially reactive include, but are not limited to the following:

- Class F Coal Ash meeting the requirements of AASHTO M 295
- Slag Cement (Grade 100 or 120) meeting the requirements of AASHTO M 302
- Densified Silica Fume meeting the requirements of AASHTO M 307
- Lithium-based admixtures
- Metakaolin

Pozzolans or chemical admixtures required to offset the effects of potentially reactive aggregates will be incorporated into the concrete at no additional cost to the Department.

The Department may reject aggregate sources with known field history of ASR reactions, regardless of test results above.

- 703.03 **Combined Aggregate Grading for Concrete** - The combined gradation of the fine and coarse aggregates when mathematically blended using the mix design percentages shall conform to the requirements of the following table for the size or sizes designated and shall be well graded between the limits specified.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves						
Grading	S	A	AA	SP-1-7	SP-1-78	SP-2-8	SP-2-89
Aggregate Size	1½"	1"	¾"	½"	½"	⅜"	⅜"
2"	100						
1½"	95-100	100					
1"	80-100	95-100	100				
¾"	55-90	90-100	93-100	100	100		
½"	45-80	55-80	60-90	90-100	90-100	100	100
⅜"	40-65	40-65	50-80	55-85	65-90	90-100	90-100
No. 4	35-55	35-55	35-60	30-60	40-70	45-75	50-80
No. 8	25-53	28-50	30-55	25-55	30-65	35-65	35-75
No. 16	15-40	18-45	19-45	18-50	20-55	20-55	20-55
No. 30	7-30	9-30	10-33	8-32	10-38	10-38	10-40
No. 50	3-14	4-14	4-16	3-16	4-20	4-20	4-20
No. 100	0-6	0-6	0-6	0-6	0-7	0-8	0-8
No. 200	0-3.5*	0-3.5*	0-3.5*	0-3.5*	0-3.5*	0-3.5*	0-3.5*
* The percent passing the No. 200 sieve shall not exceed 6.0% for any fine aggregate. The percent passing the No. 200 sieve shall not exceed 2.0% for any single coarse aggregate. The percent passing the No. 200 sieve shall not exceed 4.0% for the combined gradation of self-consolidating concrete (SCC) mix designs.							

- 703.04 **Removed**

- 703.05 **Aggregate for Sand Leveling** - Aggregate for sand leveling shall be sand of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The aggregate shall meet the grading requirements of the following table.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
⅜"	85-100
No. 200	0-5.0

703.06 **Aggregate for Base and Subbase** - The following shall apply to Sections (a.) and (c.) below. The material shall have a Micro-Deval value of 25.0 or less as determined by AASHTO T 327. If the Micro- Deval value exceeds 25.0, the Washington State Degradation DOT Test Method T113, Method of Test for Determination of Degradation Value (January 2009 version) shall be performed, except that the test shall be performed on the portion of the sample that passes the ½ in sieve and is retained on the No. 10 sieve. If the material has a Washington Degradation value of less than 15, the material shall be rejected.

The material used in Section (b.) below shall have a Micro-Deval value of 25.0 or less as determined by AASHTO T 327. If the Micro-Deval value exceeds 25.0 the material may be used if it does not exceed 25% loss on AASHTO T 96, Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

Recycled Asphalt Pavement (RAP) shall not be used for or blended with aggregate base or subbase.

- a. Aggregate for base, Type A and B shall be crushed ledge or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of the part that passes a 3" sieve shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Type A	Type B
½"	45-70	35-75
¼"	30-55	25-60
No. 40	0-20	0-25
No. 200	0-6.0	0-6.0

At least 50% by weight of the material retained on the No. 4 sieve shall have at least one fractured face as tested by AASHTO T 335.

Type A aggregate for base shall only contain particles of rock that will pass the 2" square mesh sieve.

Type B aggregate for base shall only contain particles of rock that will pass the 4" square mesh sieve.

- b. Aggregate for base, Type C shall be crushed ledge or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay

and other deleterious substances. The material shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
	Type C
4"	100
3"	90-100
2"	75-100
1"	50-80
1/2"	30-60
No. 4	15-40
No. 200	0-6.0

At least 50% by weight of the material coarser than the No. 4 sieve shall have at least one fractured face as tested by AASHTO T 335.

- c. Aggregate for subbase shall be sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of the part that passes a 3" sieve shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Type D	Type E
1/2"	35-80	
1/4"	25-65	25-100
No. 40	0-30	0-50
No. 200	0-7.0	0-7.0

Type D aggregate for subbase gravel may contain up to 50% by weight Recycled Concrete Aggregate (RCA). When RCA is used, the portion of the resulting blend of gravel and RCA retained on a 1/2" square mesh sieve shall contain a total of no more than 5% by weight of other recycled materials such as brick, concrete masonry block, or asphalt pavement as determined by visual inspection.

RCA shall be substantially free of wood, metal, plaster, and gypsum board as defined in Note 9 in Section 7.4 of AASHTO M 319. RCA shall also be free of all substances that fall under the category of solid waste or hazardous materials.

Aggregate for subbase shall not contain particles of rock which will not pass the 6" square mesh sieve.

703.07 **Aggregates for HMA Pavements** - Coarse and fine aggregate for hot mix asphalt pavements shall be of such gradation that when combined in the proper

proportions, including filler, if required, the resultant blend will meet the composition of mixture for the type of pavement specified.

Coarse aggregate, that material retained on the No. 4 sieve, shall be crushed stone or crushed gravel and, unless otherwise stipulated, shall consist of clean, tough, durable fragments free from an excess of soft or disintegrated pieces and free from stone coated with dirt or other objectionable matter. Coarse aggregate shall not exceed an absorption of 2.0% by weight as determined by AASHTO T 85.

Fine aggregate, material that passes the No. 4 sieve, shall consist of natural sand, manufactured sand, or a combination of these. It shall consist of hard, tough grains, free from injurious amounts of clay, loam, or other deleterious substances. Fine aggregate shall not exceed an absorption of 2.3% by weight as determined by AASHTO T 84.

All individual aggregates for hot mix asphalt pavements shall meet Table 3 requirements (excluding LCP) unless otherwise noted. The Department reserves the right to sample and test the aggregate for any of the following properties at any time:

TABLE 3: AGGREGATE CONSENSUS PROPERTIES CRITERIA

Estimated Traffic, Million 18 kip ESALs	AASHTO T 335 (minimum %)	AASHTO T 304 Method A**	ASTM D4791 Method B	AASHTO T 176	Aggregate shall meet at least one of these:		
					AASHTO T 327	AASHTO T 96	WSDOT T 113*
< 3.0	75/60	≥ 40%	≤ 10%	≥ 45	≤ 18.0%	≤ 40%	≥ 30
3.0 to < 10	90/80	≥ 45%		≥ 50		≤ 35%	
≥ 10	95/90					≤ 30%	N/A
* As determined by Washington State DOT Test Method T 113, Method of Test for Determination of Degradation Value except that the reported degradation value will be the result of testing a single composite specimen from that portion of the sample that passes the ½" sieve and is retained on the No. 10 sieve.							
** Property will be evaluated on a mix design basis by calculating a weighted average based upon individual aggregate values (weighted average by the percentage proportion of the aggregate within the design).							

- **AASHTO T 335** - “90/80” denotes that 90% of the coarse aggregate has one fractured face and 80% has two fractured faces.
- **AASHTO T 304** - Criteria are presented as percent air voids in loosely compacted fine aggregate, (U).
- **ASTM D4791** - Criteria are presented as maximum percent by weight of flat and elongated particles (5:1 ratio).

The entire HMA wearing course shall come from the same source of material and the same job mix formula, except when permission is obtained from the Department to change sources.

703.08 **Recycled Asphalt Pavement** - Recycled asphalt pavement shall consist of salvaged asphalt materials from milled pavements or production waste that has been processed before use to meet the requirements of the job mix formula. It shall be free of winter sand, granular fill, construction debris, or other materials not generally considered asphalt pavement.

703.081 **RAP for Asphalt Pavement** - Recycled Asphalt Pavement (RAP) may be introduced into hot-mix asphalt pavement at percentages approved by the Department according to the MaineDOT Policies and Procedures for HMA Sampling and Testing.

If approved by the Department, the Contractor shall provide documentation stating the source, test results for average residual asphalt content, and stockpile gradations showing RAP materials have been sized to meet the maximum aggregate size requirements of each mix designation. The Department will obtain samples for verification and approval prior to its use.

The maximum allowable percent of RAP shall be determined by the asphalt content, the percent passing the 0.075 mm sieve, the ratio between the percent passing the 0.075 mm sieve and the asphalt content, and Coarse Micro-Deval loss values as tested by the Department.

The maximum percentage of RAP allowable shall be the lowest percentage as determined according to Table 4 on next page:

TABLE 4: MAXIMUM PERCENT RAP ACCORDING TO TEST RESULTS

Classification	Maximum RAP Percentage Allowed	Asphalt content standard deviation	Percent passing 0.075 mm sieve standard deviation	Percent passing 0.075 mm sieve / asphalt content ratio	Residual aggregate M-D loss value
Class III	10%	≤ 1.0	N/A	≤ 4.0	≤ 18
Class II	20%	≤ 0.5	≤ 1.0	≤ 2.8	
Class I	30%	≤ 0.3	≤ 0.5	≤ 1.8	

The Department will monitor RAP asphalt content and gradation during production by testing samples from the stockpile at approximately 15,000 T intervals (in terms of mix production). The allowable variance limits (from the numerical average values used for

mix designs) for this testing are determined based upon the maximum allowable RAP percentage and are shown below in

TABLE 5 - RAP VERIFICATION LIMITS

Classification	Asphalt content (compared to aim)	Percent passing 0.075 mm sieve (compared to aim)
Class III	± 1.5	± 2.0
Class II	± 1.0	± 1.5
Class I	± 0.5	± 0.7

For specification purposes, RAP will be categorized as follows:

- **Class III** – A maximum of 10.0% of Class III RAP may be used in any base, intermediate base, surface, or shim mixture. A maximum of 20.0% of Class III RAP may be used in hand-placed mixes for item 403.209.
- **Class II** – A maximum of 20.0% Class II RAP in any base, binder, surface, or shim course.
- **Class I** – A maximum of 20.0% Class I RAP may be used in any base, intermediate base, surface, or shim mixture without requiring a change to the specified asphalt binder. A maximum of 30.0% Class I RAP may be used in in any base or intermediate base mixture provided that a PG 58-28 or PG 58-34 asphalt binder is used. A maximum of 30.0% Class I RAP may be used in any surface or shim mixture provided that PG 58-34 asphalt binder is used. Mixtures exceeding 20.0% Class I RAP must be evaluated and approved by the Department.

The Contractor may use up to two different RAP sources in any one mix design. The total RAP percentage of the mix shall not exceed the maximum allowed for the highest classification RAP source used (i.e. if a Class I & Class III used, total RAP must not exceed 30.0%). The blended RAP material must meet all the requirements of the classification for which the RAP is entered (i.e. 10% Class III with 20% Class I, blend must meet Class I criteria). The Department may take belt cuts of the blended RAP to verify the material meets these requirements. If the Contractor elects to use more than one RAP source in a design, the Contractor shall provide an acceptable point of sampling blended RAP material from the feed belt.

In the event that RAP source or properties change, the Contractor shall notify the Department of the change and submit new documentation stating the new source or properties a minimum of 72 hours prior to the change to allow for obtaining new samples and approval.

- 703.09 **HMA Mixture Composition** - The coarse and fine aggregate shall meet the requirements of Section 703.07. The several aggregate fractions for mixtures shall be sized, graded, and combined in such proportions that the resulting composite blends, including RAP aggregate will meet the grading requirements of the following table:

AGGREGATE GRADATION CONTROL POINTS						
Nominal Maximum Aggregate Size---Control Points (Percent Passing)						
Sieve Designation	Type 25 mm	Type 19 mm	Type 12.5 mm	Type 9.5 mm	Type 9.5 mm Thin Lift Mixture (TLM)	Type 4.75 mm
	Percent By Weight Passing - Combined Aggregate					
37.5 mm	100					
25 mm	90-100	100				
19 mm	-90	90-100	100			
12.5 mm	-	-90	90-100	100	100	100
9.5 mm	-	-	-90	90-100	95-100	95-100
4.75 mm	-	-	-	-90	60-95	80-100
2.36 mm	19-45	23-49	28-58	32-67	47-65	40 - 80
1.18 mm	-	-	-	-	-	-
0.60 mm	-	-	-	-	-	-
0.30 mm	-	-	-	-	-	-
0.075 mm	2.0-6.0	2.0-6.0	2.0-6.0	2.0-7.0*	2.0-7.0*	2.0-7.0
* For 9.5 mm nominal maximum aggregate size mixtures, the maximum design aim for the percent passing the 75 µm sieve is 6.5%.						

- 703.10 **Aggregate for Untreated Surface Course and Leveling Course** - Aggregate for untreated surface course and leveling course shall be screened or crushed gravel consisting of hard durable particles which are free from vegetable matter, lumps or balls of clay and other deleterious substances. If this item is to be used underneath pavement, it must have a Micro-Deval value of 20.0 or less as determined by AASHTO T 327. If the Micro-Deval value exceeds 20.0, the material may be used if it does not exceed 25% loss on AASHTO T 96, Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los

Angeles Machine. The aggregate shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Untreated Aggregate Surface Course	
	Type A	Type B
1"	95-100	95-100
¾"	90-100	90-100
No. 4	40-65	10-45
No. 10	10-45	10-35
No. 200	0-7.0	0-6.0

- 703.11 **Aggregate for Shoulder** - The gradation of that portion passing a 3" sieve shall meet the gradation requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves		
	*Paved or Unpaved Lifts 4" or Greater	Paved Lifts < 4"	Unpaved Lifts < 4"
1"	-	90-100	90-100
¼"	25-70	25-100	25-70
No. 40	5-30	5-50	5-30
No. 200	2.0-10.0	2.0-10.0	2.0-10.0
* Shall not contain particles larger than 6" or the thickness of the lift being placed, whichever is less.			

- 703.12 **Aggregate for Crushed Stone Surface** - Crushed stone surface shall be of quarried stone and have a Micro-Deval value of 18% or less as determined by AASHTO T 327. The aggregate shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
1"	100
¾"	60-90
½"	10-35
⅜"	2-15
No. 4	0-5

- 703.13 **Crushed Stone $\frac{3}{4}$ "** - Aggregate for Crushed Stone $\frac{3}{4}$ " shall be of quarried stone and have a Micro-Deval value of 18.0% or less as determined by AASHTO T 327. The aggregate shall meet the grading requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
1"	100
$\frac{3}{4}$ "	90-100
$\frac{1}{2}$ "	20-55
$\frac{3}{8}$ "	0-15
No. 4	0-5

- 703.14 **Removed**

- 703.15 **Filler** - These materials shall conform to the following specification requirements for the designated materials.

Mineral filler shall conform to the requirements of AASHTO M 17.

- 703.18 **Common Borrow** - Common borrow shall consist of earth, suitable for embankment construction. It shall be free from frozen material, perishable rubbish, peat, and other unsuitable material including material currently or previously contaminated by chemical, radiological, or biological agents unless the material is from a DOT Project and authorized by DEP for use.

The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4% above optimum, which shall be determined in accordance with AASHTO T 180, Method C or D.

- 703.19 **Granular Borrow** - Granular borrow shall consist of sand or gravel of hard durable particles free from vegetable matter, lumps or balls of clay, frozen material and other deleterious substances. The gradation of that portion passing a 3" sieve shall meet the gradation requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Material for Underwater Backfill	Material for Embankment Construction
No. 40	0 - 70	0 - 70
No. 200	0 - 7.0	0 - 20.0

Granular borrow for underwater backfill shall contain no particles or fragments larger than 3". Granular borrow for embankment construction shall contain no particles or fragments with a maximum dimension in excess of the compacted thickness of the layer being placed.

- 703.20 **Gravel Borrow** - Gravel borrow shall consist of well graded granular material having no rocks with a maximum dimension of over 6". The gradation of that portion passing a 3" sieve shall meet the gradation requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
¼"	0 - 70
No. 200	0 - 10.0

- 703.21 **Rock Borrow** - Rock borrow shall consist of hard durable rock broken to various sizes that will form a compact embankment with a minimum of voids. The maximum size for any rock shall be 3 ft in its greatest dimension.

- 703.22 **Underdrain Backfill Material** - Material for underdrain shall be free from organic matter, frozen material and shall conform to the following tables:

Type B material shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
1"	95-100
½"	75-100
No. 4	50-100
No. 20	15-80
No. 50	0-15
No. 200	0-5.0

Type C material shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
1"	100
¾"	90-100
⅜"	0-75
No. 4	0-25
No. 10	0-5

- 703.24 **Stone for French Drains** - Stones for French drains shall consist of hard, durable rock and shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
6"	90-100
1½"	0-40
No. 4	0-5

- 703.25 **Stone Fill** - Stones for stone fill shall consist of hard, sound, durable rock that will not disintegrate by exposure to water or weather. Stone for stone fill shall be angular and rough. Rounded, subrounded, or long thin stones will not be allowed. Stone for stone fill may be obtained from quarries or by screening oversized rock from earth borrow pits. The maximum allowable length to thickness ratio will be 3:1. The minimum stone size (10 lb) shall have an average dimension of 5". The maximum stone size (500 lb) shall have a maximum dimension of approximately 36". Larger stones may be used if approved by the Resident. Fifty percent of the stones by volume shall have an average dimension greater than 12" (200 lb).
- 703.26 **Plain and Hand Laid Riprap** - Stone for riprap shall consist of hard, sound durable rock that will not disintegrate by exposure to water or weather. Stone for riprap shall be angular and rough. Rounded, subrounded or long thin stones will not be allowed. The maximum allowable length to width ratio will be 3:1. Stone for riprap may be obtained from quarries or by screening oversized rock from earth borrow pits. The minimum stone size (10 lb) shall have an average dimension of 5". The maximum stone size (200 lb) shall have an average dimension of approximately 12". Larger stones may be used if approved by the Resident. 50% of the stones by volume shall have an average dimension greater than 9" (50 lb).
- 703.27 **Stone Blanket** - Stones for stone blanket shall consist of sound durable rock that will not disintegrate by exposure to water or weather. Stone for stone blanket shall be angular and rough. Rounded or subrounded stones will not be allowed. Stones may be obtained from quarries or by screening oversized rock from earth borrow pits. The minimum stone size (300 lb) shall have minimum dimension of 14", and the maximum stone size (3,000 lb) shall have a maximum dimension of approximately 66". Fifty percent of the stones by volume shall have average dimension greater than 24" (1,000 lb).
- 703.28 **Heavy Riprap** - Stone for heavy riprap shall consist of hard, sound, durable rock that will not disintegrate by exposure to water or weather. Stone for heavy riprap shall be angular and rough. Rounded, subrounded, or thin, flat stones will not be allowed. The maximum allowable length to width ratio will be 3:1. Stone for heavy riprap may be obtained from quarries or by screening oversized rock from earth borrow pits. The minimum stone size (500 lb) shall have minimum dimension of 15", and at least 50% of the stones by volume shall have an average dimension greater than 24" (1,000 lb).

- 703.29 **Stone Ditch Protection** - Rock used for ditch protection shall consist of sound, durable rock that will not disintegrate by exposure to water or weather. Fieldstone, rough quarry stone, blasted ledge rock or tailings may be used. The rock shall be graded within the following limits or as otherwise approved.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
12"	90-100
4"	0-15

The size of any stone shall not exceed 18" when measured along its longest axis.

- 703.30 **Removed**

- 703.31 **Crushed Stone** – Crushed stone shall be obtained from rock of uniform quality and shall consist of clean, angular fragments of quarried rock, free from soft disintegrated pieces or other objectionable matter.

The stone, which shall be similar to railroad ballast, shall meet the following gradation requirements (see Table on next page):

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
2½"	100
2"	95-100
1"	0-30

- 703.32 **Definitions (ASTM D 2488, Table 1)**

- **Angular** - Particles have sharp edges and relatively plane sides with unpolished surfaces
- **Subrounded** - Particles have nearly plane sides but have well-rounded corners and edges
- **Rounded** - Particles have smoothly curved sides and no edges

- 703.33 **Stone Ballast Aggregate** - for stone ballast shall be clean and graded crushed stone aggregate with a hard, dense angular particle structure providing sharp corners and cubicle fragments with prime consideration for drainage efficiency.

The material retained on the ¾" sieve shall contain not more than 5%, by weight of flat and elongated particles when performed in accordance with test method ASTM D 4791, Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate, using a dimensional ratio of 1:5.

The material shall have an absorption no greater than 1.5% by weight and a bulk specific gravity of 2.60 or greater as determined in accordance with AASHTO T 85 modified for weight of sample.

The material shall not exceed 30% loss on ASTM C535, Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

SECTION 704 - MASONRY UNITS

- 704.01 **Clay or Shale Brick** - Except as modified below, brick shall conform to the requirements of one of the following specifications:

Type of Brick	Specification
Sewer, Catch Basin and Manhole	AASHTO M 91, Grade MS or SM
Building	AASHTO M 114, Grade SW

- 704.02 **Brick for Paving** - Brick for paving shall conform to the requirements of AASHTO M 114 (C62, Grade SW) for Building brick or shale, with the following modifications:

- The absorption limits shall be from 5% to 12% for the average of 5 bricks.
- The compressive strength shall not be less than 6,000 psi.
- The modulus of rupture shall not be less than 1,000 psi.
- The bricks shall be No. 1, water struck type for paving.

The bricks shall be 2¼" by 3¾" by 8" with permissible variations not to exceed 1/16" in depth, 1/8" in width and ¼" in length.

Before ordering new brick, samples shall be submitted in whole straps to show color range.

- 704.03 **Concrete Masonry Blocks** - Concrete masonry blocks may be rectangular or segmented and when specified shall have ends shaped to provide interlock at vertical joints.

Solid blocks for catch basins and manholes shall conform to the requirements of ASTM C139.

SECTION 705 - JOINT MATERIAL

- 705.01 **Preformed Expansion Joint Filler** - Preformed expansion joint filler shall be non-extruding and resilient bituminous type and shall conform to the requirements of AASHTO M 213.

- 705.02 **Joint Mortar** - Joint mortar shall consist of 1 part Portland Cement, 2 parts sand and sufficient water to obtain the required consistency. Mortar shall be used within 30 minutes after its preparation.

The cement shall conform to the requirements of Portland Cement AASHTO M 85, Type II or IIA.

The sand shall meet the requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Joints Thicker Than ½"	Joints ½" or Thinner
⅜"	100	-
¼"	-	100
No. 4	95-100	-
No. 8	70-95	85-100
No. 16	45-80	60-90
No. 30	25-55	35-70
No. 50	10-30	15-45
No. 100	2-10	0-15
No. 200	0-5.0	0-5.0

When necessary, material retained on the No. 4 sieve may be removed.

The sand shall be subjected to the colorimetric test for organic impurities, AASHTO T 21, and when a color darker than the reference standard color solution (laboratory designation Plate III) is produced, the material shall be rejected.

- 705.03 ***Flexible Watertight Gaskets*** - Flexible gaskets, either rubber or plastic, shall conform to ASTM C990.

SECTION 706 - NON-METALLIC PIPE

- 706.01 ***Removed***

- 706.02 ***Reinforced Concrete Pipe*** - This pipe shall conform to the requirements of AASHTO M 170M/M 170. Elliptical pipe shall conform to the requirements of AASHTO M 207M/M 207. Unless otherwise specified, pipe wall design and use of elliptical reinforcement in circular pipe are optional. Pipe arch shall conform to the requirements of AASHTO M 206M/M 206.

Aggregates shall meet the requirements of Section 703.01 and Section 703.02 for fine aggregates and coarse aggregates respectively, except that grading requirements are hereby waived.

Fine and coarse aggregate sources shall meet the Alkali Silica Reactivity (ASR) requirements of Section 703.0201.

Precast reinforced concrete special sections shall conform to the requirements of the cited specifications to the extent to which they apply.

- 706.03 ***Removed***

- 706.04 ***Removed***

- 706.05 ***Removed***

- 706.06 ***Corrugated Polyethylene Pipe for Underdrain, Option I, and Option III Culvert Pipe*** - Six inch diameter underdrain pipe and fittings shall conform to the requirements of AASHTO M 252, slot-perforated. Twelve to 60" diameter, Option I/III shall conform to the requirements of AASHTO M 294 Type S. Pipe to be used for Underdrain Type C shall meet the requirements of AASHTO M 294, Type SP and have Class I perforations. All polyethylene pipe shall be smooth lined and shall meet the pipe stiffness requirements shown on the Standard Details. The manufacturing plants of polyethylene pipe shall participate annually in the AASHTO Product Evaluation & Audit Solutions process for plastic pipe and resins which includes audits by the AASHTO Re:Source. Plants shall be listed as "Compliant" on the AASHTO Product Evaluation & Audit Solutions website and take immediate corrective action for any deficiencies found during audits. Continued compliance with all elements of the AASHTO Product Evaluation & Audit Solutions/ AASHTO Re:Source program and the Maine DOT manufactured Materials Verification Program will be required in order to continue supplying product to the Maine DOT.
- 706.07 ***Removed***
- 706.08 ***PVC (Polyvinylchloride) Pipe*** - This pipe and fittings shall conform to the requirements of AASHTO M 278. All pipe shall be supplied with gasket type joints.
- 706.09 ***PVC (Polyvinylchloride) Perforated Pipe*** - This pipe and fittings shall conform to the requirements of AASHTO M 278 or ASTM F949 for 6" underdrain and AASHTO M 278 for underdrain larger than 6" diameter.
- 706.10 ***Corrugated Polypropylene Pipe for Option I and Option III Culvert Pipe*** - Option I/III pipe and fittings shall conform to the requirements of AASHTO M 330 Type S (dual wall) or Type D (triple wall). All polypropylene pipe shall be smooth lined and shall meet the pipe stiffness requirements of AASHTO M 330. The manufacturing plants of polypropylene pipe shall participate annually in the AASHTO Product Evaluation & Audit Solutions process for plastic pipe and resins which includes audits by the AASHTO Re:Source. Plants shall be listed as "Compliant" on the AASHTO Product Evaluation & Audit Solutions website and take immediate corrective action for any deficiencies found during audits. Continued compliance with all elements of the AASHTO Product Evaluation & Audit Solutions/ AASHTO Re:Source program and the Maine DOT manufactured Materials Verification Program will be required in order to continue supplying product to the Maine DOT.

SECTION 707 - METALLIC PIPE

- 707.01 ***Removed***
- 707.02 ***Corrugated Steel, Metallic Coated Pipe*** - This pipe and special fittings such as elbows, tees, and wyes shall conform to the requirements of AASHTO M 36/M

36M Type I, IR, II, or III for the specified sectional dimensions, sheet thickness, and coating.

707.03 **Removed**

707.04 **Removed**

707.05 **Corrugated Steel, Metallic Coated Pipe for Underdrain** - This pipe and special fittings such as elbows, tees, and wyes shall conform to the requirements of AASHTO M 36/M 36M, Type III, Class 1 perforations.

707.06 **Corrugated Aluminum Alloy Pipe and Pipe Arches** - This pipe and special fittings such as elbows, tees, and wyes shall conform to the requirements of AASHTO M 196/M 196M, Type I, IR, or II. Special sections, such as elbows and metal end sections, shall be of the thickness called for on the plans and shall conform to the applicable requirements of AASHTO M 196/M 196M. Aluminum sheet shall conform to the requirements of AASHTO M 197/M 197M.

707.07 **Polymer Precoated, Galvanized Corrugated Steel Pipe and Pipe Arches** - This pipe and special fittings such as elbows, tees and wyes shall conform to the requirements of AASHTO M 245/M 245M, Type 1 with Grade 250/250 polymer coating. Steel sheet shall conform to the requirements of AASHTO M 246/M 246M.

707.08 **Corrugated Aluminum Alloy Pipe for Underdrain** - This pipe and special fittings such as elbows, tees, and wyes shall conform to the requirements of AASHTO M 196/M 196M, Type III, Class 1 perforations or Type IIIR, Class 4 perforations.

707.09 **Steel Structural Plate Pipe, Pipe Arches, Arches, Box Culverts, and Fasteners** - Plates, bolts, nuts and other accessories shall conform to the requirements of AASHTO M 167/M 167M and the following additional requirements:

- a. All shop welding shall meet the requirements of the latest edition of AWS D1.1, Structural Welding Code - Steel.
- b. Annually, the fabricator shall have quality control tests performed on uncoated random samples of the lightest and heaviest thickness plates produced by welding. The sampling and testing shall be done by a recognized independent testing agency and copies of the test reports, including all welding parameters, shall be submitted to the Fabrication Engineer on an annual basis.
- c. The Fabrication Engineer reserves the right to conduct unannounced inspections of the fabricators facilities and to take random samples of welded plates representative of gages supplied to the Department.
- d. No field welding will be allowed.

707.10 **Aluminum Coated (Type 2) Corrugated Steel Pipe** - This pipe shall conform to the requirements of AASHTO M 36/M 36M using steel sheet conforming to AASHTO M 274.

- 707.11 **Zinc - Coated (Galvanized) Corrugated Steel Pipe** - This pipe shall conform to the requirements of AASHTO M 36/M 36M using steel sheet conforming to AASHTO M 218.
- 707.12 **Removed**
- 707.13 **Removed**
- 707.14 **Aluminum Alloy Structural Plate Pipe, Pipe Arches, Arches, Box Culverts, and Fasteners** - Plates for this pipe shall conform to the requirements of AASHTO M 219/M 219M. Bolts and nuts shall conform to the requirements of ASTM F468M alloy 6061-T6 and F467 alloy 6061-T6.

SECTION 708 - PAINTS AND PRESERVATIVES

- 708.01 **Exterior Ready Mixed Paint** - Exterior paint for wood structures should be a good quality house paint approved by the Resident.
- 708.02 **Removed**
- 708.03 **Pavement Marking Paint** - Paint for final and temporary pavement marking shall meet the requirements of the Maine DOT Maintenance Fast-Dry Water-Based Traffic Paint on file at Highway Maintenance in Augusta.
- Glass beads shall conform to the requirements of AASHTO M 247, Type I.
- 708.04 **Tree Wound Paint** - Tree wound paint shall be an approved waterproof, adhesive, and elastic paint, manufactured and customarily used for painting cuts on trees. It shall contain an antiseptic ingredient and be free from kerosene, creosote, coal tar, or any other injurious material.
- 708.05 **Timber Preservative** - Timber preservatives shall conform to the requirements of AASHTO M 133 and AWWA Standard U1. All preservatives shall meet the requirements of the US EPA regulations under the Federal Insecticide, Fungicide and Rodenticide Act.

SECTION 709 - REINFORCING STEEL AND WELDED STEEL WIRE FABRIC

- 709.01 **Reinforcing Steel** - Reinforcing steel, whether plain, galvanized, epoxy coated, or zinc and epoxy dual-coated, shall be deformed bars conforming to the requirements of AASHTO M 31 (ASTM A615). Bars shall be Grade 60 unless otherwise specified on the Plans. Epoxy coated reinforcing steel shall also conform to the requirements of AASHTO M 284 (ASTM A775). The requirements of AASHTO M 284 (ASTM A775), Sections 5.2.1, 5.3, 5.4, and 15.1 shall be mandatory. Zinc and epoxy dual-coated reinforcing steel shall conform to the requirements of ASTM A1055.

Low-carbon, chromium, reinforcing steel shall be deformed bars conforming to the requirements of ASTM A1035. Bars shall be Grade 100 and alloy Type CS unless otherwise specified on the Plans.

Stainless Steel Reinforcement shall be deformed stainless steel bars conforming to the requirements of ASTM A955. Bars shall be at a minimum Grade 60, unless otherwise specified on the Plans. The chemical composition shall conform to one of the types listed in Table 2 of ASTM A955 or UNS S32304 Duplex. Heat treatment condition per ASTM A955 is hot rolled. Bars shall be finished in accordance with ASTM A955, Section 15.

Fabricated deformed steel reinforcing grids shall conform to the requirements of AASHTO M 54 (ASTM A184). Welding and welder qualifications for reinforcing bar grids shall conform to the requirements in Section 503.

709.02 **Welded Steel** - Wire Fabric Welded steel wire fabric shall meet the requirements of AASHTO M 336 Standard Specification for Steel Wire and Welded Wire, Plain, and Deformed, for Concrete Reinforcement.

709.03 **Steel Strand** - Prestressing strand shall meet the requirements of AASHTO M 203 Steel Strand, Uncoated Seven-Wire for Concrete Reinforcement.

Lateral post-tensioned strands for pre-cast/post-tensioned concrete products shall be 0.600" diameter AASHTO M 203 strand with a corrosion inhibitive coating covered with an extruded polypropylene sheath.

SECTION 710 - FENCE AND GUARDRAIL

710.01 **Barbed Wire** - Barbed wire shall conform to the requirements of AASHTO M 280. The Design number shall be 12-4-5-14R with, coating Type Z, metallic coating Class 3 if zinc coated or coating Type A, (0.30 oz/ft²) if aluminum coated.

710.02 **Woven Wire** - Wire and stays shall conform to the requirements of AASHTO M 279. The Design number shall be 1047-12-11, Grade 60, coating Type Z, coating Class 3 if zinc coated. The Design number shall be 1047-12-11, Grade 60, coating Type A, if aluminum coated.

710.03 **Chain Link Fabric** - Chain Link fabric shall conform to the requirements of AASHTO M 181, Type I, Class D if zinc coated, or Type II if aluminum coated, or Type IV, Class B if PVC coated. The wire shall be 9 gauge and the mesh shall be 2" unless otherwise noted on the plans. Tension wire shall be 7 gauge (0.177" diameter) steel coil spring wire and have a zinc coating or an aluminum coating. Zinc coating shall be Class 3 and aluminum coating shall be a minimum of 0.4 oz/ft².

710.04 **Metal Beam Rail** - Galvanized steel rail elements shall conform to the requirements of AASHTO M 180, Class A, Type II.

When corrosion resistant steel is specified, rail shall conform to AASHTO M 180, Class A, Type IV. Beams of corrosion resistant steel shall not be painted or galvanized. They shall be so handled and stored that the traffic face of these beams, used in a continuous run of guardrail, shall not show a distinctive color differential.

When metal beam rail is to be installed on a curve having a radius of curvature of 150 ft or less, the beam sections shall be fabricated on an arc to the required radius and permanently stamped or embossed with the designated radius.

The Department may take one piece of guardrail, a backup plate, and end or buffer section from each 200 pieces in a lot, or from each lot if less than 200 pieces are included therein for determination of compliance with specification requirements. If one piece fails to conform to the requirements of this specification, two other pieces shall be tested. If either of these pieces fails to conform to the requirements of this specification, the lot of material represented by these samples shall be rejected. A lot shall be considered that quantity of material offered for inspection at one time that bears the same heat and coating identification.

710.05 **Cedar Rail Fence** - Rails and posts for cedar rail fence shall be of cedar, reasonably straight, machine or hand peeled and branch stubs cut flush.

710.06 **Fence Posts and Braces** - Wood posts shall be of cedar, white oak, or tamarack or other AWP approved species, of the diameter or section and length shown on the plans.

Round wood posts shall be of seasoned stock straight and sound and shall have been cut from live growing trees with the outer and inner bark removed and all knots trimmed flush with the surface of the post. Rotted, loose or hollow knots, plugged or open holes will not be permitted. Sound knots will be permitted if the diameter of any one knot or the combined diameter of 2 or more knots occurring in the same cross section is not greater than one-third of the circumference of the post at that cross section. Posts shall be of uniform taper from top to bottom not to exceed 1½" of taper in 7 ft.

The minimum diameter of heartwood in line posts at their small end shall be no less than 3". The minimum diameter of line posts at the small end shall be no less than 3". The maximum diameter of line posts at the small end shall be 6".

The minimum diameter of heartwood in end, corner, gate, and barway posts shall be 4½" at the small end. The minimum diameter of end, corner, gate, and barway posts at the small end shall be 4½". The maximum diameter of end, corner, gate, and barway posts shall be 8".

Braces shall be of spruce, eastern hemlock, Norway pine, pitch pine, or tamarack timbers or other AWP approved species, or spruce, cedar, tamarack or other AWP approved species round posts of sufficient length to make a diagonal brace between adjacent posts. All wood posts and braces shall be

pressure-treated in accordance with AASHTO M 133 and AWP A U1, UC4A Commodity Specification B: Posts.

Metal posts and braces for woven wire fence shall conform to the requirements of AASHTO M 281. Posts and post assemblies shall be galvanized according to the requirements of AASHTO M 111. Assembly hardware shall be zinc coated in accordance with AASHTO M 232M/M 232. The type of post furnished shall be channel or U unless otherwise noted on the plans.

Metal posts, rails, and bracing for chain link fence shall be as specified in AASHTO M 181. Type I, Grade 1 or Grade 2 posts shall be used with zinc coated chain link fabric. Type II, Grade 1 or 2 shall be used with aluminum coated chain link fabric. End and corner posts shall be 2" inside diameter. Line posts shall be 1½" inside diameter. Top and brace rails shall be 1¼" inside diameter. Expansion sleeves, turnbuckles and other fittings and hardware shall be galvanized in accordance with the applicable requirements in AASHTO M 181.

710.07 Guardrail Posts - Posts shall be of wood or steel.

- a. Wood posts shall be of Norway pine, southern yellow pine, pitch pine, Douglas fir, red pine, white pine, or eastern hemlock or other AWP A approved species. They shall be of straight and sound timber cut from live growing trees, free from loose knots or other structurally weakening defects, including shake, holes and heart rot over 1" in diameter. The posts shall be free from season checks that exceed ¼" in width. A tolerance of 1" in length and ¼" in width or thickness is permitted in the dimensions of rectangular posts. They shall be well sawn and have square edges except that wane not more than 1½" wide and extending not more than ½ the length of the piece will be allowed on that portion of the post to be placed below ground. Sound, tight, well spaced knots to 2½" or less in diameter will be permitted.

Wood posts and offset brackets shall be preservative treated in accordance with the requirements of AASHTO M 133 and AWP A U1, UC4A Commodity Specification B: Posts.

Composite material blocks tested and meeting the requirements of the National Cooperative Research Program Report 350 and approved by the FHWA may be used as offset brackets.

- b. Galvanized steel posts shall conform to the requirements of AASHTO M 270 Grade 250 (36) if a rolled section or ASTM A769 Grade 36 if a welded section. Fabrication will be in accordance with Section 504 - Structural Steel. Galvanizing shall be in accordance with Section 506 - Shop Applied Protective Coating - Steel.
- c. Corrosion resistant steel posts shall conform to the requirements of ASTM A769, Grade 50W if a welded section. Fabrication will be in accordance with Section 504 - Structural Steel. The portion of the post that is

underground shall meet the galvanized steel post requirements in Section b. above.

- 710.08 **Guardrail Hardware** - Guardrail hardware shall conform to the applicable standards contained in the latest ARTBA Bulletin No. 268B, "A Guide to Standardized Highway Barrier Rail Hardware," approved by the AASHTO-ARTBA-AGC Joint Cooperative Committee, Technical Bulletin Number 268-B.

All galvanized fittings, bolts, washers, and other accessories shall be in accordance with the requirements of AASHTO M 111, M 232 or AASHTO B 695, Class 50, Type I, whichever applies. All galvanizing shall be done after fabrication.

Hardware for corrosion resistant guardrail shall be in accordance with ASTM A25M/A325, Type 3, except the 16" bolts and nuts for attaching the metal beam rail to the posts, which may be galvanized as specified above.

SECTION 711 - MISCELLANEOUS BRIDGE MATERIAL

- 711.01 **Steel Pipe Piles, Splices and Tips** - Steel pipe piles shall conform to the requirements of ASTM A252. The steel pipe piles shall be Grade 3, $F_y = 45$ ksi, with either straight or spiral butt-welded seams. Lap welded seams are not acceptable. The steel shall be a Prequalified Base Metal from the AWS D1.1 Structural Welding Code - Steel.

Cast steel points, splices and open end cutting shoes shall conform to the requirements of ASTM A27 Grade 65/35 or ASTM A148 Grade 90/60. Pipe pile splice backup ring material shall be any steel listed in AWS Structural Steel Welding Code D1.1, Table 3.1, with the exception of 100 ksi minimum yield strength steels

- 711.02 **Gabions** - Each shipment of gabions to a job site shall be accompanied by a certificate that states that the material conforms to the requirements of this specification. The certificate shall be on manufacturer's letterhead and shall be signed by an officer of the company having legal authority to bind the company.

Mesh openings shall be hexagonal in shape, measuring approximately 3" by 4" and shall be uniform in size. Double twist mesh joints shall be flexible with each pair of wires twisted three half turns, commonly called triple twisted, to prevent unraveling. Steel wire and galvanizing shall meet the requirements of ASTM A641M/A641 and ASTM A90, shall have a Class 3 coating, and shall be soft temper. The wire mesh shall have a sufficient elasticity to permit elongation of the mesh equivalent to a minimum of 10% of its length.

- a. **Galvanized Gabions without Polyvinylchloride Coating** - The diameter of the steel wire mesh shall be 0.1181" after galvanizing. The diameter of the selvedge wire, running through all the edges (perimeter wire), shall be 0.1535" after galvanizing. The diameter of the wire for assembling and

lacing the gabion units shall be 0.0866" after galvanizing. The above wire sizes shall have a tolerance of +/- 2.5%.

- b. **Polyvinylchloride (PVC) Coated Gabions** - When specified on the plans, all galvanized steel wire shall be coated with a minimum of 0.015" of gray or green PVC, which shall be suitable to resist the destructive effects of immersion in acidic, salt, or polluted water, exposure to ultra violet light and abrasion and retain these characteristics after a period of not less than 3,000 hours when tested in accordance with ASTM A975. The diameter of the steel wire mesh shall be 0.1063" after galvanization and 0.1363" overall, core wire plus PVC coating.

The diameter of the selvedge wire running through all the edges (perimeter wire) shall be 0.1338" after galvanizing and 0.1638" overall, core wire plus PVC coating. The diameter of the wire for assembling and lacing the gabion units shall be 0.0866" after galvanizing and 0.1166" overall, core wire plus PVC coating. All wire sizes shall have a tolerance of +/- 2.5%, the thickness of the PVC excluded.

The mesh shall be capable of withstanding the test described below:

- An uncut section of mesh 6 ft long and of a minimum width of 3 ft, including all selvedge bindings, shall have the ends securely clamped for 3 ft along the width of the sample. When the width of the section under test exceeds 3 ft, the clamps shall be placed in the middle portion of the width and the excess width shall be allowed to fall free on each side of the clamped section. The sample shall then be subjected to sufficient tension to cause 10% elongation of the sample section between clamps. After elongation and while clamped as described above (and otherwise unsupported), the section shall be subjected to a load applied to an area of 1 ft² located approximately in the center of the sample section between the clamps and in a direction perpendicular to the direction of the tensile force. The sample shall withstand without rupture of any wire or opening of any mesh fastening, an actual load, so applied, equaling or exceeding 6,000 lb. The ram head used in the test shall be circular with its edges beveled or rounded to prevent cutting the wires.

711.03 **Stones for Gabions** - Stones to fill gabions shall be of clean, hard, and durable rock with a minimum dimension of 4" in all directions and a maximum dimension of 12".

Stones to fill hand filled gabions shall be of clean, hard, durable, crushed ledge or quarried rock with a minimum dimension of 4" in all directions and a maximum of 12".

- 711.04 **Bridge Drains** - Bridge drains shall be fabricated in conformance with the details shown in the Contract documents, and to the requirements of Section 504 - Structural Steel. All bridge drain parts shall be hot-dip galvanized in accordance with the requirements of Section 506 - Shop Applied Protective Coating-Steel.
- 711.05 **Removed**
- 711.06 **Stud Shear Connectors, Anchors and Fasteners** - Shear connectors shall meet the dimensional tolerances of Figure 9.1 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code (D1.5 Code). Shear connectors, anchors and fasteners shall meet the material requirements of Section 9 of the D1.5 Code. Shear connectors shall meet the mechanical property requirements of Table 9.1, Type B of the D1.5 Code. Anchors and fasteners shall meet the mechanical property requirements of Table 9.1 of the D1.5 Code, Type A.
- 711.07 **Mattresses** - Each shipment of mattresses on a job site shall be accompanied by a certificate that states that the material conforms to the requirements of this specification. The certificate shall be on the manufacturer's letterhead and shall be signed by an officer of the company having legal authority to bind the company.

Mesh openings shall be hexagonal in shape, measuring approximately 2½ by 3¼" and shall be uniform in size. Double twist mesh joints shall be flexible with each pair of wires twisted three half turns (triple twisted) to prevent unraveling. Steel wire and galvanizing shall meet the requirements of ASTM A641M/A641 and ASTM A90, shall have a Class 3 coating, and shall be soft temper. The wire mesh shall have a sufficient elasticity to permit elongation of the mesh equivalent to a minimum of 10% of its length ±.

- a. **Galvanized Mattresses without Polyvinylchloride Coating** - The diameter of the steel wire mesh shall be 0.0866" after galvanizing. The diameter of the selvedge wire, running through all the edges (perimeter wire), shall be 0.1063" after galvanizing. The diameter of the wire for assembling and lacing the units shall be 0.0866" after galvanizing. The above wire sizes shall have a tolerance of ±2.5%.
- b. **Polyvinylchloride (PVC) Coated Mattresses** - When specified on the plans, all galvanized steel wire shall be coated with a minimum thickness of 0.015" of gray or green PVC, which shall be suitable to resist the destructive effects of immersion in acidic, salt or polluted water, exposure to ultra violet light and abrasion and retain these characteristics after a period of not less than 3,000 hours when tested in accordance with ASTM A975 The diameter of the steel wire mesh shall be 0.0866" after galvanization and 0.1166" overall minimum, core wire plus PVC Coating.

The diameter of the selvedge wire running through all the edges (perimeter wire) shall be 0.1050" after galvanizing and an overall minimum diameter of 0.1350", core wire plus PVC coating. The diameter of the wire for assembling and lacing the units shall be 0.0866" after galvanizing and

0.1166" nominal overall, core wire plus PVC coating. All wire sizes shall have a tolerance of $\pm 2.5\%$, the thickness of the PVC excluded.

The mesh shall be capable of withstanding the test described below:

- An uncut section of mesh 6 ft long and a minimum width of 3 ft, including all selvedge bindings, shall have the ends securely clamped for 3 ft along the width of the sample.
- When the width of the section under test exceeds 3 ft, the clamps shall be placed in the middle portion of the width and the excess width shall be allowed to fall free on each side of the clamped section.
- The sample shall then be subjected to sufficient tension to cause 10% elongation of the sample section between clamps.
- After elongation and while clamped as described above (and otherwise unsupported), the section shall be subjected to a load applied to an area of 1 ft² located approximately in the center of the sample section between the clamps and in a direction perpendicular to the direction of the tensile force.
- The sample shall be able to withstand without rupture of any wire or opening of any mesh fastening, an actual load, so applied, equaling or exceeding 6,000 lb.
- The ram head used in test shall be circular with its edges beveled or rounded to prevent cutting the wires.

711.08 ***Stones for Mattresses*** - Stones to fill mattresses shall be of clean, hard, and durable rock with a minimum dimension of 3" in all directions and a maximum dimension of 6".

711.09 ***Neoprene Pads*** - The neoprene shall be either chloroprene or natural polyisoprene of 50 +/-5 Shore A durometer hardness and shall conform to the requirements of Sections 18.10.2 of AASHTO LRFD Bridge Construction Specifications, where applicable.

711.10 ***H-Beam Piles, Splices and Tips*** - Steel H-beam piles shall be ASTM A572, Grade 50 minimum.

Steel H-beam pile splicers shall be ASTM A572, Grade 50 minimum.

H-Beam pile tips shall consist of pile points equipped with cutting teeth. The slope forming the point shall not be steeper than 1¾:1. Material for H-Beam pile tips shall consist of plain cast steel pile points conforming to the requirements of AASHTO M 103 (ASTM A27), Grade 65/35 or ASTM A148, Grade 80/50. The use of pile tips fabricated by welding sections of plate in an "H" configuration will not be allowed.

- 711.11 **Elastomer** - Elastomer for bearings shall conform to AASHTO LRFD Bridge Construction Specification Section 18.2.3 except that the elastomer compound shall be Grade 3 or 4 or 5, unless otherwise noted on the Plans. A higher grade of elastomer may be substituted for a lower one.
- 711.12 **Stainless Steel** - Stainless steel shall conform to the requirements of ASTM A167 Type 308 or ASTM A240, Type 304.
- 711.13 **Polytetrafluoroethylene (PTFE)** - The PTFE, filled or unfilled, shall conform to the requirements of Section 18.8 of AASHTO, LRFD Bridge Construction Specifications. PTFE resin shall conform to the requirements of ASTM D4894 or D4895.

SECTION 712 - MISCELLANEOUS HIGHWAY MATERIAL

- 712.01 **Removed**
- 712.02 **Calcium Chloride** - Calcium chloride shall conform to the requirements of AASHTO M 144.
- 712.04 **Stone Curbing and Edging** - Stone for curbing and edging shall be approved granite from acceptable sources. The stone shall be hard and durable, predominantly gray in color, free from seams that impair its structural integrity and of smooth splitting character. Such natural variations may include bands or clusters of mineral or both of mineral crystallization that do not impair the structural integrity of the curb stone. The dimensions shape and other details shall be as shown on the plans.

The exposed face of stone curb shall be free from indications of drill holes. Half drill holes not larger than $\frac{3}{4}$ " diameter will be permitted in the arris line in the plane of the back.

- a. **Vertical Curb** - shall have a top surface sawed or dressed to an approximate true plane with no depression or Projection on that surface of over $\frac{1}{8}$ ". The top front arris line shall be pitched straight and true with no variations from a straight line greater than $\frac{1}{4}$ ". The top back arris line shall meet the same requirement except that indentations of a maximum of $\frac{3}{8}$ " will be allowed. There shall be no Projection or depression on the back face that would exceed a batter of 1 horizontal on 3 vertical for a distance from the top of 3".

The front face shall be at right angles to the top and shall be smooth split and have no Projections greater than 1" or depressions greater than $\frac{1}{2}$ ", measured from the vertical plane of the face through the top arris line for a distance down from the top of 8". The remainder of the face shall have no Projections or depressions greater than 1" from the plane of the face.

The ends of the curb shall be approximately square with the planes of the top, back and face and so finished that when the sections are placed end

to end with the required minimum spacing of ¼" no more than ⅝" space shall show in the joint for the full width of the top surface and for the entire exposed front face. The remainder of the end may extend back no more than 8" from the plane of the joint.

Drill holes through the curb will be allowed providing they are at least 9" below the top and are mortared full with Portland Cement mortar before placing the stone.

- b. **Miscellaneous Stone Curb** - When a depressed or modified section of curb is called for on the plans or ordered by the Resident, for driveways, crossings, closures, transitions or for other reasons, the Contractor shall furnish curbing with the required modifications.

- c. **Curb Inlets** - Inlets used at catch basins shall conform to the applicable requirements of Vertical Curb, Type 1 and to the shape, dimensions, and details as shown on the Standard Detail

Natural grain size and color variations characteristic of the source deposit will be permitted.

- d. **Dimensions** - The stone curb units shall be of the dimensions indicated on the plans and shall be cut in lengths of not less than 4 ft nor greater than 10 ft. Random lengths of curb less than 4 ft in length may be obtained if the Resident determines it necessary to meet field conditions. All curb to be set on a radius of 60 ft or less shall be cut.

- e. **Vertical Bridge Curb** - shall conform to the requirements above, except as indicated on the plans and as follows:

1. The back face of the curb stones shall have no Projections or depressions greater than 1", measured from the vertical plane of the back face through the arris or pitch line down to the bottom of the stone. The front face shall be finished as required for Vertical Curb, Type 1, except that it shall be finished the full distance down on the face. Bottoms of curb stones shall be approximately parallel to the top and sawed or dressed to lay with a bedding of approximately 1" for the full length of the stone.
2. Anchor holes shall be provided in the back of the stones, pitched down as shown on the plan, a maximum of 18" from each end of the stone and spaced horizontally at a maximum of 4 ft apart. A minimum of 2 anchor holes shall be provided in each stone.
3. The ends of stones at expansion joints between spans and at ends of the bridge shall be cut to present a vertical face when set in position, beveled to the skew angle, if any and the entire end finished in the same manner as the top.

4. The exposed edges of the stones at intermediate joints shall be trimmed square with the planes of the top and front face so that a neat, parallel joint, free from drill holes is formed between the stones. Length of stones shall be so scheduled that joints will be uniform in width along any run of curb. Joints shall be $\frac{1}{2}" \pm \frac{1}{8}"$. A joint shall be provided at each curb and sidewalk Contraction joint of the bridge.
 5. Stones set transversely at ends of a bridge, when the grade exceeds 2%, shall have the top beveled to fit the grade of the bridge.
 6. Mortar for bedding shall be composed of 1 part Portland Cement and 2 parts sand with sufficient water to form a workable mix. Cement, sand, and water shall conform to Section 502 - Structural Concrete.
 7. Mortar for pointing shall be composed of equal parts sand and Portland Cement with sufficient water to form a workable mix and shall conform to Section 502 - Structural Concrete.
 8. Portland Cement grout shall be made the same as mortar for pointing, except that consistency shall be such that it will flow readily.
- f. **Curb Type 5** - The exposed face shall be smooth split to an approximate true plane having no Projections or depressions which will allow over 1" to show between a 2 ft straightedge and the face when the straightedge is placed as closely as possible on any part of the face. Half drill holes not more than 3" in length and $\frac{3}{4}"$ in diameter will be permitted along the bottom. The arris line, top front shall be straight and true with no variation from a straight line greater than $\frac{1}{8}"$. The arris lines at the bottom of the face shall be straight and true so that not over 1" shall show between the stone and a straightedge for the full length of the stone. The ends shall be square to the length at the face and so finished that when the stones are placed end to end, no space more than $1\frac{1}{2}"$ will show in the joint for the width of the face.

When Type 5 Curbing is required on a curve, the pieces shall be shaped as described in the table on the Standard Detail plans.

712.05 **Preformed Plastic**

Type of Material - This section covers reflectorized plastic materials preformed into rolls or ribbons of various lengths, pliability, and widths suitable for use as reflecting pavement markings on Portland Cement concrete or hot mix asphalt pavement. The pavement marking material used shall be from the Department's QPL and have been tested through AASHTO Product Evaluation & Audit Solutions.

General Characteristics - The preformed marking materials shall consist of white or yellow films with pigments selected and blended to provide the appropriate highway colors for traffic markings. Glass or ceramic beads shall be incorporated to provide immediate and continuing retroreflection. The size,

quality, and refractive index of the beads shall be such that the performance requirements of this specification shall be met.

The edges of the preformed material shall be clean cut and true. The preformed plastic material may be supplied complete with a precoated, factory applied adhesive for immediate pavement application without the use of heat, solvent, or other types of adhesive for immediate pavement application without the use of heat, solvent, or other types of adhesive operations or it may be furnished with separate adhesives as recommended by the manufacturer.

The affixed material shall be capable of molding itself to the pavement contoured by the action of traffic and maintain its original dimensions and placement under normal traffic conditions at the pavement temperatures, which could occur within the State. After application, the markings shall be immediately ready for traffic.

Physical Requirements - Color - Pigments shall be selected and blended to conform to standard highway colors throughout the expected life of the material. When tested by Federal Test Method Standard 141 Method 4232, the white shall be no darker than Color Number 37778 of Federal Standard Number 595 and the yellow shall conform to Color Number 33538 of Federal Standard Number 595 (Highway Yellow Color PR#1).

Retro-reflectivity - The retro-reflective preformed film shall have a layer of reflective spheres bonded to the top surface. The white and yellow film shall have the following initial minimum retro-reflectance values at 0.2° and 0.5° observation angles and 86° entrance angle as measured in accordance with the photometric testing procedures of ASTM D4061.

Retro-reflectance values shall be expressed as specific luminance in millicandelas per square meter per lux ($mcdm^{-2}lx^{-1}$) [millicandelas per square foot/foot-candle ($mcd ft^{-2}fc^{-1}$)]

	White		Yellow	
Observation Angle	0.2°	0.5°	0.2°	0.5°
SL [$mcdm^{-2}lx^{-1}$] [$mcd ft^{-2}fc^{-1}$]	550	380	410	250

The test distance shall be 50 ft and the sample size a 2 by 2½ ft rectangle. The angular aperture of both the photoreceptor and light Projector shall be 10 minutes of arc. The reference center of the sample and the reference axis shall be taken perpendicular to the test sample.

Bead Retention - When tested with a 2 by 6" sample bent over a ½" diameter mandrel with the 2" dimension perpendicular to the mandrel axis, microscopic examination of the arc on the mandrel shall show no more than 10% of the beads are entrapped in the binder and less than 40% of the surface of the bead.

Application - The preformed plastic material shall be capable of application to non-defective pavement surfaces that are dry and free from dirt or other foreign matter. For normal application, the pavement temperature should be at least 60°F and rising.

Special instructions should be supplied by the vendor for application to be made at pavement temperatures below 60°F. Application shall be according to manufacturer's recommended procedures. Plastic pavement marking materials shall only be applied to surfaces with temperatures within the range specified by the manufacturer for optimum adhesion.

Adhesive, activators or special coatings for various types of pavement surfaces - shall be provided with the preformed plastic material. Detailed information must be supplied with the material outlining required application procedures for such adhesives, activators, or special coating.

Preformed plastics - shall be capable of being applied to new asphalt pavement immediately prior to the final rolling of the new surface and of being rolled into place with conventional pavement and highway rollers. The plastic material and adhesives used in such applications shall be of the type that water used on the roller to prevent asphalt pickup shall not be harmful to the successful application of the plastic.

Special equipment - necessary for the successful installation of any preformed plastic material shall be available from the manufacturer of the plastic material on a lease, loan, or purchase basis.

Longitudinal lines - shall be offset at least 2" from construction joints of Portland Cement concrete pavement. When directed by the Resident, opening of 6" lengths shall be left at 20 ft intervals in edge lines not inlaid into the pavement surface that are placed on the inside of superelevated curves so as to prevent the ponding of water on the pavement surface.

712.06 **Precast Concrete Units** - Precast concrete units shall conform to the plan dimensions and shall meet the requirements of AASHTO M 199 except as modified below.

Approved structural fibers may be used as a replacement of 6 x 6 #10 gauge welded wire fabric when used at an approved dosage rate for the construction of manhole and catch basin units. The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List of Macro Synthetic Fibers for Concrete Reinforcement.

Cement shall conform to Section 701. An approved air-entraining admixture shall be added to obtain the required air content.

Aggregates shall meet the quality requirements of Section 703.01 - Fine Aggregate for Concrete and Section 703.02 - Coarse Aggregate for Concrete except that limitations on grading and the fineness modulus may be omitted.

The concrete mix design shall be approved by the Department. Concrete shall contain 6.0% air content, plus or minus 1.5% tolerance when tested according to AASHTO T 152. All concrete shall develop a minimum compressive strength of 4000 psi in 28 Days when tested according to AASHTO T 22. The absorption of a specimen, when tested according to AASHTO T 280, Test Method "A", shall not exceed 9.0% of the dry mass.

712.061 **Structural Precast Concrete Units** - Shall be made per Standard Specification Section 534

712.07 **Catch Basin and Manhole Frames, Grates and Covers, Drainage, Sewer, Utility, and related castings** - shall conform to the plan dimensions and shall be gray iron or ductile iron castings conforming to the requirements of AASHTO M 306.

712.08 **Corrugated Metal Units** - The units shall conform to plan dimensions and the metal to AASHTO M 36/M 36M. Bituminous coating, when specified, shall conform to AASHTO M 190 Type A.

712.09 **Catch Basin and Manhole Steps** - Steps for catch basins and for manholes shall conform to ASTM C478M [ASTM C478], Section 13 for either of the following material:

- (a) **Aluminum steps** - ASTM B221M, [ASTM B211] Alloy 6061-T6 or 6005-T5.
- (b) **Reinforced plastic steps** - Steel reinforcing bar with injection molded plastic coating copolymer polypropylene. Polypropylene shall conform to ASTM D4101.

712.10 – 712.22 **Removed**

712.23 **Flashing Lights** - Flashing Lights shall be power operated or battery operated as specified.

- (a) Power operated flashing lights shall consist of housing, adapters, lamps, sockets, reflectors, lens, hoods and other necessary equipment designed to give clearly visible signal indications within an angle of at least 45° and from 10 to 300 ft under all light and atmospheric conditions.

Two circuit flasher controllers with a two-circuit filter capable of providing alternate flashing operations at the rate of not less than 50 nor more than 60 flashes per minute shall be provided.

The lamps shall be 650 lumens, 120 volt traffic signal lamps with sockets constructed to properly focus and hold the lamp firmly in position.

The housing shall have a rotatable sun visor not less than 7" in length designed to shield the lens.

Reflectors shall be of such design that light from a properly focused lamp will reflect the light rays parallel. Reflectors shall have a maximum diameter at the point of contact with the lens of approximately 8".

The lens shall consist of a round one-piece convex amber material which, when mounted, shall have a visible diameter of approximately 8". They shall distribute light and not diffuse it. The distribution of the light shall be asymmetrical in a downward direction. The light distribution of the lens shall not be uniform, but shall consist of a small high intensity portion with narrow distribution for long distance throw and a larger low intensity portion with wide distribution for short distance throw. Lenses shall be marked to indicate the top and bottom of the lens.

- (b) Battery operated flashing lights shall be self-illuminated by an electric lamp behind the lens. These lights shall also be externally illuminated by reflex-reflective elements built into the lens to enable it to be seen by reflex-reflection of the light from the headlights of oncoming traffic. The batteries must be entirely enclosed in a case. A locking device must secure the case. The light shall have a flash rate of not less than 50 nor more than 60 flashes per minute from minus 20°F to plus 150°F. The light shall have an on time of not less than 10% of the flash cycle. The light beam projected upon a surface perpendicular to the axis of the light beam shall produce a lighted rectangular projection whose minimum horizontal dimension shall be 5° each side of the horizontal axis. The effective intensity shall not have an initial value greater than 15.0 candelas or drop below 4.0 candelas during the first 336 hours of continuous flashing. The illuminated lens shall appear to be uniformly bright over its entire illuminated surface when viewed from any point within an angle of 9° each side of the vertical axis and 5° each side of the horizontal axis. The lens shall not be less than 7" in diameter including a reflex-reflector ring of ½" minimum width around the periphery. The lens shall be yellow in color and have a minimum relative luminous transmittance of 0.440 with a luminance of 2854 Kelvin. The lens shall be one-piece construction. The lens material shall be plastic and meet the luminous transmission requirements of this specification. The case containing the batteries and circuitry shall be constructed of a material capable of withstanding abuse equal to or greater than 1.21 mm thick steel [No. 18 U.S. Standard Gauge Steel]. The housing and the lens frame, if of metal shall be properly cleaned, degreased and pretreated to promote adhesion. It shall be given one or more coats of enamel which, when dry shall completely obscure the metal. The enamel coating shall be of such quality that when the coated case is struck a light blow with a sharp tool, the paint will not chip or crack and if scratched with a knife will not powder. The case shall be so constructed and closed as to exclude moisture that would affect the proper operation of light. The case shall have a weep hole to allow the escape of moisture from condensation. Photoelectric controls, if provided, shall keep the light operating whenever the ambient light falls below 215 lx [20 foot-candles]. Each light shall be plainly marked as to the manufacturer's name and model number.

If required by the Resident, certification as to conformance to these specifications shall be furnished based on results of tests made by an independent testing laboratory. All lights are subject to random inspection and testing. All necessary random samples shall be provided to the Resident upon request without cost to the Department. All such samples shall be returned to the Contractor upon completion of the tests.

712.24 – 712.31 **Removed**

712.32 **Copper Tubing** - Copper tubing and fittings shall conform to the requirements of ASTM B88M Type A [ASTM B88, Type K] or better.

712.33 **Non-metallic Pipe, Flexible** - Non-metallic pipe and pipe fittings shall be acceptable flexible pipe manufactured from virgin polyethylene polymer suitable for transmitting liquids intended for human or animal consumption.

712.34 **Non-metallic Pipe, Rigid** - Non-metallic pipe shall be Schedule 40 polyvinylchloride (PVC) that meets the requirement of ASTM D1785. Fittings shall be of the same material.

712.341 **Metallic Pipe** - Metallic pipe shall be ANSI, Standard B36.10, Schedule 40 steel pipe conforming to the requirements of ASTM A53 Types E or S, Grade B. End plates shall be steel conforming to ASTM A36/A36M.

Both the sleeve and end plates shall be hot dip galvanized. Pipe sleeve splices shall be welded splices with full penetration weld before galvanizing.

712.35 **Epoxy Resin** - Epoxy resin for grouting or sealing shall consist of a mineral filled thixotropic, flexible epoxy resin having a pot life of approximately one hour at 50°F. The grout shall be an approved product suitable for cementing steel dowels into the preformed holes of curb inlets and adjacent curbing. The sealant shall be an approved product, light gray in color and suitable for coating the surface.

712.36 **Hot Mix Asphalt Curb** - The performance graded asphalt binder for hot mix asphalt curb shall meet a PG 58-28 or a PG 64-28. The aggregate shall conform to the requirements of Subsection 703.07. The coarse aggregate portion retained on the No. 8 sieve may be either crushed rock or crushed gravel.

The mineral constituents of the hot mix asphalt shall be sized and graded and combined in a composite blend that will produce a stable durable curbing with an acceptable texture.

Hot Mix Asphalt for curb shall meet the requirements of Section 403 - Hot Mix Asphalt Pavement.

712.37 **Precast Concrete Slab** - Portland Cement concrete for precast slabs shall meet the requirements of Section 502 - Structural Concrete, Class A.

The slabs shall be precast to the dimension shown on the plans and cross section and in accordance with the Standard Detail plans for Concrete Sidewalk

Slab. The surface shall be finished with a float finish in accordance with Subsection 502.14(c). Lift devices of sufficient strength to hold the slab while suspended from cables shall be cast into the top or back of the slab.

- 712.38 **Stone Slab** - Stone slabs shall be of granite from an acceptable source, hard, durable, predominantly gray in color, free from seams which impair the structural integrity and be of smooth splitting character. Natural color variations characteristic of the deposit will be permitted. Exposed surfaces shall be free from drill holes or indications of drill holes. The granite slabs in any one section of backslope must be all the same finish.

The granite slabs shall be scabble dressed or sawed to an approximately true plane having no Projections or depressions over ½" under a 2 ft straightedge or over 1" under a 4 ft straightedge. The arris at the intersection of the top surface and exposed front face shall be pitched so that the arris line is uniform throughout the length of the installed slabs. The sides shall be square to the exposed face unless the slabs are to be set on a radius or other special condition which requires that the joints be cut to fit, but in any case shall be so finished that when the stones are placed side by side no space more than ¾" shall show in the joint for the full exposed height.

Lift pin holes in all sides will be allowed except on the exposed face.

SECTION 713 - STRUCTURAL STEEL AND RELATED MATERIAL

- 713.01 **Structural Steel** - Highway bridge steel shall meet the requirements of AASHTO M 270. The grade of steel shall be as specified on the plans.

Main load-carrying components subject to tensile stresses or stress reversal shall meet the notch toughness requirements in AASHTO M 270M, Table 11, Zone 2, for non-fracture critical steel or Table 12, Zone 2 for fracture critical steel. Frequency of tension tests shall comply with the requirements of S1.

IMPACT TEST SAMPLING AND TESTING PROCEDURES SHALL BE IN ACCORDANCE WITH AASHTO T 243 M/T 243 AND AASHTO T 244.

Steel for ancillary bridge products and steel structures shall conform to AASHTO M 270 or one or more of the following:

- ASTM A36
- ASTM A572
- ASTM A588
- ASTM A53
- ASTM A500
- ASTM A595 Grade C
- ASTM A786
- ASTM A847
- ASTM A992

Ancillary bridge products shall be as described below:

- (a) bearings
- (b) drainage components
- (c) expansion devices (gland seal, compression seal, finger joint)
- (d) modular expansion devices
- (e) steel bridge rail
- (f) catwalks and inspection walkways

713.02 **High Strength Bolts** - Bolts shall conform to the requirements of ASTM F3125, Grade A325, Type 1 or Type 3. Type 3 bolts shall be supplied for all structures utilizing unpainted AASHTO M 270M weathering steel. Type 1 galvanized bolts shall be used for all structures utilizing metallized or galvanized steel.

Nuts shall meet the requirements of ASTM A563.

Circular and beveled washers shall conform to the requirements of ASTM F436.

Direct Tension Indicators (DTI'S) shall conform to the requirements of ASTM F959. DTI's for use with painted steel shall have a plain "as fabricated" finish. DTI's for use with unpainted steel shall be galvanized to the requirements of ASTM B695 Class 50, Type I and have a fusion-bonded epoxy coating. DTI's used with galvanized steel, metalized steel and steel coated with a zinc-rich primer shall be galvanized to the requirements of ASTM B695 Class 50, Type I.

"Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies shall meet the requirements of ASTM F3125, Grade F1852.

Bolts, nuts and washers specified to be galvanized, shall be galvanized in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695 Class 50, Type I.

All fastener (bolts and nuts), whether black or galvanized, shall be coated with a suitable lubricant. Galvanized nuts shall be lubricated with a lubricant containing a visible dye.

Each lot of bolts, nuts, washers and DTI's shall be tested by the manufacturer in accordance with the tests tabulated in Table 1 - Test Schedule. The testing frequency for bolts, nuts and washers from each shipping lot of fasteners shall be as specified in the applicable AASHTO/ASTM Standard Specifications. The testing frequency for each production lot of DTI's shall be as specified in ASTM F959.

TABLE 1 - TEST SCHEDULE*

Bolts	Tensile Strength (Wedge Test) Proof Load Hardness Coating Thickness	ASTM F606 ASTM F606 ASTM F606 ASTM B695
Nuts	Proof Load Hardness Coating Thickness	ASTM F606 ASTM F606 ASTM B695
Washers	Hardness Coating Thickness	ASTM F606 ASTM B695
DTI's	Coating Thickness Compression Load	ASTM B695 ASTM F959
* The supplier(s) shall submit test reports for all testing required in this Table. Test reports shall contain, in addition to the test results, the name and address of the testing agency, the manufacturer, lot tested, and Mill Test Reports for all steel used in the manufacture of the fastener assemblies and DTI's.		

The supplier shall perform, or cause to be performed a Rotational Capacity Test (RCT) for every production lot combination of bolts, washers and nuts. Each combination shall be designated with a unique RCT lot number. The test results shall be furnished to the Engineer.

713.03 **Preformed Pads** - Preformed pads shall be made with new unvulcanized rubber and unused fabric fibers and shall be approximately 1/8" thick after compression and vulcanizing with a proportion of fiber content sufficient to maintain strength and stability. The surface hardness shall be 85 to 95 Shore A Durometer. The ultimate breakdown limit of the pad under compressive loading shall be no less than 10,000 psi.

713.04 **Bronze or Copper-Alloy Bearing and Expansion Plates** - Bronze bearing and expansion plates shall conform to the requirements of AASHTO M 107 (ASTM B22), Alloy No. 911 and copper alloy bearing and expansion plates shall conform to the requirements of AASHTO M 108, (ASTM B100) Alloy No. 510 or 511, unless otherwise specified. The bearing surface(s) subject to sliding action shall be provided with trepanned recesses (not grooves) filled with a lubricating compound. The lubricating compound shall consist of graphite and metallic substances with a lubricating binder capable of withstanding the atmospheric elements. The compound shall be pressed into the recesses to form dense, non-plastic lubricating inserts.

The lubricating area shall comprise between 25% and 35% of the total area of the plate subject to sliding action. The sliding surface(s) shall be planed parallel to the prevailing direction of movement of the structure and subsequently polished, unless detailed otherwise.

713.05 **Cold-finished Carbon Steel Shafting** - Cold-finished carbon steel shafting shall conform to the requirements of AASHTO M 169. Grade Designation 1021-1030 inclusive, cold drawn, either semi-killed or fully-killed, shall be furnished unless otherwise specified.

713.06 **Castings** - Gray iron castings, for use other than for drainage castings, (Section 712.07) shall conform to the requirements of AASHTO M 105. Class Number 35 shall be furnished unless otherwise specified.

Malleable iron castings shall conform to the requirements of ASTM A47. Grade Number 32510 shall be furnished unless otherwise specified.

Carbon Steel Castings for General Applications shall conform to the requirements of AASHTO M 103. The grade 70-36 of steel shall be used unless otherwise specified.

Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

Castings shall be boldly filleted at angles and the arrises shall be sharp and perfect.

All castings must be sand blasted or otherwise effectively cleaned of scale and sand to present a smooth, clean, and uniform surface.

713.07 **Metal Bin Type Retaining Wall** - The metal for bin type retaining wall members shall be galvanized and shall conform to the applicable requirements of AASHTO M 36.

When fiberglass, aramid or carbon graphite fiber coating is specified, the galvanized metal sheets used to form the retaining wall, except the base plates and connecting channels, shall additionally be coated on both sides with a layer of fiberglass, aramid or carbon graphite fibers applied in sheet form by pressing it into the molten spelter. Immediately after the metallic bond has solidified the fibers shall be thoroughly saturated with a bituminous saturant conforming to the following requirements:

Penetration at 77°F, 3.5 oz, 5 seconds	0.14 - 0.018"
Loss on heating at 325°F, 1.75 oz, 5 hours	Not more than 1.5%
Flash point (open cup)	Not less than 440°F
Penetration at 77°F, 3.5 oz, 5 seconds, of residue after heating at 325°F, as compared with penetration of asphalt before heating	Not less than 70%
Insoluble in carbon disulfide	Not more than 2%

Testing shall be in accordance with methods specified in AASHTO M 20.

Whenever possible in the manufacture of the units, a minimum forming radius of 1" is to be maintained. All units that are formed with less than 1" radius shall be hot-dipped galvanized after forming.

Bolts shall conform to the requirements of ASTM F568 Class 4.6 (ASTM A307) and galvanized in accordance with AASHTO M 232.

- 713.08 **Steel Extrusions** - Material for steel extrusions for expansion devices shall be ASTM A36/A36M, ASTM A588/A588M, or ASTM A242/A242M, except that ASTM A242/A242M shall not be used for extrusions that are to be welded.

SECTION 714 - JOINT SEALS

- 714.01 **Elastomer for Seal Elements** - The preformed elastomeric polychloroprene joint seal elements, both compression and gland type, shall conform to the requirements of AASHTO M 297.

- 714.02 **Fabric for Seal Elements** - Fabric used for reinforcement in a seal element shall be a non-wicking fabric conforming to the requirement of ASTM D578.

- 714.03 **Lubricant Adhesive** - The lubricant-adhesive shall be a 1 part, moisture curing, polyurethane and aromatic hydrocarbon solvent mixture and shall have the following physical properties:

Solids content	60 - 80% by weight
Service Range	5°F to 120°F minimum
Film Strength (ASTM D412)	1,200 psi minimum
Elongation at Break	250% minimum

Each lot of lubricant-adhesive shall be delivered in sealed containers plainly marked with the manufacturer's name or trademark and the date of manufacture. Maximum shelf life shall not exceed 6 months.

- 714.04 **Sealant** - The sealant shall be a one part, moisture curing, polyurethane base, non-sag, elastomeric product, conforming to the requirements of Federal Specification TT-S-0023OC(2), Type II, Class A or ASTM C920, Type S, Grade NS, Class 25.

Each lot of sealant shall be delivered in sealed containers plainly marked with the manufacturer's name or trademark and the date of manufacture. Maximum shelf life shall be as recommended by the manufacturer.

- 714.05 **Compression Seals** - Compression seals shall be multi-channel extruded shapes made of material conforming to the requirements of Section 714.01 - Elastomer for Seal Elements, and in a configuration as determined by each particular manufacturer and as shown in the Contract documents. The seal shall be marked on the top surface with the manufacturer's name or trademark, the lot number and the size designation at intervals of 5 ft or less. Actual seal

dimensions shall not differ from the nominal dimensions by more than 1/16"/inch of depth or width, or a maximum of 1/4" whichever is less.

The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.

- 714.06 **Gland Type Seals** - Gland type seals shall be single membrane extruded or molded shapes, made of material conforming to the requirements of Section 714.01 - Elastomer for Seal Elements and of a configuration as determined by each manufacturer and as shown in the Contract documents. The seals shall be marked on the top surface with the manufacturer's name or trademark, the lot number and the size designation at intervals of 5 ft or less. If fabric is used to reinforce the seal, it shall conform to the requirements of Section 714.02 - Fabric for Seal Elements.

The material used shall be one of the products listed on the Maine Department of Transportation's Qualified Products List.

SECTION 715 - LIGHTING MATERIAL

- 715.01 **Removed**

- 715.02 **Steel Conduit** - Galvanized steel conduit shall be of uniform thickness with scale-free, smooth circular bore to permit cutting of clean, true threads.

Steel conduit and couplings shall be Schedule 40 galvanized steel pipe conforming to the requirements of ASTM A53. Threaded couplings shall be conduit type permitting the end of conduits to fully abut each other squarely within the coupling. Other fittings for metal conduit, exclusive of bushings shall be threaded malleable iron conforming to the requirements of ASTM A338 and shall be galvanized in accordance with the requirements of AASHTO M 232.

All bushings shall be threaded, insulated grounding type.

- 715.03 **Non-Metallic Conduit** - Non-metallic conduit shall be rigid unplasticized polyvinylchloride conduit, suitable for Type II or Type III installations, whichever is required and shall conform to the standards of the NEMA or the UL.

- 715.04 **Prewired Conduit** - Prewired conduit will no longer be accepted

- 715.07 **Secondary Wiring** - Secondary wiring cables, including neutrals and grounding conductors, shall be 600 volt cables and shall consist of single conductor, stranded, soft-drawn or annealed copper wire, insulated with flame retardant, moisture and heat resistant thermoplastic material. The cable shall be UL approved and listed as THW, THWN or XHHW.

Wire shall be of sufficient size to allow a maximum voltage drop of 5% from source of power to the most remote luminaire. Phase identification shall be made by factory-applied color coding.

Terminal lugs shall be cast copper alloy, solderless, mechanical type.

All conduit connections in above ground junction boxes and light standards shall be made by connector kits, fused or nonfused, as indicated on the plans. Splices for the roadway lighting shall be made by straight through or wye connector kits as required. Where these connector kits cannot be used as verified by the Resident, connections on cables in junction boxes shall be made by splicing as described elsewhere. The connector kits shall be a quick disconnect type. Double connector kits shall be used where there is more than one phase conductor.

Fused "wye" connectors shall be composed of a "wye" line side housing assembled with a load side and fuse terminal housing. The housing shall be formed from water-resistant synthetic rubber. Each housing shall provide a water seal around the cables and when fully assembled shall form a watertight connector.

The interior shall be arranged to receive and retain line side wiring and the fuse contacts. The fuse contacts shall be spring-loaded copper designated for 30 amperes, 600 volts, shall have 90% minimum conductivity and shall be suitable for gripping 5 amperes or as designated on the plans, 600 volt cartridge type midget fuse approximately 13/32" in diameter and 1½" long. The contacts shall be fully annealed. The load side conductors shall be connected by crimping and the line side conductors shall be connected with screws. The connector shall be of the non-locking type that will break off under extreme tensile stress leaving no exposed metal contacts on the line side of the connector.

The cable diameter used will determine the size of each housing. The load side housing shall retain the fuse when disconnected.

Non-fused connectors shall be similar to the fused "wye" connectors. The cable diameter will determine the size of each housing of each connector.

Fuses for connectors shall be rated at 5 amperes or as indicated on the plans.

715.08 ***Luminaire LED fixtures*** -The luminaire shall be designed for the wattage rating and voltage indicated on the plans and for operating on a multiple circuit. All luminaires shall be new and be the product of the same manufacture

The LED shall have a minimum of 100,000 hours and have a 10 year warranty on the fixture and led modules.

Light color temperature shall be 5000-5500 k. Each fixture shall have a minimum of at least 2 separate light sources. Lenses or refractors shall be guaranteed not to yellow for a period of 20 years. Fixtures shall be IES full cutoff. Lm 80 test data shall be supplied in the bid package

The LED fixtures must be equipped with a Smart Driver. The Smart Driver shall provide current regulation for individual light clusters. Current accuracy over the LED operating temperature range must be +/- 3%. It shall have over temperature

protection, shut down at critical temperature and resume operation temperature. Under voltage lockout for power off or brownout.

The line side of each fixture/ retrofit must have surge suppression that meets or exceeds ANSI/IEEE C62.41-2002 Category C-.

Led fixtures shall have a lamp lumen depreciation of no more than (LLD) 15% over 52,000 hours, 12 years.

On any Contract supplying at least 10 light fixtures 1 additional spare fixture for each 10 fixtures shall be supplied to Maine Department of Transportation.

715.09 ***Luminaire, Lamp and Ballast for High Mast Lighting*** - Shall conform to 715.08. The luminaire shall provide ANSI-IES Type I, Type IV, or Type V distributions.

715.10 ***Photo Electric Control*** - The control shall meet the following minimum requirements:

- a. ***Unit Design*** - The photoelectric unit shall consist of a light sensitive element connected directly to a control relay without intermediate amplifications. The unit shall be zenith sensing type.
- b. ***Housing*** - The photoelectric control shall be housed in a weatherproof housing.
- c. ***Operating Levels*** - The operating levels shall be factory set to turn on at approximately 2.0 foot-candles and off at approximately 6.0 foot-candles.
- d. ***Supply Voltage*** - The control shall be capable of operation on a supply voltage of 105 to 285 volts.
- e. ***Base*** - The base of the unit shall be provided with a 3-prong, EEL-NEMA standard twist lock plug mounting.
- f. ***Directional Design*** - The control shall be oriented in a northerly direction according to the manufacturer's recommendation.
- g. ***Surge Protection*** - The unit shall have a built-in surge protective device for protection from induced high voltage and follow through currents.

715.11 ***Service Equipment*** - The service pole or service rack and other entrance equipment shall be as detailed on the plans. All service equipment new or upgraded shall be marked with an appropriate arc flash plaque or decal with the following information :

- Flash hazard boundary
- Cal/cm² hazard at 18"
- PPE level
- Shock hazard when cover is
- Limited approach boundary
- Restricted approach boundary
- The prohibited approach boundary

This shall be located on the outside of the equipment and shall be visible, weatherproof, and fade resistant, and not easily removed.

All new controller cabinets, traffic signal or lighting, shall be configured to eliminate arc flash. All electrical equipment will be dead front, no open terminals, bus bars, breakers, or exposed terminal strips.

All live parts over 50 volts shall be covered with Lexan or a suitable barrier to eliminate the possibility of an arc flash.

The control cabinet shall be fabricated from cast aluminum, sheet aluminum, galvanized steel, or stainless steel. The following are required:

- a. Hinged cover with weather protected hasp for padlocking. The lock will be provided by others.
- b. Mounting brackets.
- c. Suitable bossed and threaded holes in the case wall for conduit installation.
- d. Independent single pole magnetic trip circuit breakers.
- e. Manual control switch.
- f. Lightning arresters in load and line side - rated 650 Volts RMS, indoor type.
- g. **Contactor** - One double pole, single throw solenoid (shall be non-mercury) contactor with contacts rated at the voltage and amperes shown on the plans. The coil shall be capable of operating at the voltage shown on the plans, 60 hertz. The contactor shall be normally open unless otherwise specified. The contacts shall be mercury.
- h. Ground rods shall be copperclad steel or galvanized, 5/8" diameter, 8 ft long, complete with ground clamp and square head bolt.

Dry-Type transformers shall be designed for indoor and outdoor installation. The following are required:

- a. 25 KVA rating, 120/240 volt primary, 240/480 volt secondary, single phase 3 wire system, if single phase service is supplied.
- b. Frequency - 60 hertz.
- c. Key-hole mounting slots and lifting groove.
- d. Insulation system for 239°F rise at 104°F ambient.
- e. Wiring compartment located on bottom front of unit. Access through a single cover.
- f. Heat barrier to protect connecting cables.
- g. Connecting leads to extend 6" from box and identified with metal tags.
- h. Core and coils to be contained within a non-ventilated weatherproof enclosure.
- i. Conduit knockouts to be located on bottom, back and sides of wiring compartment.
- j. Maximum sound level to be 40 decibels.

Rack-mounted circuit breakers shall be enclosed in NEMA 3R enclosures with rain-tight hubs. The breakers shall be rated for 3 pole, 125 amperes, 600 volt, 4 wire service. Lugs for padlocking shall be supplied.

The service entrance rack shall be constructed as shown on the plan. Minor modifications will be permitted, if approved by the Resident to accommodate variations in equipment dimensions. Lumber shall be as shown on the plan. Bolts and hardware shall be hot-dipped galvanized steel.

- 715.12 ***Lowering System for High Mast Lighting*** - Each pole shall be furnished with a mechanical lowering system operated by cables and an electrically operated winch that will permit servicing of the luminaires and associated electrical and mechanical apparatus from the ground. Lowering systems shall permit lowering of the complete assembly, including luminaires, ballasts, fuses, and other apparatus, which may require periodic inspection or servicing, to a height of 5 ft or less above the pole base plate.

At the top of the pole shaft there shall be mounted a detachable head assembly which remains fixed in position during the raising and lowering operation. The head assembly shall consist of 3 or more symmetrically located fixed support arms, which will carry the weight of the lowering assembly. The fixed head assembly shall incorporate no moving parts except for the necessary pulleys, rollers, or sheaves that guide the lowering cables and electrical cable during the lowering operation of the assembly. The fixed head assembly and luminaire lowering ring shall be galvanized steel. All required pulley rollers or sheaves and associated bearings, bushings and shafts shall be constructed of highly corrosion resistant materials not relying upon plating of the parent material for corrosion protection. All pulleys and rollers attached to the head assembly shall have permanently lubricated bearings or bushings.

All parts of the head assembly shall be protected with covers, screens, shields, as necessary, to prevent entrance of dirt, moisture, ice accumulation, nesting of insects or birds or other contaminants harmful to the operation of the lowering device.

All miscellaneous fittings, fasteners, or hardware shall be fabricated from corrosion resistant materials that do not rely on plating for their corrosion protection.

A lightning rod of approved design shall be attached to the top of each pole and shall be firmly attached to the pole shaft or head assembly to provide good electric bonding to the pole shaft.

The entire luminaire lowering ring assembly shall be raised and lowered by three or more symmetrically placed stainless steel aircraft type cables located inside the pole shaft and extending through the head assembly support arms and attached to the lowering ring. Electrical cable supplying energy from the base of the pole to the luminaire ring shall be rough service mining type cable consisting of 3-600 volt conductors assembled with a messenger into a single cable. No electrical disconnect shall be permitted at the top of the pole. In addition, a stainless steel guide cable or equivalent shall be attached to the inside of the pole shaft to prevent the twisting of the lowering and electrical cables during the

raise-lower operation. Each of the stainless steel lowering cables shall be capable of supporting the entire lowering assembly.

When the luminaire ring assembly is in the fully raised position, a mechanism for securing the luminaire ring to the head assembly shall be provided. Such mechanism shall provide support for the lowering ring and shall latch the ring to the head assembly thus permitting the removal of all tension on the cables. All mechanisms shall be designed to provide the operator with a positive means of ascertaining when the raising operation is complete and the ring assembly is in the proper resting position.

The inner portion of the lowering ring shall be equipped with a protective bumper or roller system which will prevent damage to the pole shaft surface and preclude excessive swing during the lowering-raising operation.

Winches shall be operated by an appropriately geared 120 volt electric drive motor with adjustable torque limiter that can be easily hand-transported. One drive motor assembly shall be furnished which will operate all units. A rubber covered heavy-duty type "SO" rated 600 volt cable with connectors shall be provided to test the luminaires when they are in a fully lowered position.

An approved junction box shall be installed in the hand hole of each pole that will accommodate the terminations of the underground cable with the cable in the pole serving the luminaires and to include a 480 volt grounded receptacle.

Secondary lightning arresters shall be rated for 650 volts RMS and shall be designed for outdoor use. The arresters shall be installed in each phase conductor to ground and shall be attached in or on the luminaire lowering device in a location accessible for inspection and servicing when the device is lowered.

SECTION 716 - STRUCTURAL ALUMINUM AND RELATED MATERIAL

716.01 *Aluminum Railings*

- a. ***Aluminum Extrusions*** - Traffic rails, hand rails, splice bars, and pales brackets shall conform to the requirements of ASTM B221, Alloy 6061-T6 or 6351-T5. Post and post bases shall conform to the requirements of ASTM B221, Alloy 6061-T6. Pales shall conform to the requirements of ASTM B429 Alloy 6063-T5. Washers shall conform to the requirements of ASTM B209, Alloy Alclad 2024-T4.
- b. ***Aluminum Rivets*** - Rivets shall conform to the requirements of ASTM B316, Alloy 6061-T6 (cold heading). Rivets shall have a button type manufactured head. Self-plugging, aluminum blind fasteners for pale panels shall meet the following requirements: 1) Sleeve-ASTM B211, Alloy 5056 (Stabilized), 2) Pin - ASTM B211, Alloy 2017 (Naturally Aged). The driven fastener shall meet the requirements for ultimate shear and tensile strength of Military Specification MIL-R-7885.

- c. **Miscellaneous Aluminum Parts** - Rail caps shall be either sand cast or permanent-mold cast and shall conform to the requirements of ASTM B26 or ASTM B108, Alloy A356-T6. All aluminum bars and plates shall conform to the requirements of ASTM B209, Alloy 6061-T6. Standard structural shapes conform to the requirements of ASTM Specification B308.
- d. **Steel Anchor Assembly** - Steel spacers for post anchors shall conform to the requirements of ASTM A36. Nuts embedded in concrete shall conform to the requirements of ASTM A307.

Anchor bolts, exposed nuts and washers shall conform to the requirements of ASTM A449 or ASTM F1554, Grade 55 and shall be galvanized in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695, Class 50, Type I.
- e. **Stainless Steel Parts** - Cap screws, for fastening clamp bars and set screws for pale-panel brackets shall conform to the requirements of ASTM F593, Alloy Group 1, Condition CW.

SECTION 717 - ROADSIDE IMPROVEMENT MATERIAL

717.01 **Fertilizer** - Fertilizer shall be commercial fertilizer having available elements in conformity with the standards of the Association of Official Agricultural Chemist. The fertilizer shall be furnished in unopened bags with the weight, contents, and guaranteed analysis shown there on or on a securely attached tag.

- a. **Grass Seed Fertilizer** - shall be

Property	Specification	Breakdown of Property
Nitrogen (N)	23%	At least 50% from slow release sources
Phosphorus (P)	0%	No phosphorus
Potassium (K)	12%	40% from potassium magnesium sulphate
Iron (Fe)	1%	From iron sulphate

- b. **Slow Release Fertilizer Tablets** - Planting Tablets shall be a long lasting 20-10-5 plus minors $\frac{3}{4}$ oz tablet.
- c. **Water Soluble Fertilizer** - shall be:

Property	Specification
Nitrogen	20%
Phosphorus	10%
Potassium	20%

Completely water soluble, non-corrosive, without chlorides or carbonates, and containing a color tracer dye.

717.011 **Humic Acid Soil Conditioner** - Humic Acid Soil Conditioner shall come from naturally occurring dry granular unaltered oxidized lignite, also called Humate, or equivalent product approved by the department's landscape architect, crushed to a particle size which passes a US standard 7 mesh screen [$\frac{1}{8}$ "]. Humate or equivalent product shall have a Humic Acid equivalent content of 70% (by weight).

717.02 **Agricultural Ground Limestone** - Agricultural ground limestone shall have the following mechanical analysis:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
No. 10	100
No. 20	90-100
No. 100	50-100
Total Carbonates	≥ 80

Agricultural ground limestone may be shipped in containers or in bulk. Packaged material shall be delivered in the manufacturer's standard containers. The containers shall be new and so constructed to assure safe arrival at the site. The net weight of the contents shall not exceed 100 lb per container. The manufacturer's name, a guarantee analysis, and the net weight shall appear on each container. Bulk shipments shall be accompanied by certificates stating manufacturer's name, weight, and guarantee analysis.

Liquid lime may be substituted for agricultural ground limestone when seeding hydraulically. Liquid lime shall be water soluble and contain the following analysis:

Property	Specification
Elemental Calcium (Ca)	19%
Nitrogen (N)	15.5 % of which 1% is from Ammoniacal Nitrogen and 14.5 % is from Nitrate Nitrogen

Liquid lime shall be delivered in the manufacturer's unopened containers. The manufacturer's name, a guaranteed analysis, and the quantity shall appear on each container.

717.03 **Seed** - All seed shall be certified as to mixture, germination, purity, and live seed. Each variety shall conform to the following:

Property	Specification
Germination	>80%
Pure Live Seed	>85%
Purity	>85%
Weed Seed	<1.0%

All seed shall be from the current year's crop unless recent tests by an approved testing agency demonstrate that older seed meets the above requirements.

Seed Mixtures shall consist of seed proportioned percent by weight as follows:

Method #1 - Park Mixture	
Property	Specification
Creeping Red Fescue	45% +/- 4%
Kentucky Bluegrass	25 +/- 4%
Chewings Fescue	15 +/- 4%
Perennial Ryegrass	10 +/- 2%
Annual Ryegrass	5 +/- 2%
Method #2 - Roadside Mixture #2	
Property	Specification
Red Fescue	35% +/- 4%
Sheep Fescue	35% +/- 4%
Red Top	5% +/- 2%
White Clover	6% +/- 2%
Annual Rye	19% +/- 2%
Method #3 - Roadside Mixture #3	
Property	Specification
Crown Vetch	50% +/- 4%
Perennial Lupine	25 % +/- 4%
White Clover	4% +/- 4%
Perennial Rye Grass	21% +/- 4%

717.04 **Mulch**

- (a) **Hay mulch** - shall consist of long fibered hay, reasonably free from weeds and other undesirable material. No material shall be used which is so wet, decayed or compacted as to inhibit even and uniform spreading. No chopped hay, grass clippings, or other short fibered material shall be used unless directed.
- (b) **Straw mulch** - shall consist of long fibered straw derived from oats, wheat, rye or other cultivated grains, reasonable free from weeds and other undesirable material. No material shall be used which is so wet, decayed or compacted as to inhibit even and uniform spreading. No chopped hay, grass clippings, or other short fibered material shall be used unless directed.

- (c) **Cellulose fiber mulch** - shall consist of elongated wood fibers from virgin or recycled sources and post-consumer newsprint. The woods fibers shall be tested to show no lead, asbestos or other heavy metals exceeding EPA toxic levels. Cellulose fiber mulch shall be free of refuse, physical contaminants, and material toxic to plant growth. Cellulose fiber shall not contain more than 30% post-consumer newsprint.
- (d) **Bark mulch** - shall consist of soft wood bark fragments that have been aged for at least 6 months. Bark mulch shall be free of refuse, physical contaminants, material toxic to plant growth, and reprocessed wood products. Bark mulch shall be a well-graded material conforming to the following:

Property	Specification
pH	4.0 to 8.0
2" Sieve Designation	100% passing
Soluble Salts Content	<4.0 mmhos/cm

- (e) **Erosion control mix** - shall be an organic substance of source separated materials, separated at the point of waste generation that may include; forest residues, bark, paper mill flume grit, stump grindings and aged wood waste. Erosion control mix shall be free of refuse, physical contaminants, material toxic to plant growth, and reprocessed wood products. Erosion control mix may contain rocks less than 4" in diameter and shall be a well graded material conforming to the following:

Property	Specification
pH	5.0 to 8.0
6" Sieve Designation	100% passing
¾" Sieve Designation	75 to 85% passing
Soluble Salts Content	<4.0 mmhos/cm
Organic Matter	20 to 100%, dry weight basis

- (f) **Stone mulch** - shall be clean native stone free of refuse, physical contaminants, material toxic to plant growth, and limestone. Stone mulch shall conform to the following:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
¾"	100
¼"	0-10

717.05 **Mulch Binder** - Shall consist of a commercially developed product for the tacking of hay or straw. Binder shall be free of refuse, physical contaminants, material toxic to plant growth, or asphalt. Paper fiber mulch may be used as a binder at the rate of 5 lb/unit. Paper fiber mulch shall consist of 100% post-consumer newsprint processed to be applied hydraulically.

717.061 **Erosion Control Blankets** - Shall consist of a machine produced rolled blanket of biodegradable fibers, evenly distributed over the entire area of blanket, of a consistent thickness, sewn into a biodegradable mesh on the top and bottom surface using a cotton blend thread. The blanket shall remain in place when subject to shear stress of 1.55 lb/ft². The blanket shall remain intact until grass is established. The blanket shall be a product currently listed on the department's Qualified Products List (QPL) of Rolled Erosion Control Products.

See Section 618.10 - Seeding, Maintenance and Acceptance.

717.063 **Ground Anchors** - Shall consist of metal staples or biodegradable stakes as recommended by the manufacturer of the erosion control blanket to be used.

717.07 **Herbicide** - The herbicide shall be an approved chemical registered in the State of Maine for the required treatment.

717.09 **Humus** - Humus shall be an organic substance meeting the following:

Property	Specification
pH	4.5 to 8.0
1" Sieve Designation	100% passing
Soluble Salts Content	<4.0 mmhos/cm
Organic Matter	35%, minimum
Dewar Self Heating	>5 stability

Humus may be a natural peat from sedge, sphagnum or reed origin, or compost from source separated materials that may include leaf and yard trimmings, food scrapes, food processing residues, manure and other agricultural residuals, or biosolids. Humus shall contain no visible admixture of refuse or other physical contaminants or any material toxic to plant growth.

SECTION 718 - TRAFFIC SIGNALS MATERIAL

718.01 **Vehicular Signal Indications**

- a. **Vehicular signal heads for traffic signals and flashing beacons** - shall conform to or exceed the current edition of the ITE "Standard for Adjustable Face Vehicle Traffic Control Signal Heads." Each housing section shall be complete with a one-piece, hinged door mounting for the lens and other parts of the optical system, watertight gaskets, and simple door-locking device. The optical system shall be mounted so that the various parts may be swung open for ready access or removal. The sections shall be interchangeable and constructed so that sections can be removed or added. All new traffic signal (vehicular and/or pedestrian) heads shall have light emitting optical assemblies for all colors.

There shall be a round opening in the top and bottom of each head to receive 1½" supporting pipe frame. All parts of the housing, including the

doors and end plates shall be of die cast aluminum or polycarbonate free from flaws, cracks, blow holes, or other imperfections.

All exposed bolts, screws, hinge pins, and door-locking devices shall be stainless steel. All interior screws and fittings shall be stainless steel or approved nonferrous, corrosion-resistant material.

All gaskets, including door, optical assembly, exclusive of lampholder gaskets, shall be of neoprene. Lampholder gaskets shall be of a material unaffected by heat.

All light emitting diode optical assemblies shall be wired so that a white wire will be connected to the ground and black or colored wire to the terminal of the LED optical assembly. The wires shall in turn be connected to the terminal block mounted inside at the back of the housing. The terminal block shall have sufficient screw type terminals to terminate all field wires and lamp wires with separate screws. The terminals to which field wires are attached shall be permanently identified or the wiring shall be color coded to facilitate fieldwork. Each LED assembly shall be provided with a removable visor hood unless tunnel hoods or louvered hoods are specified on the plans. Hoods for 8" sections shall be 7" long, hoods for 12" sections shall be 9½" long.

All heads to be modified shall be retrofitted with light emitting diode optical assemblies for all colors.

When 2 or more vehicular signal heads or a combination of vehicular signal heads and pedestrian signal heads are installed on 1 pole, only 1 conduit riser shall be used. The signal heads shall not be connected together by the use of liquid tight flexible metal conduit and terminal fittings.

All new vehicular signal faces installed at any one intersection shall be of the same make and type.

LED optical assemblies for the 8" units shall be 650 lumen minimum initial output, 120 volt, 100,000 hour rated life, clear traffic signal lamps. Lamps for the 12" units shall be 1900 lumen minimum initial output, 120 volt, 100,000 hour rated life.

The intensity and distribution of light from each illuminated signal LED optical assembly shall conform to the latest revisions of the ITE "Standard for Adjustable Face Vehicle Traffic Control Signal Heads," and the "Standard for Traffic Signal LED."

- b. ***Programmed Visibility Vehicular Indications*** - The programmed visibility traffic signal vehicular indication shall optically determine the visibility zone of indication without the use of hoods or louvers. The Projected signal may be visible or selectively veiled anywhere within 15° of the optical axis.

The signal head shall be adjustable to various angles between 9° above and below horizontal. No indication shall result from external illumination and each indication shall be illuminated separately. The visibility of the signal indication shall be adjustable within the signal head to fit the lane or lanes in which traffic is to be controlled.

The illumination lamp shall be a nominal 150 watt, 115 volt AC, 3 prong, sealed beamed type, having an integral reflector and an average rated life of 6,000 hours. A dimming device shall be provided to reduce the candela at each signal head for nighttime operation to approximately 15% of the candlepower for daytime operation.

A circular reflector with a specular inner surface shall mate the lamp to a diffusing element.

An internal imaging surface shall be provided to permit an effective veiling system to be applied as determined by the desired visibility zone. The Contractor shall notify the Resident 48 hours prior to the application of the veiling system. The optical limited-diffuser shall be provided with positive indexing means and shall be composed of heat resistant glass.

The objective lens shall be a high resolution planar incremental lens thermetically sealed within a flat laminate of weather resistant acrylic. The lens outline shall be symmetrical. Lens colors shall conform to the latest ITE transmittance and chromaticity standards.

The signal shall be housed in cast aluminum or polycarbonate, conforming to the latest ITE alloy and tensile requirements. Each section shall have a sun visor. The cast aluminum shall have a chromate preparatory treatment before the application of green or yellow baked enamel prime and finish. The lens cover and the interior of the case shall be flat black. Hinge and latch pins shall be stainless steel. All access openings shall be sealed with weather resistant rubber gaskets.

The lamp fixture housing shall be readily accessible and lamp replacement shall not require special tools nor necessitate major disassembly.

Electrical connections between the case and lamp holder shall be an interlock assembly that disconnects the lamp holder when open. Number 16 wire shall be used to connect the lamp receptacle to the signal head terminal.

The signal head shall be capable of being mounted to standard 1½" fittings as a signal head section, as a multiple section face or in combination with other signal heads.

The signal section shall be provided with a rigid connection that permits tilting from at least 9° above or below the horizontal while maintaining a

common vertical line through couplers and conduit. No special tools should be needed for servicing or mounting.

- c. All exposed wiring for traffic signals, beacons, solar panels, etc. shall be IMSA 19-1 rated and be of sufficient size to carry the full load unless approved by the resident engineer

718.02 ***Pedestrian Signal Indications*** - All pedestrian signal head indications shall be displayed within a rectangular background and shall consist of symbolized messages (Upraised Hand and Walking Person).that shall be at least 6" high. All pedestrian heads shall be LED optical assemblies and shall have countdown displays.

LED optical assemblies shall be 1,900 lumen minimum initial output, 120 volt, 100,000 hour rated life.

When 2 or more pedestrian signal heads are installed on 1 wood pole, only 1 conduit riser shall be used. The pedestrian signal heads shall not be connected by the use of liquid tight flexible metal conduit.

Pedestrian signal heads which use fiber optic bundles to form the message shall achieve the color of the messages by filters between the light source and the optical bundles. The legends shall be 5" minimum in height with a 5/8" stroke. The housing materials shall conform to the requirements for conventional pedestrian signal housings. The message shall be illuminated by a light source designed to operate on a 120 volt source and shall be rated for 100,000 hour average life. The flashing message shall be accomplished by use of a solid-state flasher required for conventional pedestrian signal indications.

718.03 ***Signal Mounting*** - All trunnions, brackets, and suspensions used for assembling and mounting signal control faces shall be entirely weather tight. The inside area of the cross section of the tubular arms shall not be less than the inside area of 1½" IPS pipe to permit the signal control wires or cable to be inserted through them. For polycarbonate signal heads with 3 or more sections or requiring mounting extensions greater than 12" in length, reinforcing plates shall be used to reinforce the housings at the point of attachment. The bottommost section of a signal head assembly mounted on a pedestal pole shall have an aluminum housing.

After final adjustment, all vehicular and pedestrian signal heads, regardless of mounting arrangement, shall be fastened by a positive locking device acceptable to the Resident. This device shall prevent any deviation from the position set, but shall allow for readjustment of the signal head later in the same installation or in another installation without the necessity of damaging any part of the signal head.

718.04 ***Vehicular Loop Detectors*** - Vehicle detectors shall consist of wire loops and self-contained detection equipment capable of registering independently the presence or passage of any vehicle passing over the loop at any speed up to 70

mph and at any temperature between -35 and +165°F. Each loop detector shall contain its own integral power supply and shall operate between 95 VAC and 135 VAC. The input power shall be protected by fuse or resettable circuit breaker.

The detector amplifiers shall be self-tuning, solid state construction except for the output relay. Printed circuit design shall allow the components to be removed and replaced without permanent damage to the printed circuit boards or tracks.

Detector amplifiers installed in a common cabinet shall have a frequency difference and shall not interfere with the operation of other detector amplifiers installed in the same cabinet.

All input and output circuits for each amplifier shall enter by a single connector provided with a threaded shell. All controls, indicator lights, meters, fuse holders, circuit breakers and connectors shall be mounted on the front panel of the detector amplifier. All controls shall be adjustable without the use of tools and the controls shall be clearly and permanently identified.

The detector unit shall show a visible indication of vehicle calls. After a power interruption, the units shall return to normal operation within 30 seconds. If any vehicle stops over a portion of the loop registering a call, the detector shall be capable of detecting additional vehicles traversing the loop after approximately 15 seconds.

Detectors shall detect vehicles by lanes of traffic and shall not detect traffic moving away from the intersection when properly positioned in normal travel lanes. Detection must be positive and not erratic under all actual operating conditions with the exception of storm damage to the detector.

All detectors shall be capable of detecting all four-wheeled vehicles for all lengths of lead-in up to 750 ft for single detection loops and for a combined lead-in length of 750 ft in the case of multiple loops.

Detector loop wire shall be number 14 THWN stranded wire, moisture and heat resistant. Lead-in cable shall conform to the detector manufacturer's recommendations. The wire shall be encapsulated in vinyl tubing over its entire length.

No damage shall occur in the detector if the pavement loop or lead-in becomes short-circuited.

- 718.05 ***Microwave Detectors*** - Microwave detectors shall work on an operational frequency of 10.525 GHz. The detection method shall be microwave with adjustable patterns with a response time of 165 milliseconds and an adjustable hold time of 0.5 to 5 seconds. It shall be powered from 10 VAC to 24 VAC. All contacts shall be form C, 5 amp rated. The detector shall have a fail-safe microprocessor circuit so that if the unit fails it will place the controller in recall on the apparent phase.

718.06 ***Pedestrian Detectors*** - Pedestrian push button detectors shall be weatherproof and constructed to eliminate the possibility of electrical shock in all weather conditions.

The pedestrian push button detectors shall conform to MUTCD requirements.

718.07 ***Controllers***

All traffic signal controllers (controllers) shall be rack-mounted, solid state, menu driven, keyboard units conforming to the ATC 5201 v06.25 Advanced Transportation Controller (ATC) Standard. The controller shall be supplied with all necessary interfaces needed to support Advanced Transportation Controller Cabinet (ATCC) / Serial Interface Unit (SIU) communications. The controller shall be designed and supplied to provide the number of phases and sequencing as shown on the plans without any auxiliary equipment. Each controller supplied shall be the same manufacturer, model and contain the same firmware level and version number; the type of controller, auxiliary equipment, and other operational features shall be as noted on the plans.

Traffic signal controllers shall meet the following requirements:

- Contain ATC API operational software conforming to ATC 5401 Standard v02.
- Be configured to operate in an ATCC 5301 v02 cabinet platform.
- Be supplied with the appropriate version of the Linux operating system, Board Support Package (BSP) and internal processing levels necessary to support connected vehicle (CV) as well as local and system operations.
- Be fully compliant with NTCIP 1201 and 1202 standards.
- Include a minimum of 3 High Speed USB 2.0 ports.
- Include a minimum of 3 10/100BaseT, RJ45 Ethernet connector ports.
- Meet the functional requirements of the NEMA TS-2, 2016 Standard, including all amendments.
- Support Flashing Yellow Arrow (FYA) and Flashing Red Arrow (FRA) operation with the ability to provide a minimum of 6 flashing pairs.
- Be supplied with an internal real-time clock and calendar capable of daily, weekly, and yearly event programming.
- Be capable of providing flashing operation of the signal lights, as indicated on the plans. Transfer from flashing operation or to flashing operation shall conform to the MUTCD.
- When on manual operation per input from the ATCC, manual advance of the intervals by use of hand cord control shall cause the controller to advance to the next programmed interval only upon pulse signal from the hand cord circuit, interval timing shall hold the interval for the minimum

programmed amber and red clearance intervals. All phases shall be called regardless of vehicle or pedestrian detection.

- Pedestrian phases shall not be extended or reserviced by actuation of the pedestrian detector during the walk interval, pedestrian clearance interval, or current phase and actuations shall be placed into memory and serviced in a following phase or cycle.
- Have documented compatibility with the MaineDOT traffic signal central management system (TSCMS) to meet the applicable requirements in this specification. If a documented history cannot be provided, then it will be the contractor's responsibility to coordinate a demonstration of the proposed controller to show the available functionality when connected to the MaineDOT TSCMS before the submittal of the proposed controller will be approved.
- Contain the ability to alter the controller unit's internal database using a built-in front panel keyboard, using a computer connected to the controller unit with an Ethernet cable, and remotely using either a web-based user interface or the MaineDOT TSCMS.
- Be supplied and installed with the ability to collect, store, and report various measures of effectiveness (MOE's) including or equivalent to:
 - Event and Alarm history
 - Flash Status
 - Stop Time Status
 - Cabinet Door Status (Open and Closed)
 - Coordination Status (Active, Failure, and Faults)
 - Preemption Events
 - Unit Control (System, Time Base, Interconnect, and Manual)
 - System Activity
 - Record and log vehicle detector actuations depending on user customizable parameters such as bin size.
 - Vehicle speeds using either one-detector or two-detector configuration.
- Shall collect and process all 255 high resolution enumerations as defined in the report "Indiana Traffic Signal Hi Resolution Data Enumerations", dated November 2012. This data will be processed in the controller and be available to be transferred to the MaineDOT TSCMS or via download from the web-based user interface. If communications are not available, then the data can be transferred through a USB memory device connected to the front of the controller.
- Be able to backup and restore Controller programing data to a USB memory device connected to the front of the controller. No additional software shall be required to perform this function.

- Be able to backup and restore Controller programming data using either a web-based user interface or through the MaineDOT TSCMS.
- Be able to upgrade the Controller firmware via USB memory device connected to the front of the controller. No additional software shall be required to perform this function.

Construction Requirements

- The controller unit shall be enclosed in a sheet metal case with protective painted finish, designed to permit easy access to the interior and removal of printed circuit boards and modules without the use of special tools. All program controls, fuses, and indicator lights shall be mounted on the front panel and shall be clearly and permanently labeled.
- All equipment inputs, outputs, and terminals shall be identified by the phase designations shown on the plans.
- The field electrical loading for flash operation shall be wired through the transfer relays such that the load on the 2-circuit flasher is as balanced as possible within the limitations of the signal phasing.
- Electrical filtering/surge protection shall be supplied and installed in each cabinet in accordance with ATCC 5301 v02 requirements and the manufacturer's recommendations. At a minimum, surge suppression shall be provided for incoming electric utility power conductors, all signal control circuits, vehicle detection, and pedestrian detection terminations.
- Each traffic controller unit, flasher and all other current interrupting devices shall be equipped with a suitable radio interference suppressor installed at the input power point.
- Interference suppressors shall be designed to minimize interference in both broadcast and aircraft frequencies. Suppressors shall be designed for 125 percent of the total connected load and shall meet standards of the UL and the EIA.
- If noted on the plans, hardwire preempt circuits shall be provided for emergency vehicles and/or railroad crossings. The clearance and preempt indications shall be as noted on the plans. Preempt circuits shall function during stop and go and flashing operation unless otherwise noted. The duration of clearance and preempt intervals shall be adjustable over the range noted on the plans and shall be labeled according to function. The railroad preempt circuit shall be designed to operate as a fail-safe loop through a normally made contact on the railroad's control relay in the railroad's control cabinet. Railroad preemption shall have precedence over all preemption intervals for other purposes.

- The reliability of the equipment shall be demonstrated by test performance detailed in 718.08 that will confirm that the controller unit, fully wired cabinet, and auxiliary equipment meet the operational and functional requirements of the plans and specifications.

718.08 **Controller Cabinet** - The traffic signal control equipment shall be enclosed within a dust and moisture-proof aluminum housing with an auxiliary door in door feature. There are two cabinet configuration options that are specified for use; a ground mounted cabinet and a pole mounted cabinet.

All new controller cabinets, traffic signal, or lighting, shall be configured to eliminate arc flash. All electrical equipment will be dead front, no open terminals, busbars, breakers, or exposed terminal strips. The cabinet shall be designed, constructed, and installed with all necessary provisions to comply with the latest NFPA 70E requirements. All electrically live parts over 50 volts shall be covered with Lexan or a suitable physical barrier to eliminate the possibility of an arc flash.

All wiring shall comply with all applicable local electrical codes as well as the National Electric Code.

Cabinet Requirements

The ground mounted cabinet shall be a NEMA "P" size cabinet (44"W x 26"D x 67"H). The cabinet front provides for user interface to the in-cabinet equipment including the front panel of the controller, the cabinet status displays and detection system control interface. The cabinet rear provides access for cable termination and shall only be accessed for installation and for cabinet troubleshooting. The cabinet shall be supplied with four doors; two on the front face and two on the back face. Each door shall open independently with an independent center post latching for each of the four doors. The cabinet shall be supplied with two side by side, 19" rack cages which shall extend from the bottom to the top of the cabinet. The left-side rack of the cabinet relative to facing the cabinet from the front, to be referred to as the 'Control' side, shall house the control devices such as the controller, Cabinet Monitor Unit (CMU) and Auxiliary Display Unit (ADU), switch packs and power distribution panel. The right-side rack of the cabinet relative to facing the cabinet from the front, to be referred to as the 'Power and Auxiliary' side, shall house the spare card cage assembly and battery back-up devices and communications elements. The ground mounted cabinet shall meet the following additional requirements:

- The spare card cage assembly shall not be wired to any cabinet device, but rather used to store spare rack mounted cabinet devices such as switch packs, serial interface units (SIUs), CMUs, and phase selectors.
- Be supplied with 32 output channels and 48 input channels.
- Be supplied with a 6" minimum high riser aluminum base that elevates the cabinet above the cabinet foundation.

- Have a pliable seal composed of caulking compound or mastic placed between the cabinet base and the concrete foundation to prevent dust and dirt from entering the cabinet.
- Be supplied and installed with an electric service meter socket trim and electrical service disconnect switch mounted on the exterior, Power and Auxiliary side of the cabinet. The meter and disconnect switch shall be installed centered on the side of the cabinet without doors such that it is not less than 48" nor more than 60" above final grade. The Contractor shall coordinate with the local electric utility company to determine the appropriate type of electric service meter socket trim and electrical conductors to be used. The line side cable shall be routed external to the cabinet from the ground to a 50 amp disconnect switch, then continuing to the bottom of the electric service meter socket trim, all through rigid steel conduit furnished and installed by the Contractor. The load side cable shall be routed through the cabinet and terminated on the line side of the main cabinet circuit breaker. The cable shall be routed between the edge of the rack system and the cabinet side wall, along the bottom of the cabinet, and below the bottom opening of the doors so that the cable does not block or enter into available rack space. Care shall be taken by the Contractor when installing the electric service meter socket trim and electrical service disconnect switch so that there is no damage inflicted on installed devices or the rack system during the installation. All metal shavings produced during the drilling of the access hole for the electric service shall be removed from the cabinet interior by the Contractor. The Contractor shall install appropriate bushings to all cabinet penetrations.

The pole mounted cabinet shall be a Model 336S cabinet (24" W x 20" D x 46" H). The cabinet shall be supplied with a 19" rack cage which shall extend from the bottom to the top of the cabinet. The cabinet shall be supplied with two doors; one on the front face and one on the back face. The cabinet front provides for user interface to the in-cabinet devices including the front panel of the controller, the cabinet status displays and detection system control interface. The cabinet rear provides access for cable termination and shall only be accessed for installation and for cabinet troubleshooting. The pole mounted cabinet shall meet the following additional requirements:

- Accommodate all control equipment including temperature control equipment. It shall be designed to be attached to the type of pole indicated in the contract plans. If the controller cabinet is to be ground mounted, details of the installation will be shown on the plans. Piano type hinges on cabinet doors shall be fabricated of stainless steel with a stainless-steel hinge pin. The cabinet shall be supplied with reinforcing plates where the cabinet is supported by the pole hangers.
- Be supplied with 16 output channels and 24 input channels.

- Require an electric service meter and disconnect switch system to be installed as indicated in the Plans or as directed by the Resident and approved by the local electric utility company. Line side cable shall be installed in a rigid steel conduit, flexible liquid tight conduit or PVC Schedule 80 conduit from the meter and disconnect to the underside of the pole mounted cabinet.

Both the ground mount and pole mount cabinets shall be configured to provide the following output/input channel assignments:

Channel	Input	Output
1-8	Vehicle Phase Call 1-8	Vehicle Phase 1-8
9-12	Pedestrian Phase Call 2,4,6,8	Pedestrian Phase 2,4,6,8
13-16		Overlap A, B, C, D
17+	Special Functions	

The cabinet shall be supplied with a police door panel located in the middle area of the front door for both cabinet types. The switches shall be mounted in the police panel and labelled as to function. Four switches shall be supplied as follows:

- Power On/Off
- Signal On/Off
- Signal/Flash
- Manual/Auto with cord

The manual control cord shall be a coiled type, sealed weather proof covered hand switch extending to six feet when fully stretched. The cord shall be fastened to the cabinet via a compression type connector to provide strain relief for the cord's electrical connections. The police door panel shall be of sufficient size so as to store the manual control cord when panel door is closed.

The cabinet shall be supplied with a technician's panel mounted on the back of the police panel. This panel shall be supplied with the following switches:

- Controller On/Off
- Flash/Auto (Allows the controller to cycle while flashing)
- Signals On/Off (Allows the controller to cycle with signal displays being dark)
- Stop Time Normal/On (Provides the ability to manually activate a controller stop time input)

All manual control switches, push button control, flashing switch, signal switch and any other specified switches shall be located to be accessible within the outside door, without exposing the controller mechanism.

The cabinet shall be supplied with white LED light panels which shall automatically illuminate via a door open switch whenever one of the four main cabinet doors are opened for the ground mount cabinet or two main doors for the side of pole cabinet. The ground mounted cabinet shall contain four LED light panels per side totaling eight panels for the cabinet; one panel each at the top and bottom portion of the front side and back side on the Control side and Power/Auxiliary side of the cabinet. Each light panel shall produce a minimum of 250 lumens for a total minimum lumen output of 2000 lumens with all eight panels illuminated. The minimum output per side would be 1000 lumens. The LED panels shall be protected by a clear shatterproof shield. The side of pole mounted cabinet shall contain four light panels; one at the top of the rack assembly and one at the bottom rack assembly on each side of the cabinet. A second door open status switch per door shall activate a controller input to log a report event that one of the doors was opened. All door open status switches shall be connected to the same controller input. For the ground mount cabinet, there shall be two switches on each of the four main doors. For the side-of-pole mount cabinet, there shall be two switches on each of the two main doors..

The cabinet shall be provided with a thermostatically controlled ventilating fan(s) and air filters. The fan and vents shall be arranged in such a manner that the air intake is at the cabinet bottom and the exhaust is at the cabinet top. The ventilating system shall meet the following requirements:

- be designed to prevent the entrance of rain, snow, dust, and insects.
- Two fans shall be supplied and installed for the ground mount cabinet and one fan shall be supplied and installed for the pole mounted cabinet. The electric fan shall have ball or roller bearings and shall have a capacity of 100 ft³ per minute. The fans shall be rated for continuous duty with a minimum service life of 3 years. The fan blades shall be supplied with a safety screen to prevent accidental contact with the blades.
- The air intake vents shall be rain tight and covered with a removable glass fiber filter. There shall be two intake vents provided with the ground mount cabinet and one intake vent supplied with the pole mount cabinet. The removable air filter shall be firmly held in place such that cracks and openings are eliminated to ensure that all air is filtered.
- The thermostat shall be mounted on the top interior of the cabinet and user adjustable to allow for temperature settings from a minimum of 70°F to 140°F and capable of activating the fans within plus or minus five degrees of the set temperature.

The cabinet shall contain a pull-out drawer, 19" wide with sufficient strength to hold a laptop computer. The top of the drawer shall be covered with a non-conductive, non-skid material and hinged such that a storage space is available to store cabinet documentation or small parts. The pull-out shelf shall be located in the rack space directly under the controller unit. The back of the control side

front door shall contain a resealable, heavy-duty opaque plastic envelope with two grommets that provide mounting to two integrated hooks installed on the back side of the front cabinet door. The heavy-duty plastic envelope will be used to store cabinet wiring diagrams and operations manuals that cannot be accommodated in the pull-out draw storage tray.

The cabinet main doors shall be provided with a stop to limit door opening to both 90° and 180° ±10°. The door stop bar shall be a captive type mechanism that serves to keep the bar in contact with the cabinet at both stop bar ends and provided with a catch that can be operated when the door reaches these 2 positions and will hold the door open securely until released. The cabinet shall be supplied with a three-point draw roller latching system consisting of the following latching points:

- Center of the cabinet (lock)
- Top of the cabinet- controlled by door handle
- Bottom of the cabinet - controlled by door handle

The latching points on the top and bottom of the cabinet door shall remain in the locked position until the door lock is disengaged. The locking mechanism shall be equipped with nylon rollers to secure the top and bottom of the door.

The cabinet shall be supplied with a ¾" diameter shank, stainless steel latching handle for each door. The latching handle shall have a provision for padlocking the door in a closed position.

The cabinet main doors hinge pins shall be made of stainless steel.

The locks for the switch compartment door of the cabinet shall unlock with a skeleton style (#1) key. The locks for the main doors of the cabinet shall unlock with a Corbin #2 key. One set of keys shall be furnished with each cabinet.

The cabinet shall be supplied with a permanent label mounted on the upper portion of the inside front main door which contains the name of the cabinet manufacturer, controller manufacturer, model/part number and year/month of assembly.

The cabinet shall be supplied with a laminated door sticker. This sticker shall be permanently affixed to the inside front control side of the cabinet door for the ground mount cabinet and the inside front side of the pole mount cabinets. At a minimum, the sticker shall contain the following information:

- Vehicle detection information including detector channel assignment, phase assigned, approach and cabinet termination points.
- If applicable, network communications information for all in-cabinet devices. This includes IP addresses, subnet mask and MAC address.
- Per approach preemption information including channel, approach/direction and termination points.

- Field termination chart showing per approach/per phase numbering of all signal circuits.
- Signal phasing and signal plan with intersection geometry and signal head designations.

The main cabinet circuit breaker shall be rated at 30 amps. Circuit breakers shall be approved and listed by the UL. The operating mechanism shall be enclosed and shall be trip-free from operating handle under load and shall be trip-indicating. All circuit breakers shall be quick-make, quick-break on either automatic or manual operation. Contacts shall be silver alloy enclosed in an arc quenching chamber. Overload tripping of breakers shall not be influenced by an ambient temperature range of from 0 to +158°F.

Auxiliary Equipment Requirements

The cabinet shall be supplied with a global positioning system (GPS) antenna to provide an accurate time reference for the cabinet. The antenna shall be mounted at the top of the cabinet in the back-left corner of the enclosure. The antenna shall be mounted such that it provides a waterproof seal; eliminating any possibility for water penetration into the cabinet. The GPS system cable shall be connected and integrated into the controller.

The cabinet shall be supplied with a generator panel. The generator panel shall consist of a manual transfer switch and a twist-lock four prong connector for generator hookup. The transfer switch knob and twist-lock connector shall be located inside a generator access panel with a separate lockable door mounted on the lower left, exterior of the control side wall of the ground mount cabinet and on the lower left side of the pole mounted cabinet. The door shall be equipped tamper resistant hinge. The generator panel assembly shall be housed in a heavy-duty, vandal resistant, weatherproof, dustproof enclosure designed for exterior applications. The generator access panel door shall have a moveable plate to cover an opening for the generator cable. The connection to an external generator shall be a waterproof, secure connection. The connection shall allow authorized personnel; to access, connect and secure an external electrical source to the cabinet for power restoration. The generator panel door shall contain a weather proof seal and supplied with a lock accessed with a J201 key. The generator transfer switch shall be a Reliance C30A1N Signa Series or approved equal

The cabinet shall be supplied with a GFI outlet to be installed on the upper left, exterior of the control side wall of the ground mount cabinet and the upper left side of the pole cabinet. The electrical outlet will be GRCI protected, house in a locked access enclosure. The GFI outlet shall be supplied via its own 15 amp circuit breaker. The GFI outlet assembly shall be housed in a heavy-duty vandal resistant, weatherproof, dustproof enclosure designed for exterior applications. The GFI enclosure door shall contain a weather proof seal and supplied with a lock accessed with a Corbin #2 key.

The cabinet shall be supplied with detector test switch panel. This panel shall be rack mounted and located above the controller. There shall be a total of 12 switches to allow for the manual placement of detector calls into the controller. Each switch shall be clearly labelled as to input channel and function. Each switch position shall correspond to the same controller input; switch one is for controller input channel one, switch two is for controller input channel 2, etc. Switches 1-8 shall correspond to phase 1-8 vehicle calls. Switches 9-12 shall correspond to pedestrian calls 2, 4, 6 and 8. The switch labels shall define the corresponding vehicle or pedestrian phase called and switch position function. Detector switches shall be three position and function as follows:

- Up Position= Provides a constant call
- Center Position= Normal operation (Phase receives call from detectors)
- Down Position = Provides a momentary call

A Cabinet Monitor Unit (CMU) and Auxiliary Display Unit (ADU) shall be supplied and installed in each cabinet. The CMU and ADU shall conform to requirements defined in the Advanced Transportation Controller Cabinet (ATCC) 5301 v02 standard. The CMU/ADU units shall support 32 channels. All configuration programming shall be resident in a non-volatile Datakey device. Each CMU shall be supplied with a Datakey programmer and associated software. The Datakey programming software shall include a set-up wizard which shall assist the user with the initial set up of the device. The Contractor shall program the Datakey with data entries appropriate for each intersection. All programming resident on the Datakey shall be included in the hardcopy.

The cabinet monitor unit shall be connected to the field terminals of the signal light circuit to provide protection against conflicting green, yellow or walk indications being simultaneously energized as a result of controller failure, relay or solid-state switch failure, short circuited field wiring or other failures.

When a conflict is detected, the cabinet monitor unit shall cause the signal system to commence flashing operation; energize the stop-timing circuit of the controller while controller power shall remain on; lock-in flashing operation until manual actuation of the momentary contact reset push button resident on the cabinet monitor unit.

A cabinet power supply shall be supplied with each cabinet. The cabinet power supply shall comply with ATCC 5301 v02 (EDI Model 2216-2412-HV or equivalent).

A GFCI duplex outlet and two multi-outlet strips shall be supplied with each cabinet and connected to clean power.

A full complement of switch packs shall be supplied with each cabinet. Switch packs shall comply with ATCC 5301 v02.

A full complement of SIUs shall be supplied with each cabinet. The Serial Interface Units (SIU) shall comply with ATCC 5301 v02.

A full complement of flashers shall be supplied with each cabinet. Flashers shall comply with ATCC 5301 v02. The field electrical loading for flash operation shall be wired through the transfer relays such that the load on the 2-circuit flasher is as balanced as possible within the limitations of the signal phasing.

A full complement of flash transfer relays shall be supplied with each cabinet. Flash transfer relays shall comply with ATCC 5301 v02.

In addition to the full complement of switch packs, SIU's, flashers, and flash transfers relays, two additional SIU's shall be supplied. All spare equipment required to be supplied with the ground mounted cabinet shall be stored in the spare equipment rack. Spare equipment required to be supplied with the pole cabinet shall be delivered to MaineDOT.

Electrical filtering/surge protection shall be supplied and installed in each cabinet in accordance with ATCC 5301 v02 requirements and the manufacturer's recommendations. At a minimum, surge suppression shall be provided for incoming electric utility power conductors, all signal control circuits, vehicle detection, pedestrian detection, communications and preemption system terminations.

Three copies of the database programming for all in cabinet devices shall be provided with each cabinet. The database programming sheets shall reflect as-built programming resident in each unit at the time of acceptance.

The Contractor shall reconfigure the default user name and passwords on all communications / control equipment within the ATC Controller and Cabinet. This includes but is not limited to the ATC traffic controller, ATC ancillary equipment, video detection equipment, Ethernet switches, and routers. The new user name and passwords shall be created in coordination with the MaineDOT Traffic Division staff and or as directed by the engineer; no manufacture default level passwords shall be allowed. The Contractor shall utilize network communications encryption settings on all forms of wired Ethernet data paths. No "in the clear" communications shall be allowed. At a minimum all wired Ethernet connections shall meet 802. IAE standards. The Contractor shall supply and configure a Cyber Intrusion and Prevention Device (CIPD) in each ATC cabinet. The CIPD shall prevent any unauthorized access/ connections to the traffic control system. Upon detection of unauthorized attempts, the CIPD shall notify the agency via SMS message and or email and log the event. The CIPD shall be installed prior to any remote access device. The Contractor shall coordinate with the agencies Information Technology and Operational Technology (IT/OT) staff and or the engineer for finale configuration of the CIPD. No direct access to the traffic system shall be allowed without the installation of a CIPD and or Router/Firewall.

Cabinet Testing Requirements

The testing process is required to ensure that the controller and cabinet assembly perform properly and meet all requirements described and required as part of this project have been met. This includes testing of all hardware and all software supplied and installed as part of this project. All tests shall be conducted in accordance with the approved test procedures developed by the Contractor. The Contractor shall submit test procedures and forms/checklists for review and approval to the Engineer.

All components of the controller and cabinet shall be bench tested for a minimum of 72 continuous hours by the Contractor at the Contractor's facility prior to delivery to the project. Testing shall be performed by an IMSA, level 3 (Field or Bench) Certified Signal Technician using a test board and in conformance with the design loads, phasing, timing and auxiliary equipment such as pre-emption. Upon completion of satisfactory bench testing, a written approval will be supplied to the Contractor by the Engineer. This approval does not relieve the Contractor from ensuring proper operation of the equipment. The approval shall accompany the cabinet and controller when delivered to the project.

The Contractor shall supply vendor specific or any test specific software for testing, as needed, at no additional cost.

At a minimum, the test plan developed by the Contractor shall contain the following sampling of test items:

- a) Installation of all the equipment into the cabinet as required per the plans and specifications.
- b) Setting of the phase timings of the controller in accordance with plans.
- c) Checking all of the wiring connections for physical tightness.
- d) Observing the sequences, timings and operations of the controller to verify conformance to the plans and specifications.
- e) Test the police panel switches installed in the panel.
- f) Test Pre-emption and/or Priority operation - Optical Detector - with the receivers wired in the cabinet and using an emitter, test each pre-emption or priority run as per the plans. Hard Wired - Attach a temporary push button as per the plans and test each pre-emption or priority run as per the plans.
- g) Check exhaust fan controls by applying heat from a 100-watt lamp on an extension cord to the thermostat.
- h) Check heat lamp controls by cooling the thermostat.
- i) Check cabinet monitor unit by testing for any conflicting Greens or Yellows by the use of a jumper wire attached to a displayed Green or

Yellow and to the other non-parent Greens or Yellows to ascertain that conflicting colors are not present. Test all possible combinations of conflicting displays.

Upon completion of the project, a print out of the databases contained in the controller, CMU, Preemption, Video Detection or any other equipment shall be provided to the Engineer. The databases shall be provided either via a hard copy printout or on a "thumb drive."

Tests shall be conducted by the Contractor, witnessed by the Engineer, at the Contractor's facility. The test facility shall be clean, heated/air conditioned and have provisions for the simultaneous testing of at least three (3) controller and cabinet assemblies. The controller and cabinet assembly shall be wired and programmed to provide the signal phasing, timing and operations shown on the design plans for that particular location. A test light board and a manual detector call panel shall be connected to each cabinet assembly to verify display outputs and vehicle/pedestrian input calls.

This test plan, when approved and executed, must demonstrate that the controller and cabinet assembly meet all of the requirements contained in the project Plans and Specifications.

The Contractor shall propose testing plans and submit the test plan(s) and procedures as detailed herein to the Resident and Design Engineers for approval prior to testing. Each of the test plans shall contain the following elements:

- Proposed date, time, and location of the testing
- Names of the Contractor personnel who will be conducting the testing
- Descriptive overview of the proposed test procedure
- List of test equipment required to perform the testing
- Test cases and test logging forms which detail every step of the test procedure:

Test logging forms shall be presented in tabular format, with separate columns for each of the following:

- Test case description detailing the test step to be performed.
- Expected result
- Actual result
- Pass/fail
- Comments

The Contractor shall supply separate test logging forms at the time of testing for each test plan, and for each device location. The test logging forms shall show the device location, date, and the start and end times of the test.

At the end of each test logging form, there shall be signature and date locations for each of the following:

- Contractor personnel conducting the test
- MaineDOT representative witness
- Engineer witness

Signatures on the test logging form will signify only that the test was performed and witnessed, not that it passed or failed.

The detailed Test Plans shall be submitted to the Engineer no later than 30 Days prior to the beginning of each test phase.

The Contractor shall have approved test plans prior to submitting a request to schedule the start of any test activities. The Contractor shall notify the Engineer no less than 14 Days prior to the beginning of any equipment or systems testing.

Testing shall provide verification and documentation that all requirements included in the Contract Documents are met. The Test Plans shall be developed by the Contractor to provide a mechanism that ensures that all contract requirements have been tested fully and verified.

If any deviations or changes to the approved Test Plans arise, it shall be resubmitted by the Contractor for review and approval by the Engineer at least 14 Calendar Days prior to any planned test activity stage. No tests shall be conducted until the Engineer have approved the test plan.

A summary of all tests shall be produced at the completion of each testing phase of the project to ensure that all requirements defined by the system are satisfied.

MaineDOT reserves the right to examine and test or retest any or all materials furnished by the Contractor for the project to determine if they meet the requirements specified within the Contract Documents.

If MaineDOT decides that any material used in the construction of this project is defective or otherwise unsuitable, and the workmanship does not conform to the requirements of this Contract, the Contractor shall replace such defective parts and material at no cost to the Project.

The times and dates of the tests shall be approved by the Engineer. The Contractor shall conduct all tests in the presence of the Engineer. Testing shall take place only on weekdays, which are official working days, unless the Engineer allows the test to be conducted and/or continued on weekends and non-working days. The Contractor shall make a request in writing at least 14 Days prior to the proposed testing, and schedule tests only if permission is granted by MaineDOT in writing.

The Contractor shall be responsible for the conduct and documentation of the results of these tests that will be countersigned by the Engineers at the end of each test. The signature of the Engineer implies only proof of presence. Test results shall be packaged and submitted to the Engineer within one week of test

completion. No test phase shall begin until all prior test phases have been completed, and test results have been approved by the Engineer.

718.09 **Flasher** - The flasher shall be a two circuit solid state device with no contact points or moving parts, producing between 50 and 60 flashes per minute with a 50% to 67% duty cycle. The flasher mechanism shall be mounted on a plug-in base with a plug-in mounting. The flasher relay shall energize the flasher and transfer signal light circuits from the controller unit to the flasher. The flasher shall be capable of breaking and carrying 10 amps on each circuit at 125 volts. All amber indications shall be on one circuit and all red indications shall be on the other circuit. The flasher shall be protected from lightning damage by a device intended for use with solid state equipment. The flashing mechanism shall be independent of the controller unit and shall remain in operation upon shutdown of the controller or removal of the controller unit from the cabinet. The pedestrian indications shall be flashed with a separate solid-state flasher.

718.10 **Program Selection** - The weekly program selection unit shall be capable of automatically supervising the operation of cycle 1, cycle 2, cycle 3, split 1, split 2, split 3, reset 1, reset 2, reset 3, and flashing operation. The weekly program selection unit shall allow selection and/or omission of these functions to be varied on a daily basis. The weekly program selection unit shall enable function transfers to be made as often as 15 minutes.

Solid state devices used to automatically select dial, reset and flashing modes shall meet the applicable functional requirements of mechanical devices. They shall maintain the preset program during power interruption and shall continue timing functions using a reserve power source.

718.11 **Contacts and Relays** - All contacts used in connection with interval indications shall be of pure coin silver or its equivalent and shall be capable of breaking and carrying at least 15 amperes at 120 volts AC. The Contractor is directed to arrange the internal wiring and number of circuits so that the contact rating is not exceeded.

All actuated controllers shall be equipped with external type signal light relays.

Relays shall not be used in connection with any automatic non-flashing red, yellow or green indication in installations having pre-timed electro-mechanical equipment, without the approval of the Resident.

Relays shall be designed for continuous duty. Relays shall be designed to operate at ambient temperatures from -30°F to +158°F.

Each relay shall be mounted on a plug-in base with a plug-in mounting. Coils shall have a power consumption of 10 volt-amperes maximum and shall be designed for continuous duty on 120 volts, AC.

A leakage resistor, which shall permit current to pass through the relay coil if the contacts should remain closed after the coil circuit is opened, shall be installed with each external signal light relay to overcome residual magnetism effects.

All relays shall be of a rating sufficient to carry the electrical loads imposed upon them. A sufficient number shall be provided so that the total load is distributed among the various circuits in such a manner that the rating of each relay is 150% of the load.

The monitor unit shall be connected to the field terminals of the signal light circuit to provide protection against conflicting green, yellow or walk indications being simultaneously energized as a result of controller failure, relay or solid state switch failure, short circuited field wiring or other failures.

When a conflict is detected, the monitor unit shall cause the signal system to commence flashing operation; energize the stop-timing circuit of the controller while controller power shall remain on; lock-in flashing operation until manual actuation of the momentary contact reset push button; remove power from the signal light circuit; disable all functions of the "Flash-Automatic" and "Automatic Manual" switches in the police panel.

Each circuit of the solid state switching devices shall have a minimum rating of 1,000 watts for tungsten lamp load at 120 volts, AC. The solid state switching devices shall be plug-in mounted to a base. Solid state switching devices shall be protected from transient voltages and lightning by components especially designed for use with solid state devices.

Circuit breakers shall be approved and listed by the UL. The operating mechanism shall be enclosed and shall be trip-free from operating handle under load and shall be trip-indicating. All circuit breakers shall be quick-make, quick-break on either automatic or manual operation. Contacts shall be silver alloy enclosed in an arc quenching chamber. Overload tripping of breakers shall not be influenced by an ambient temperature range of from 0 to +158°F.

- 718.12 **Conductors** - The number and size of conductors required in each cable is indicated on the plans. All conductors shall be stranded copper conductors. Multiconductor cables shall conform to the latest revisions of IMSA Specification Number 19-1 or 20-1. The service ground rod shall be 8 ft by 5/8" copperclad rod.

The service wiring shall be single conductor number 6 AWG THW stranded copper black insulated and number 6 AWG THW stranded copper white insulated rated 600 volts.

All circuits for the timer and each auxiliary control unit shall terminate in a multiple contact connector. Conductors shall be attached to all pins of the connector and cabled. Conductors of the cable, except spares, shall be fitted with terminal ends compatible with the terminal block and shall have identifying bands. The ends of all spare conductors shall be taped.

- 718.13 **Non-Invasive Detection - Stop Bar** - The Stop Bar Vehicle Detection (SBVD) system shall detect vehicles on a roadway and send detector outputs to the traffic signal controller. All identical components of the SBVD system supplied by the Contractor as part of this project shall be from the same manufacturer and

be the same make, model, and firmware revision. The proposed SBVD system shall be consistent with the recommendations in the “MaineDOT Procedure for Traffic Signal Design and Operation”, notably the accepted vendors and systems for vehicle detection systems.

The SBVD system, at a minimum, shall:

- be non-intrusive (i.e. above ground) and shall consist of:
 - Mounting Brackets.
 - IP based traffic sensor assemblies, detection module, and/or cabinet interface device. (non-video based traffic sensors shall only be required to provide IP based cabinet interface device). Analog based cameras with separate video encoders shall not be allowed.
 - Communications Cable.
- be connected to the ethernet switch or the field monitor unit and all communications shall be routed IP based electronically through the field monitor unit (FMU) or ethernet switch. The use of external communication methods such as other cellular modems or connections to internet service provider modems must be routed through the FMU and shall not be allowed within the internal network of the ATCC.
- be powered through one of the power outlets available on the FMU. It is the intent that the SBVD system can be powered down and restarted through remote control of the power outlet on the FMU.
- be capable of detecting if and when vehicles, bicycles, and pedestrians are in a designated area and be able to place a call through the in-cabinet serial interface unit (SIU) bus to the appropriate detector channel within the traffic signal controller.
- be able to determine if the system’s ability to accurately detect vehicles is compromised and shall fault in an “always on” state.
- collect, store, and report signal performance data consistent with the following requirements:
 - The SBVD system shall be able to track and classify vehicles, bicycles, and pedestrians to determine turning movements. The system should have a documented history of being at least 95% accurate in similar conditions to the project location. If a documented history cannot be provided, then it will be the contractor’s responsibility to coordinate a demonstration of the proposed SBVD system consistent with the testing requirements in this specification before the submittal of the proposed SBVD system will be approved.

- The SBVD system shall be able to classify the vehicles based on estimated length.
- The SBVD system shall be capable of storing the relevant vehicle based signal performance data in a vehicle by vehicle format. If this is not possible for all data types, then data may be summarized into five minute or lower bins on a case-by-case basis.
- The SBVD system shall be capable of automatically collecting the signal performance data and shall be able to store the data for a period of at least 12 months on the detection module or cabinet interface device without an external connection to the internet.
- The SBVD system shall allow for the retrieval of signal performance data through an ethernet based connection to the detection module or cabinet interface device either in the field or through the internal network of the ATCC.
- If the location has been identified the intersection as a high-priority SPM intersection on the plans, then the SBVD system will have the following additional requirements:
 - The SBVD system shall monitor and record the status of the phase channels and detector channels from the traffic signal controller through the SIU bus at a frequency of no less than 10 times per second.
 - The SBVD system shall be able to classify vehicles consistent with the “MaineDOT Data Collection Guidelines”.
 - The SBVD system shall be able to estimate the speed of vehicles at defined user configurable points, such as entering or exiting a detection zone.
 - The SBVD system shall allow for the retrieval of signal performance data through a http based application programming interface (API), or equivalent automated process, in “xml”, “json”, or “csv” formats. The signal performance data shall be available in a per vehicle format, be viewable in real time, and store at least 168 hours of data locally on the device.
- be compatible with ATCC 5301 v02 standards.
- be compatible with ATC 5201 v06 standards.
- be able to operate without degradation over a temperature range of -40 to 165°F at a relative humidity up to 95% non-condensing.

- provide remote access to the latest available image or digital video stream of all IP video detection units installed at the intersections through either a HTTP request or through a Real Time Streaming Protocol (RTSP) compatible with RFC2326 standards. Detection systems that do not utilize video shall be able to display the current state of the vehicle detection zones and approximate vehicle locations in a digital twin model of the intersection.
- support remote configuration of the SBVD system settings such as adding and removing users and the configuration of the detection module and/or cabinet interface device through an ethernet based connection to the detection module or cabinet interface device either in the field or through the internal network of the ATCC.
- support remote configuration of the vehicle, bicycle, and pedestrian detection configuration including:
 - The number, location, and size of detection zones.
 - Configuration of the detector channel and assigned phase for each zone.
 - Configuration of detection zones for signal performance measure data collection.
- have user-based restrictions in place to limit functionality including:
 - The ability to view imagery or digital video streams.
 - The ability to make changes to the SBVD system settings.
 - The ability to view and download signal performance data.

Construction Requirements

The Contractor shall be responsible for furnishing all training, labor, materials, cables, connectors, tools, equipment, shipping, and incidental items necessary to complete the installation and make the non-invasive stop bar vehicle detection system fully operational.

Installation of the non-invasive stop bar vehicle detection system shall include the installation of any and all associated equipment including, but not limited to, the following:

- ***Traffic Sensor Assembly*** - The Contractor shall furnish traffic sensor assemblies per manufacture requirements, either one sensor per approach or two or more 360-degree sensors per intersection. The traffic sensor assembly(s) shall be affixed to the support structure in accordance with the manufacturer's instructions to provide the optimal field of detection.

- **Detection Module or Cabinet Interface Device** - The Contractor shall furnish one detection module or cabinet interface device per cabinet.
- **Detector Cable** - The Contractor shall furnish the specified cable type, all connectors, sealing tape and incidental work necessary to complete the installation of the connector cable between the traffic sensor assembly and the detection module or cabinet interface device.
- **Mounting Brackets and Ancillary Equipment and Labor** - The Contractor shall furnish detector mounting brackets and all associated equipment labor, materials, and incidental work necessary to attach the detector assemblies to a mast arm or extension bracket, complete the installation and make the SBVD system fully operational. All equipment shall be installed and wired in a neat and orderly manner in conformance with the manufacturer's instructions.
- The Contractor shall install the SBVD system software on any number of computers/systems as required by MaineDOT and the Engineer to allow visual confirmation of the detection zones as shown on the plans.
- The traffic sensor locations shown on the Plans are for illustrative purposes only. The final locations for the traffic sensors shall be located in the field and shall be approved by MaineDOT and/or the Engineer. The Contractor may be required to adjust and readjust the location of existing and proposed vehicle detection zones in the presence of the Engineer, at no additional cost, to verify that the SBVD system is accurately detecting traffic, including correct calls to the desired detection channels and a lack of false calls on non-desired detection channels.

After the SBVD system is installed in the field and operational, the MaineDOT and/or the Engineer will evaluate the signal performance data collected by the system to verify if the system meets the requirements within this specification. At a minimum, the turning movement counts collected by the SBVD system will be compared to turning movement counts collected by other means and the MaineDOT reserves the right to require testing of other requirements. The comparison turning movement counts should meet the following criteria:

- At least two 30 minute periods collected at different times of day, including at night.
- The turning movement counts should not be collected with inclement weather.
- The turning movement counts should be collected under moderate traffic.

If the MaineDOT and/or the Engineer determines that the SBVD system does not meet one or more of the requirements within this specification then the Contractor may be required to adjust the location, orientation, or number of the

traffic sensor assemblies and/or adjust the location of the vehicle detection zones. Upon which the SBVD system will be reevaluated.

Installation will be considered complete when the Contractor shows the system successfully and consistently places a request to the controller to call and extend the appropriate phase based on a vehicle detected in the detection zone, remote access to the SBVD system, and the SBVD system requirements have been verified.

- 718.14 ***Non-Invasive Detection - Advance*** - The Advance Vehicle Detection (AVD) system shall detect vehicles on a roadway and send detector outputs to the traffic signal controller. All identical components of the AVD system supplied by the Contractor as part of this project shall be from the same manufacturer and be the same make, model, and firmware revision. The proposed AVD system shall be consistent with the recommendations in the “MaineDOT Procedure for Traffic Signal Design and Operation”, notably the accepted vendors and systems for vehicle detection systems. No additional hardware, software items and/or subscription fees/costs shall be needed/allowed to satisfy the requirements as defined in these specifications.

The AVD system, at a minimum, shall:

- be non-intrusive (i.e. above ground) and shall consist of:
 - Mounting Brackets.
 - IP based traffic sensor assemblies, detection module, and/or cabinet interface device. (non-video based traffic sensors shall only be required to provide IP based cabinet interface device). Analog based cameras with separate video encoders shall not be allowed.
 - Communications Cable.
- be connected to the ethernet switch or the field monitor unit and all communications shall be routed IP based electronically through the field monitor unit (FMU) or ethernet switch. The use of external communication methods such as other cellular modems or connections to internet service provider modems must be routed through the FMU and shall not be allowed within the internal network of the ATCC.
- be powered through one of the power outlets available on the FMU. It is the intent that the AVD system can be powered down and restarted through remote control of the power outlet on the FMU.
- be capable of detecting if and when vehicles, bicycles, and pedestrians are in a designated area and be able to place a call through the in-cabinet serial interface unit (SIU) bus to the appropriate detector channel within the traffic signal controller. The system should have a documented history of being at least 95% accuracy of determining if one or more

vehicles, bicycles, or pedestrians are within the designated area in similar conditions to the project location. If a documented history cannot be provided, then it will be the contractor's responsibility to coordinate a demonstration of the proposed AVD system consistent with the testing requirements in this specification before the submittal of the proposed AVD system will be approved.

- be able to determine if the system's ability to accurately detect vehicles is compromised and shall fault in an "always on" state.
- be compatible with ATCC 5301 v02 standards.
- be compatible with ATC 5201 v06 standards.
- be able to operate without degradation over a temperature range of -40 to 165°F at a relative humidity up to 95% non-condensing.
- provide remote access to the latest available image or digital video stream of all IP video detection units installed at the intersections through either a HTTP request or through a Real Time Streaming Protocol (RTSP) compatible with RFC2326 standards. Detection systems that do not utilize video shall be able to display the current state of the vehicle detection zones and approximate vehicle locations in a digital twin model of the intersection.
- support remote configuration of the AVD system settings such as adding and removing users and the configuration of the detection module and/or cabinet interface device through an ethernet based connection to the detection module or cabinet interface device either in the field or through the internal network of the ATCC.
- support remote configuration of the vehicle, bicycle, and pedestrian detection configuration including:
 - The number, location, and size of detection zones.
 - Configuration of the detector channel and assigned phase for each zone.
 - Configuration of detection zones for signal performance measure data collection.
- have user-based restrictions in place to limit functionality including:
 - The ability to view imagery or digital video streams.
 - The ability to make changes to the SBVD system settings.
 - The ability to view and download signal performance data.

Construction Requirements

The Contractor shall be responsible for furnishing all training, labor, materials, cables, connectors, tools, equipment, shipping, and incidental items necessary to complete the installation and make the non-invasive advance vehicle detection system fully operational.

Installation of the non-invasive advance vehicle detection system shall include the installation of any and all associated equipment including, but not limited to, the following:

- **Traffic Sensor Assembly** - The Contractor shall furnish traffic sensor assemblies per manufacture requirements, either one sensor per approach or two or more 360-degree sensors per intersection. The traffic sensor assembly(s) shall be affixed to the support structure in accordance with the manufacturer's instructions to provide the optimal field of detection.
- **Detection Module or Cabinet Interface Device** - The Contractor shall furnish one detection module or cabinet interface device per cabinet.
- **Detector Cable** - The Contractor shall furnish the specified cable type, all connectors, sealing tape and incidental work necessary to complete the installation of the connector cable between the traffic sensor assembly and the detection module or cabinet interface device.
- **Mounting Brackets and Ancillary Equipment and Labor** - The Contractor shall furnish detector mounting brackets and all associated equipment labor, materials, and incidental work necessary to attach the detector assemblies to a mast arm or extension bracket, complete the installation and make the AVD system fully operational. All equipment shall be installed and wired in a neat and orderly manner in conformance with the manufacturer's instructions.
- The Contractor shall install the AVD system software on any number of computers/systems as required by MaineDOT and the Engineer to allow visual confirmation of the detection zones as shown on the plans.
- The traffic sensor locations shown on the Plans are for illustrative purposes only. The final locations for the traffic sensors shall be located in the field and shall be approved by MaineDOT and/or the Engineer. The Contractor may be required to adjust and readjust the location of existing and proposed vehicle detection zones in the presence of the Engineer, at no additional cost, to verify that the AVD system is accurately detecting traffic, including correct calls to the desired detection channels and a lack of false calls on non-desired detection channels.

After the AVD system is installed in the field and operational, the MaineDOT and/or the Engineer will evaluate the signal performance data collected by the

system to verify if the system meets the requirements within this specification. At a minimum, the detector output status will be compared to traffic data collected by other means and the MaineDOT reserves the right to require testing of other requirements. The comparison should meet the following criteria:

- Should be at least 30-minutes of visual evaluation of the detection system under live traffic.
- Should not be collected with inclement weather.
- Should be collected under moderate traffic.

If the MaineDOT and/or the Engineer determines that the AVD system does not meet one or more of the requirements within this specification then the Contractor may be required to adjust the location, orientation, or number of the traffic sensor assemblies and/or adjust the location of the vehicle detection zones. Upon which the AVD system will be reevaluated.

Installation will be considered complete when the Contractor shows the system successfully and consistently places a request to the controller to call and extend the appropriate phase based on a vehicle detected in the detection zone, remote access to the AVD system, and the AVD system requirements have been verified.

718.15 **Field Monitoring Unit (FMU)** - This item of work shall conform to this specification. This item shall consist of furnishing and installing a FMU and software, as well as all needed accessories required for a full and complete installation, including but not limited to power adapters, Ethernet cables, and interface cables, as described herein.

Where applicable, communications from MaineDOT's cloud-based Central Management System (CMS) to the on-street traffic signal controllers shall be made through fiber optic interconnect cable connected back to existing internet connections and/or the FMU. The Contractor shall furnish and install all materials necessary for a complete and operational fiber optic interconnection to all Project intersections as shown on the plans. All connections to the CMS cloud-based system shall be via a secure VPN network.

The FMU shall be the only remote connection device used by isolated intersections to connect to the cloud-based system. All connections shall be encrypted VPN tunnels. The Contractor shall coordinate all configuration settings with MaineDOT Traffic Division and the Engineer.

The FMU central web based interface shall be a separate element from the CMS.

Materials - The materials for this work shall conform to the following requirements:

1. The work under this item specifies the requirements for the FMU. The FMU shall operate independent of the brand/type of intersection controller deployed in the ATC traffic cabinet.

2. The FMU shall conform to the following requirements:
 - 2.1 The FMU shall function correctly between -34°C and +74°C.
 - 2.2 The FMU shall be provided with appropriately rated connectors that allows the FMU to be exchanged by unplugging connectors, without tools.
 - 2.3 The FMU shall monitor and log all ATC Controller and ATC cabinet faults and or alarms.
 - 2.4 The FMU shall be wired directly to the ATC cabinet.
 - 2.5 The FMU shall have an internal cellular modem running at 4G LTE.
 - 2.5.1 The Cellular modem shall be designed to be replaced / upgraded to 5G service when available.
 - 2.6 The FMU shall incorporate an integrated GPS and cell modem.
 - 2.7 The configuration of the FMU shall be accomplished by accessing the internal web server with a browser. It shall be possible to configure the FMU without any special software.
 - 2.8 The FMU shall be powered via a standard 120V input power.
 - 2.9 The FMU shall allow for the routing of the controller configuration packets to and from the controller (either by Ethernet or serial communications) for any type of controller utilized by the MaineDOT. In this way it shall be possible to configure the controller and utilize the controller specific software to interrogate the controller, and the FMU shall provide the communications pipe which allows this to be accomplished.
 - 2.10 The FMU shall, within the size limitations above, include a battery and battery charging/monitoring circuit, to allow the FMU to function correctly even when all power to the intersection has failed. The battery shall continue to power the FMU for a minimum of 5 hours after all power has failed to the intersection.
 - 2.11 The FMU shall incorporate an integrated GPS which will allow the FMU to geo-locate itself on the FMU management software map, without configuration.
 - 2.12 The FMU shall operate without requiring a static IP address. The only configuration required at the FMU is to enter the URL of where the FMU management software is hosted.
 - 2.13 In the event that the cell service is interrupted or is not available, the FMU shall store any events that occur in internal memory and forward these events automatically to the FMU management software when the cell service is restored. In this way, a complete

record of events at the device can be maintained even if cell service is interrupted for a period. The system will store 5000 events.

- 2.14 The FMU shall utilize HTTP and HTTPS protocols, and XML data structures, for communication with the FMU management software. In this way the data will be open for future expansion and competition. The use of secret proprietary protocols is not permitted.
- 2.15 The FMU shall include Ethernet communications via an Ethernet Port with RJ45 connector.
- 2.16 The FMU shall include weather proof antennas.
- 3. Map Display FMU Management Software
 - 3.1 The FMU shall include a scrollable, zoomable map display, with the intersections and other monitored devices shown as representative icons on the map. The map shall include the ability to see the intersections using Google Streetview.
 - 3.2 The alarm status of the intersection shall be clearly indicated on the icon on the map, so that the user can see at a glance which intersections are in alarm.
 - 3.3 The map display shall also include a list of intersections, with the number and priority of alarms indicated on the list. Intersections in high priority alarm shall be moved to the top of the list, followed by medium priority, low priority and then finally by intersections not in alarm.
 - 3.4 The icons shall change to be able to clearly indicate if an intersection is offline.
 - 3.5 Clicking on the icon on the map shall expose a box with the current parameters of the intersection shown.
 - 3.6 The default map display position and zoom shall be configurable by user, so that the user's view will default to show the intersections that the user is responsible for managing.
 - 3.7 The map view shall have the ability to show Google traffic overlays on the map.
- 4. Intersection Detail Display FMU Management Software.
 - 4.1 It shall be possible to drill down, either from the map icon or from the list, to a device level detail for the intersection, which as a minimum shall display the following parameters:
 - 4.1.1 The alarm status, with priority indicated, and a text description of the alarm (if an alarm is present for this device).

- 4.1.2 The time since the last communication with the device
 - 4.1.3 The following parameters (real time now values, minimum for the Day values, maximum for the Day values, and average for the Day values).
 - 4.1.3.1 The AC mains voltage (value)
 - 4.1.3.2 The battery back-up voltage (value)
 - 4.1.3.3 The cabinet temperature (value)
 - 4.1.3.4 The cabinet humidity (value)
 - 4.1.3.5 The presence of AC power (OK or Fail)
 - 4.1.3.6 The flashing status of the intersection (OK or Flashing)
 - 4.1.3.7 Stop Time status (OK or Stop Time Active)
 - 4.1.3.8 The cabinet door status (Open or Closed)
 - 4.1.3.9 The intersection fan status (Fan On or Fan off)
 - 4.1.4 It shall be possible to view graphs of each of the value parameters in graphical form, over the recent 2 week period. This includes real time graphs of:
 - 4.1.4.1 The AC mains voltage
 - 4.1.4.2 The battery back-up voltage
 - 4.1.4.3 The cabinet temperature
 - 4.1.4.4 The cabinet humidity
5. Diagnostics and Log Display FMU Management Software
- 5.1 From the device level detail within the FMU management software, it shall be possible to drill down to get the raw data; the error logs; and the communications logs to allow a technician to fault-find problems.
 - 5.2 It shall be possible to filter the logs by Device; by Device Type and/or by Group as well as between dates.
 - 5.3 It shall be possible to print these selected logs to a local printer or a PDF file.
 - 5.4 It shall be possible to export these logs to Excel on the local computer for further analysis.
6. Alarms FMU Management Software
- 6.1 The FMU management software shall have a comprehensive alarm generation capability

- 6.2 It shall be possible to configure alarms to be generated on any parameter becoming out of tolerance, including analog values, digital values and enumerated values.
 - 6.3 Alarms shall be configurable to be of Low, High or Critical Priority.
 - 6.4 The alarm priority shall be displayed throughout the FMU management software, on all displays, using color codes such as red-critical; yellow – high; and amber-low to indicate the priority of the alarm.
 - 6.5 The current active alarms shall be accessible for view via an expandable window, to see which alarms are active and when the alarm occurred. The highest priority alarms shall rise to the top of the list.
- 7. Alerts FMU Management Software
 - 7.1 The FMU management software shall have comprehensive alerting capability, to enable the response personnel to be notified when an abnormal situation has occurred.
 - 7.2 It shall be possible to configure alerts to one or more personnel for each alarm. This will cause, as selected, an SMS and/or an email to be sent to the person when an alarm occurs.
 - 7.3 The alert shall be configurable to optionally send via email and/or via SMS a message when an alarm clears.
 - 7.4 The intention is that the FMU management software provides the alerts to the user in near real time. The SMS and email shall be issued within 30 seconds of the occurrence of event which results in an alert being issued.
- 8. Hosting and Connectivity and Service FMU / FMU Management Software
 - 8.1 The Contractor shall supply the FMU with the FMU manufacturers 10 year options for Connectivity and Service, as part of the purchase price. The Connectivity and Service agreement shall include at a minimum:
 - 8.1.1 Cellular Connectivity
 - 8.1.2 No cellular overage charges
 - 8.1.3 Extended warranty on the hardware for the period of the Connectivity and Service Agreement
 - 8.1.4 Over-the-air software updates
 - 8.1.5 Over-the-air security updates
 - 8.1.6 Future Connected Vehicles Service

SECTION 719 - SIGNING MATERIAL

- 719.01 **Reflective Sheeting** - The reflective sheeting shall consist of a retro-reflective lens system having a smooth outer surface. The sheeting shall have a precoated adhesive on the back side, protected by an easily removable liner.

The reflective sheeting and its components shall be AASHTO Product Evaluation & Audit Solutions tested and conform to all the requirements of FHWA ASTM D4956, Standard Specification for Retroreflective Sheeting for Traffic Control, including supplementary requirements. Engineering grade reflective sheeting shall meet the reflective intensity requirements of ASTM D4956, Standard Specification for Retroreflective Sheeting for Traffic Control, including supplementary requirements Type II sheeting. High intensity prismatic reflective sheeting shall meet the reflective requirements for ASTM D4956 Type III prismatic sheeting.

Reflective sheeting, used in sign construction, shall be from the Department's Qualified Products List and have been manufactured within the 6 months immediately prior to fabrication of each sign. Upon delivery at the job site of each shipment of signs, a letter of certification shall be provided by the Contractor that the reflective sheeting conforms to the requirements contained herein.

Super high intensity fluorescent retro-reflective sheeting, ASTM D4956 - Type VIII, or Type IX (prismatic), is required for all construction signs.

EXAMPLE TABLE

Engineering Grade	Type II
High Intensity	Type III
Work Zone	Type VIII or Type IX (prismatic)

For Type I Guide Signs, all reflective sheeting shall be color matched on each sign unit.

- 719.02 **Demountable High Intensity Prismatic Reflectorized Letters, Numerals, Symbols and Borders** - Demountable reflectorized letters, numerals, symbols and borders shall consist of cut out high intensity prismatic sheeting, be AASHTO Product Evaluation & Audit Solutions tested and, conforming to FHWA, "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects," 2014 FP-14 718.0.
- 719.03 **Aluminum Extrusions** - The extruded aluminum planks shall be bolted type with dimensions, holes, lengths, and cross sections as detailed on the plans. The extruded aluminum molding for edging of the extruded aluminum sign panels shall be of the cross section as detailed on the plans. Extruded aluminum planks shall conform to ASTM B221, 606-T6, 6005-T5, or 6061-T6. The extruded

aluminum planks and molding shall be free from all corrosion and dirt and the face and edges shall be true, smooth, and free from burrs and breaks.

- a. **Degreasing** - Required on aluminum plank by either of the following methods:
 1. **Vapor Degreasing** - shall be by total immersion of the plank in a saturated vapor of trichloroethylene or perchloroethylene. Trademark printing shall be removed with lacquer thinner or controlled alkaline cleaning system.
 2. **Alkaline Degreasing** - Planks shall be immersed in a tank containing alkaline solutions, controlled and titrated to the solution manufacturer's specification. Immersion time shall depend upon the amount of soil present and the gauge of the metal.
- b. **Etching**
 1. **Alkaline Etch** - The pre-cleaned aluminum surface shall be well etched in an alkaline etching material that is controlled by titration, use time, temperature and concentration specified by the solution manufacturer and rinsed thoroughly. Smut shall be removed with an acidic, chromium compound type solution as specified by the solution manufacturer and then thoroughly rinsed.
 2. **Alodine** - 500 or 1,200 is acceptable.
- c. **Drying** - Material may be air-dried or oven dried. Metal shall not be handled between all cleaning and etching operations and the application of Reflective Sheeting, except by device or clean gloves. There shall be no opportunity for metal to be exposed to grease, oils, or other contaminants before application of Reflective Sheeting.
- d. **Fabrication** - All fabrication shall be completed before metal degreasing.

719.04 **Aluminum Sheets** - All blanks shall be made of 5052-H38 or 6061-T6 aluminum. The Contractor shall guarantee the material to be free of buckles, warp, dents, cockles, burrs and defects resulting from fabrication.

- a. **Degreasing** - Required on sheet aluminum by either of the following methods:
 1. **Vapor Degreasing** - Sign blanks shall be totally immersed in a saturated vapor of trichloroethylene or perchloroethylene. Trademark printing shall be removed with lacquer thinner or controlled alkaline cleaning system.
 2. **Alkaline Degreasing** - Sign blanks shall be totally immersed in a tank containing alkaline solutions, controlled and titrated to the solution manufacturer's specifications. Immersion time shall depend upon the amount of soil present and the gauge of the metal.

b. **Etching**

1. **Alkaline Etch** - The pre-cleaned aluminum surface shall be well etched in an alkaline etching material that is controlled by titration, use time, temperature and concentration specified by the solution manufacturer, and rinsed thoroughly. Smut shall be removed with an acidic, chromium compound type solution as specified by the solution manufacturer and then thoroughly rinsed.
2. **Alodine** - 500 or 1,200 is acceptable.

- c. **Drying** - Material may be air-dried or oven dried. Metal shall not be handled between all cleaning and etching operation and packaging, except by device or clean gloves. There shall be no opportunity for metal to come in contact with grease, oils, or other contaminants prior to application of the packaging and shipping.
- d. **Fabrication** - All fabrication, including shearing, cutting, and punching of holes, shall be completed before metal degreasing. Fabrication of all metal parts shall be accomplished in a uniform and skillful manner. The surface of all sign panels shall be flat.

The minimum sheet thickness shall be 0.08" for signs of an area of 12 ft² or less and shall be 0.125" for signs over 12 ft² unless otherwise specified.

- e. **Chromate Treatment** - Treatment shall be in accordance with ASTM B449 Class I.

719.05 **Plywood** - The plywood shall conform to the following requirements:

- a. **Face stock** - Face veneers shall be Grade A.
- b. **Core and Cross Veneers** - Core and crossband veneers shall be Grade B or better and shall be solid jointed.
- c. **Glue** - The entire area of each contacting veneer surface shall be bonded with a waterproof adhesive that meets the test requirements for exterior type.
- d. **Overlay** - The overlay shall be of the high-density type. It shall be a minimum of 60 lb/1,000 ft² surface, shall be at least 0.009" thick, and have a minimum resin content of 40% based on the dry weight of the impregnated fiber. It shall consist of at least 2 sheets of resin-impregnated fiber of sufficient resin content to bond itself to the plywood. Manufacturing precautions shall be taken to prevent overlay surfaces from coming into contact with any substance that would inhibit adhesion of paint or reflective sheeting. The overlay shall be natural color.
- e. **Thickness** - The thickness of plywood shall be 5/8".
- f. **Testing** - The plastic overlay shall not delaminate from the plywood after being subjected to the exterior boiling test for glue line durability.

719.06 **Demountable Reflectorized Delineators** - Delineators shall be diamond reflectors approximately 3" square or shall be rectangular, adhesive coated reflective sheeting permanently adhered to a sheet aluminum backing. All delineators on a Project shall be the same type. Single delineators shall be clear or silver-white; double and triple delineators shall be amber.

- a. Single delineators shall have one ¼" square hole for center mounting. Double and triple delineators shall have two ¼" square mounting holes on the vertical centerline.

Single delineators shall be 3 by 3" diamonds with ¾" radius corners and two ¼" square mounting holes, 3" on center.

Double delineators shall be 3 by 6" rectangles with ¾" radius corners and two ¼" square mounting holes 5" on center.

The aluminum shall be 6061-T6, ASTM B209 or 6063-T6 or 6005-T5 0.063" thick sheet properly degreased and etched or treated with a light, tight amorphous chromate type coating.

The reflective sheeting shall be applied to properly treated base panels with mechanical equipment in a manner specified by the sheeting manufacturer.

- b. **General Requirements and Packaging** - The finished delineators shall show careful workmanship, be free of burrs, scratches or damaged reflective surface.

Delineators shall be packaged in such a manner as to insure their arrival at destination in undamaged condition. Delineators shall not become wet in storage or shipment.

719.07 **Assembly and Mounting Hardware - General** - The attachment of signs shall be in accordance with the Contract documents and the appropriate hardware prescribed in this Section. Requests for substitution for all specified material shall be submitted in writing with full documentation, including but not limited to specifications and mill certification reports, enabling the Department to evaluate the proposal promptly.

719.071 **Aluminum Planking** - The bolt assembly required to fasten the extruded aluminum planks together shall conform to the designs used in standard commercial processes for the selected type of extruded aluminum panels. Guidance for bolt hole punching and typical plank-to-plank attachment is provided in the Contract documents.

719.072 **Overhead Signing** - Sign panels mounted to independent sign support structures and support structure components mounted to bridges passing over the highway are considered to be overhead signing. Overhead signing shall be mounted on W6 by 9 steel beams conforming to the requirements of ASTM A992/A992M, galvanized in

accordance with AASHTO M 111 (ASTM A123), or the same size aluminum beams conforming to ASTM B221M, alloys and tempers of 6061-T6, 6063-T6 or 6005-T5. These components shall be horizontally spaced a maximum of 5¼ ft on center, extending from the bottom of sign panel to the top. If supplemental signs are included in the Contract, these beams will extend from the bottom of the main sign panel to the top of the supplemental sign panel. The maximum distance from the edge of the sign to the center of the W6 by 9 shall not exceed approximately 3¼ ft.

On independent sign support structures, these W6 by 9 beam components shall be fastened to chords with a pair of appropriately sized U-bolts on each side of the web at each fastening location. A similar pair of U-bolt assemblies shall be used in attaching each chord of an overhead component to upright supports. U-bolts for steel support structures shall conform to ASTM A449, Type 1. U-bolt hardware, which includes nuts, flat washers, and helical lock washers, shall be galvanized in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695, Class 50, Type I. Washers shall conform to the requirements of ASTM F436. The U-bolt material for aluminum support structures, or a combination of steel and aluminum structural components, shall be stainless steel conforming to the requirements of ASTM F593, alloy group 1, with a minimum yield strength of 45 ksi. Steel support structures may also utilize stainless steel hardware assemblies as an alternative to galvanized steel. Nuts shall be of the locking type with nylon inserts. Washers shall conform to the requirements of ASTM A276, Type 302. Flat washers, without helical lock washers, will be acceptable in this stainless steel assembly.

On bridge mounted structures, the fastener configurations shall be depicted in the Contract documents.

- 719.073 ***Post Clip Hardware for Overhead Signing*** - Signs mounted steel or aluminum W shape beam components shall be attached using post clip hardware as described in this Section as well as the Contract documents. Overhead signing shall have post clip assemblies fastened in pairs, one on each side of the web of the W shape beam, at all locations on the backside of the extruded plank panels that provide a groove accommodating a post clip bolt and assembly. Post clips shall be 356-T6 aluminum conforming to the requirements of ASTM B108. The post clip bolt material for overhead signing shall be stainless steel conforming to the requirements of ASTM A193/A193M, AISI Type 304, Grade B8. The post clip bolt nut shall be stainless steel material conforming to the requirements of ASTM A194/A194M, AISI, Type 303, Grade 8F and of the locknut type with nylon inserts. Flat

washers of these assemblies shall be stainless steel material conforming to the requirements of ASTM A276, Type 302.

719.074 **Post Clip Hardware for Roadside Signing** - Signs mounted on other than overhead locations may be mounted using aluminum hardware. The aluminum post clips shall be 356T-6 aluminum conforming to the requirements of ASTM B108. The post clip bolts, washers and nuts shall conform to the requirements of aluminum alloy 2024-T-4 (bolts and washers) and alloy 6061-T6 or 6262-T9 (lock nuts).

719.075 **Roadside Signing** - Aluminum signs mounted on U-channel posts shall be fastened with 5/16 by 1½" stainless steel bolts, washers, and self-locking type nuts. The bolts shall conform to the requirements of ASTM F593. A washer, either a white nylon or neoprene or stainless steel ASTM F593 shall be used between the head of the bolt and the face of the sign.

Plywood signs mounted on U-channel posts shall be fastened with 5/16 by 2½" stainless steel cap screws and hex nuts conforming to ASTM F593, and a washer either white nylon or neoprene or stainless steel ASTM F593 shall be used between the head of the bolt and the face of the sign.

Delineator assembly hardware shall consist of ¼ by 2¼" stainless steel bolts, washers, and self-locking type nuts. The bolt assembly shall conform to the requirements of ASTM F593.

SECTION 720 - STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS

720.01 **Aluminum Supports** - Extrusions for aluminum supports shall conform to ASTM B221 or ASTM B429, Alloy 6061-T6 or 6063-T6. Castings for use with aluminum supports shall conform to ASTM B26 or B108, Alloy 356.0-T6, except that castings for parts having a non-structural application, such as pole caps or bolt covers, may be temper F. The T6 tempers specified for Alloys 6063 and 356.0 shall be obtained by the proper heat treatment of the assemblies after all welding for the base and if required, for the handhole reinforcement has been completed. No welding will be allowed on the shaft other than as required for the attachment of the shoe base, handhole reinforcement and bracket arm. All welding for aluminum shall conform to the current edition of AWS Structural Welding Code - Aluminum D1.2 (AWS D1.2).

All welds shall be inspected and conform with AWS D1.2, Clause 5, Inspection. 100% of welds shall be visually examined (VT). In addition to VT, 10% of all partial joint penetration (PJP) and fillet welds shall be dye penetrant tested (PT); locations to be PT examined will be designated by the QAI. 25% of complete joint penetration (CJP) welds shall be ultrasonic tested (UT) or PT based on the thinner

material in the welded joint; joints with thinner material thicknesses less than 0.25" shall be PT examined and joints with thinner material thickness equal or greater than 0.25" shall be UT examined. Locations to be UT examined will be designated by the QAI. Extent of testing shall conform with AWS D1.2, Clause 5.

The exterior of all parts shall have a satin brushed or satin etched finish. The assemblies shall be free of bulges, dents, and cracks and on external surfaces, discoloration and scratches. The presence of any of these defects or any other imperfection detrimental to strength or appearance may be cause for rejection by the Resident. All assemblies shall be tire wrapped for protection during shipment, storage, and handling.

All ends of shafts open to the weather shall be fitted with a cast-aluminum or formed aluminum cap secured in place with set screws.

All assemblies shall be permanently marked on the edge of the base plate or flange, indicating alloy and temper of base plate/flange and shaft, as well as the diameter and wall thickness of the shaft.

a. ***Light Standards, Mast Arm Poles, Strain Poles and Dual Purpose Poles***

- Shafts shall be round, tapered and seamless and shall be fabricated as a single continuous unit without splices, except that shafts with a length of over 40 ft may be fabricated with one splice at approximately mid-height and dual purpose poles may be fabricated with a splice immediately above the mast arm attachment. The minimum wall thickness of the shaft shall be 0.188". A hand hole of approximately 25 in² in area, reinforced to maintain the full design strength of the shaft, shall be provided with the handhole center approximately 18" above the base. Provisions for internal grounding shall be incorporated in the handhole reinforcement. A hole, fitted with a rubber grommet, shall be provided in the shaft to match the wire-way of the bracket arm or mast arm, except that strain poles shall be provided with a wire inlet as shown on the standard details. Bases shall be shoe type and shall be supplied with suitable covers for the anchor bolts. Anchor bolt covers shall be securely fastened to the base by means of one or more stainless steel Phillips or hex head screws with a minimum size of ¼". Bases shall be welded to the shaft with both an internal and external continuous fillet weld. The use of sleeve type bases or other bases not requiring welding of the shaft to the base and the use of reinforcing sleeves will not be allowed.

Dual-purpose poles shall be provided with a pull wire for the luminaire.

b. ***Colonial Light Standards*** - Shafts shall be round, tapered and seamless and shall be fabricated as a single continuous unit without splices. The minimum wall thickness shall be 0.125" and the minimum diameter at the base shall be 5". The length of the shaft plus the base shall be 14¼ ft, with a 4" long by 3" OD straight section at the top to accept the pole top luminaire. The entire assembly of pole and base shall be black anodized.

Bases shall be handhole type with a handhole of approximately 25 in² in area and equipped with an approved locking device on the handhole cover. The bases shall have internal flanges capable of accepting four ¾" anchor bolts, equally spaced on a 10" diameter bolt circle. The bases shall be welded to the shaft with both an internal and an external continuous fillet weld.

- c. **Pedestal Poles** - Shafts shall be round, tapered and seamless and shall be fabricated as a single continuous unit without splices. The minimum outside diameter at the base shall be 6" and the minimum wall thickness shall be ⅛". The length of the pole plus the base shall be 10 ft, except that the length of poles supporting only pedestrian heads shall be 8 ft. Bases shall be transformer type with suitable covers for the anchor bolts. The bases shall be welded to the shaft with an external and an internal fillet weld.
- d. **Bridge, Cantilever and Butterfly Type Sign Support Structures** - The configuration of the foundations, bases, shafts, and trusses shall be of the Contractor's design, as approved by the Engineer, and shall use only material as specified above. Sleeve type bases or other bases not requiring welding to the shaft and the use of reinforcing sleeves will not be allowed.

720.02 **Aluminum Mast Arm and Bracket Arm** - Mast arms and bracket arms shall be of the same materials as the matching pole and have a similar finish. Member cross sections shall be either round or elliptical and have a minimum wall thickness of ⅛". Internal diameters, bends, joints, and attachments shall permit internal wiring in the upper member of the arms. Fixtures for attaching the arms to the poles shall be either castings or extrusions, sized to meet the design requirements, and shall be designed to prevent rotation of the arms about the poles. Any mechanical means used to prevent rotation shall completely penetrate both the fixture and the shaft and the use of set screws will not be allowed. All welding for aluminum shall conform to the current edition of AWS Structural Welding Code - Aluminum D1.2 (AWS D1.2).

All welds shall be inspected and conform with AWS D1.2, Clause 5, Inspection. 100% of welds shall be visually examined (VT). In addition to VT, 10% of all partial joint penetration (PJP) and fillet welds shall be dye penetrant tested (PT); locations to be PT examined will be designated by the QAI. 25% of complete joint penetration (CJP) welds shall be ultrasonic tested (UT) or PT based on the thinner material in the welded joint; joints with thinner material thicknesses less than 0.25" shall be PT examined and joints with thinner material thickness equal or greater than 0.25" shall be UT examined. Locations to be UT examined will be designated by the QAI. Extent of testing shall conform with AWS D1.2, Clause 5.

- a. **Mast Arms for Signals** - Mast arms shall be of the tapered tube truss type design, consisting of an upper and a lower member with vertical struts,

welded to form an integral unit or single member tapered arm. Mast arms shall be equipped with sturdy signal hangers and/or appropriate tenons for mounting the signal heads and shall have weatherproof wire inlets located close to the suspended signal heads.

- b. **Bracket Arms for Luminaires** - Bracket arms shall be of the single member or truss type. Single member type bracket arms shall be of the tapered upsweep design. Truss type bracket arms shall be of a tapered tube design, consisting of an upper and a lower member and a single vertical strut, welded to form an integral unit. Arms shall be equipped with an appropriate tenon for the attachment of the luminaire.

720.03 **Steel Supports** - Tapered shafts for steel supports shall conform to ASTM A595, Grade A or approved equal. Straight shafts for steel supports shall conform to ASTM A53, Grade B, ASTM A500, Grade A and B, or an approved equal. Base plates and flanges shall be fabricated of steel plate conforming to ASTM A709, Grade 36 or 50 and sized to transmit the full design load of the shaft. Steel shapes shall conform to the requirements of ASTM A992. Flange chord splice plates and base plates are considered main load carrying members and shall comply with the requirements of Section 713.01 - Structural Steel. All work shall conform to the applicable provisions of Section 504 - Structural Steel.

The interior and exterior of all support structure components shall be hot-dip galvanized in conformance with AASHTO M 111.

Chord flange splice fastener assemblies shall conform to ASTM A325, Type 1, and galvanized in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695, Class 50, Type I. Other fastener assemblies shall be as specified in Section 719.07, or as approved by the Fabrication Engineer.

All ends of shafts open to the weather shall be fitted with an appropriate cast aluminum or galvanized cast iron cap secured in place with stainless steel set screws conforming to the requirements of ASTM F593.

All assemblies of each structure shall be permanently marked on the edge of the base plate or flange indicating steel specification, type and grade of base plate/flange and shaft, as well as the diameter and wall thickness of the shaft.

- a. **Light Standards, Mast Arm Poles, Strain Poles and Dual Purpose Poles** - Shafts shall be round, unless otherwise specified in the Contract plans, and either tapered or of uniform cross section and shall be fabricated as a single continuous unit without splices, except that shafts with length over 40 ft may be fabricated with one splice at approximately mid-height and dual purpose poles may be fabricated with a splice immediately above the mast arm attachment. The minimum wall thickness of the shafts shall be number 7 gauge. A hand hole of approximately 25 in² in area, reinforced to maintain the full design strength of the shaft, shall be provided with the hand hole center approximately 18" above the base plate. Provisions for internal grounding shall be provided in a location accessible through the

hand hole. A hole, fitted with a rubber grommet, shall be provided in the shaft to match the wire-way of the bracket arm or mast arm, except that strain poles shall be provided with a wire inlet as shown on the standard details. On dual-purpose poles, a pull wire shall be provided for the luminaire.

- b. **Pedestal Poles** - Shafts shall be 4" nominal ID, schedule 40 pipe without splices. The length of the pole plus the base shall be 10 ft, except that the length of poles supporting only pedestrian heads shall be 8 ft.
- c. **Bridges, Cantilever, and Butterfly Type Sign Support Structures** - The configuration of the foundations, bases, shafts, and trusses shall be of the Contractor's design as approved by the Resident and shall use only material specified above.

720.04 **Steel Mast Arm and Bracket Arm** - Material for mast arms and bracket arms shall be as specified in Section 720.03. Internal diameters, bents, joints, and attachments shall permit internal wiring in the upper member of the arms. Arms shall be hot dipped galvanized, both inside and outside, in conformance with AASHTO M 111. All work shall conform to the applicable provisions of Section 504 - Structural Steel.

- a. **Mast Arms for Signals** - Mast arms may be of the single member or the truss type. Single member type mast arms shall be a single, straight or tapered, round member and may incorporate a maximum of 2 telescopic splices. Truss type mast arms shall be of a tapered design consisting of an upper and a lower member connected by vertical struts welded to form an integral unit. Mast arms shall be equipped with sturdy signal hangers and/or appropriate tenons for mounting the signal heads and shall have weatherproof wire inlets located close to the suspended signal heads.
- b. **Bracket Arms for Luminaires** - Bracket arms may be of the single member or the truss type. Single member type bracket arms shall be of the tapered upsweep design. Truss type bracket arms shall be of a tapered design consisting of an upper and lower member connected by a single vertical strut, welded to form an integral unit. Bracket arms shall be equipped with an appropriate tenon for the attachment of the luminaire.

720.05 **High Mast Light Standard** - High mast light standards shall have a cross section that is either round or polygonal with not less than 12 sides, and shall have a uniform taper from the base to the top, except that an expanded base section may be used, if required, to accommodate the electrical and mechanical equipment. All work shall conform to the applicable provisions of Section 504 - Structural Steel.

For unpainted high mast structures, material for the shaft, base and attachments shall conform to the requirements ASTM A709 Grade 50W or ASTM A595, Grade C.

The base plate and reinforcing components of high mast poles shall be considered main load carrying members and shall comply with the requirements of Table A, Section 713.01 - Structural Steel. If applicable, the Contractor shall submit a proposed coating specification for approval by the Fabrication Engineer.

A Certificate of Compliance shall be provided for all material in accordance with the requirements of the General Statement of Division 700 - Materials.

720.06 **Steel H-beam Posts** - Steel H-beam Post shall conform to the requirements of ASTM A992. All work shall conform to the applicable provisions of Section 504 – Structural Steel. Steel shall be hot-dip galvanized in accordance with AASHTO M 111 (ASTM A123). All steel hardware for use with H-beam poles shall be galvanized in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695, Class 50, Type I.

720.07 **Anchor Bolts** - Anchor bolts and nuts supplied for aluminum and/or steel supports shall conform to ASTM A449, Type 1, or ASTM F1554, Grade 55, both with a minimum yield strength of 55 ksi. Anchor bolts shall be supplied with 2 heavy hex nuts and 2 hardened washers and unless otherwise specified the anchor bolts shall have a 90° bend with a 6" minimum leg length at the lower end. The anchor bolts, nuts and hardened washers shall be galvanized in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695, Class 50, Type I. The bolt shall be zinc-coated 12" from the exposed end, unless otherwise specified. If the anchor bolts are to be used with breakaway devices incorporating the function of a nut, for example, longitudinally grooved breakaway couplings, nuts or washers will not be required.

Alternate materials, grades, and designs may be used for anchor bolts subject to approval of the Fabrication Engineer.

720.08 **U-Channel Posts** - Except as otherwise authorized, Rib Back U-Channel posts for signs of less than 4 ft² in area, shall be fabricated of steel weighing 2 ½ lb/ft, and shall not be doubled-up. Aluminum U-channel posts having the same strength characteristics and shape as steel U-channel posts may be used, subject to the approval of the Resident. The steel U-channel posts shall be powder coat green in accordance with AASHTO M 111.

720.09 **Wood Ornamental Light Standard** - Material for wood light standards shall be Western Red Cedar (*Rhuja Plicata*) or other species with equal or better decay resistance, approved by the Resident .

The wood cross section shall be 10 by 10" minimum. The mounting height and depth of burial shall be as shown on the plans.

The following items shall be supplied, a 2" slipfitter of corrosion resistant material of adequate length to support the luminaire, a sideplowed wire-way covered by a suitable flush filler strip to accommodate three, number 12 conductors, a pair of two-piece plinths for conduit entrance and splice box.

All bolts shall be galvanized in accordance with AASHTO M 232 (ASTM A153), ASTM F2329, or ASTM B695, Class 50, Type I.

All parts of the wood light standard shall be prefitted and predrilled, holes shall be counterbored to conceal bolts and filled with mastic compound.

The wood light standard surface finish shall be as indicated on the plans.

- 720.10 **Wood Utility Pole** - Wood Utility poles shall be Douglas Fir, Red Pine or Southern Yellow Pine, conforming to ANSI Standard Specification 05.1 and of the class and length as indicated on the plans.

Poles shall not have more than 180° twist in grain over the full length. Sweep shall be no more than 4". Tops of poles shall be beveled.

Wood Utility poles shall be pressure treated, after fabrication in accordance with AASHTO Specifications M 133 and AWWA U1, UC4B, Commodity Specification D: Poles.

- 720.11 **Mast Arms for Wood Utility Poles** - All mast arms for wood Utility pole attachment shall be standard 2" diameter pipe of specified length and shall include a mast arm head, universal joint, insulated wire inlet, tie rods, cross arm and mounting brackets. The vertical distance between the mast arm and point of attachment of the cross arm shall not be less than 40% of the mast arm length. All attachments for mast arm assemblies shall be designed to withstand stresses due to the mast arm and signal weights and wind loads generated by a 100 mph wind.

- 720.12 **Wood Sign Posts** - Wood sign posts shall be rectangular, straight and sound timber, cut from live growing native spruce, red pine, hemlock, cedar trees or other AWWA approved species, free from loose knots or other structurally weakening defects of importance, such as shake or holes or heart rot. A tolerance of 1" in length and ¼" in width or thickness is permitted in the dimensions of rectangular posts. They shall be sawn true and planed 4 sides. Nominal dimensions of rectangular posts shall be as given in the Contract documents.

Breakaway requirements - 4 by 6" posts shall have two 1½" diameter holes drilled perpendicular to traffic, one hole centered at 4" above ground level and one centered at 18" above ground level (posts shall be installed with the 6" length parallel to the roadway); 6 by 6" posts shall have two 2" diameter holes drilled perpendicular to traffic, one hole centered at 4" above ground level and one centered at 18" above ground level; 4 by 4" posts need not be modified.

All sign posts shall be pressure-treated in accordance with AASHTO M 133 and AWWA Standard U1, UC4A, Commodity Specification A: Sawn Products.

SECTION 721 - BREAKAWAY DEVICES

- 721.01 **Breakaway Devices** - Breakaway devices shall be capable of supporting all design loads and shall conform in all respects to the requirements of the AASHTO “Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals” and all applicable commentary. Breakaway Support Certification of both breakaway and structural adequacy shall be provided by the Manufacturer. Design calculations or test data of production samples to support certification shall be provided. Breakaway support components shall provide the same or greater structural strength as the support post or pole utilizing the breakaway device.

SECTION 722 - GEOTEXTILES

- 722.00 **General Geotextile Property Requirements** - This is a materials specification covering geotextile fabrics for use in stabilization/reinforcement, drainage, erosion control and separation applications. This specification sets forth a set of physical, mechanical and endurance properties that must be met, or exceeded, by the geotextile being manufactured. This specification is intended to assure both good quality and performance of geotextiles but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application. This specification is based on geotextile survivability from installation stresses. This Section is intended for use in conjunction with Section 620 - Geotextiles.

Table 1 provides strength properties for three geotextile classes. The geotextile shall conform to the properties in Table 1 based on the Geotextile Class required in the application specific sections which follow.

All Table 1 property values represent Minimum Average Roll Value (MARV) in the weakest principal direction and shall meet or exceed the values stated below. The geotextile properties required for each Class are dependent on geotextile elongation. (See Table on next page.)

TABLE 1 - GEOTEXTILE STRENGTH PROPERTY REQUIREMENTS

	Test Method ^a	Class 1 ^b		Class 2 ^b		Class 3 ^b	
		Elongation		Elongation		Elongation	
		<50% ^c	≥50% ^c	<50% ^c	≥50% ^c	<50% ^c	≥50% ^c
Grab Strength (lb)	D 4632	315	202	247	157	180	112
Sewn Seam Strength ^d (lb)	D 4632	283	182	223	142	162	101
Tear Strength (lb)	D 4533	112	79	90e	56	67	40
Puncture Strength (lb)	D 6241	618	433	495	309	371	223
Other	Test Method ^a						
Conformance	D 4759						
Sampling and Testing	D 4354						
Storage and Handling	D 4873						
^a	ASTM test method.						
^b	Required geotextile class is designated in Tables 2, 3, 4, 5, or 6 for the indicated application. The severity of installation conditions for the application generally dictates the required geotextile class. Class 1 is specified for more severe or harsh installation conditions where there is a greater potential for geotextile damage, and Classes 2 and 3 are specified for less severe conditions.						
^c	As determined in accordance with ASTM D4632. The strengths specified in the columns labeled “<50%” and “≥50%” refer to the elongation at which the geotextile material was tested. For example; if a fabric is tested at 15% elongation then it must meet or exceed the minimum strength shown in the “<50%” column. Submittals must include the percent elongation at which the material was tested.						
^d	When sewn seams are required.						
^e	The required MARV tear strength for woven monofilament geotextiles is 56 lb.						

722.01 **Stabilization/Reinforcement Geotextile** - The Stabilization/Reinforcement Geotextile shall meet or exceed the requirements of Table 2. All property values, with the exception of Apparent Opening Size (AOS), represent MARV in the weakest principal direction. Values for AOS represent maximum average roll values.

Both woven and nonwoven geotextiles are acceptable; however, woven “slit-film” geotextiles will not be allowed and woven geotextiles will not be allowed for subgrade stabilization/reinforcement under pavement structural sections. (See Table on next page.)

TABLE 2 - STABILIZATION/REINFORCEMENT GEOTEXTILE PROPERTY VALUES

Other Properties		Test Method	Requirements
Geotextile class			Class 1 from Table 1 ^a
Permittivity (minimum)		ASTM D4491	0.05/sec ^b
Apparent Opening Size (AOS)		ASTM D4751	0.43mm (maximum)
Ultraviolet Stability (Retained Strength)		ASTM D4355	50% after 500 hours of exposure
^a	Default geotextile selection. Class 2 or 3 may be specified based on survivability or field testing.		
^b	Permittivity of the geotextile should be greater than that of the soil. The Resident may also require the permeability of the geotextile to be greater than that of the soil.		

722.02 Drainage Geotextile - The Drainage Geotextile shall meet or exceed the requirements of Table 3. All property values, with the exception of AOS, represent MARV in the weakest principal direction. Values for AOS represent maximum average roll values.

Both woven and nonwoven geotextiles are acceptable, however, woven "slit-film" geotextiles will not be allowed.

TABLE 3 - DRAINAGE GEOTEXTILE PROPERTY VALUES

Other Properties	Test Method	Requirements Percent In-Situ Soil Passing #200 (0.075 mm) ^a		
		<15%	15% to 50%	>50%
Geotextile class		Class 2 from Table 1b		
Permittivity ^{c, d} (minimum)	ASTM D4491	0.5/sec	0.2/sec	0.1/sec
Apparent Opening Size (AOS) mm (maximum) ^{c, d}	ASTM D4751	0.43	0.25	0.22 ^e
Ultraviolet Stability (Retained Strength)	ASTM D4355	50% after 500 hours of exposure		
^a	Based on grain size analysis of in situ soil in accordance with AASHTO T 88.			
^b	Default geotextile selection. Class 3 may be specified based on survivability, field testing or specific drain construction requirements.			
^c	These default filtration property values are based on predominant particle sizes of the in-situ soils. In addition to the default permittivity value, the Resident may require geotextile permeability and/or performance testing based on engineering design for drainage systems in problematic soil environments.			
^d	Site specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodible soils such as non-cohesive silts; gap graded soils; alternating sand/silt laminated soils; dispersive clays; and/or rock flour.			
^e	For cohesive soils with a plasticity index greater than 7, geotextile maximum average roll value for apparent opening size is 0.30mm.			

722.03 **Erosion Control Geotextile** - The Erosion Control geotextile shall meet or exceed the requirements of Table 4. All property values, with the exception of AOS, represent MARV in the weakest principal direction. Values for AOS represent maximum average roll values.

Both woven and non-woven geotextiles are acceptable; however, woven “slit-film” geotextiles will not be allowed.

TABLE 4 – EROSION CONTROL GEOTEXTILE PROPERTY VALUES

Other Properties	Test Method	Requirements Percent In-Situ Soil Passing #200 (0.075 mm) ^a		
		<15%	15% to 50%	>50%
Geotextile class: Woven monofilament geotextiles All other geotextiles		Class 2 from Table 1 (see below) Class 1 from Table 1 (see below)		
Permittivity ^{a, b} (minimum)	ASTM D4491	0.7/sec	0.2/sec	0.1/sec
Apparent Opening Size (AOS) mm (maximum) ^{b, c, d}	ASTM D4751	0.43	0.25	0.22 ^{c, d}
Ultraviolet Stability (Retained Strength)	ASTM D4355	50% after 500 hours of exposure		
^a	Based on grain size analysis of in situ soil in accordance with AASHTO T 88.			
^b	These default filtration property values are based on predominant particle sizes of the in-situ soils. In addition to the default permittivity value, the Resident may require geotextile permeability and/or performance testing based on engineering design for drainage systems in problematic soil environments.			
^c	Site specific geotextile design should be performed especially if one or more of the following problematic soil environments are encountered: unstable or highly erodible soils such as non-cohesive silts; gap graded soils; alternating sand/silt laminated soils; dispersive clays; and/or rock flour.			
^d	For cohesive soils with a plasticity index greater than 7, geotextile maximum average roll value for apparent opening size is 0.30mm. Woven Monofilament Erosion Control Geotextiles require Class 2 geotextile class designation. All other Erosion Control Geotextiles require Class 1 geotextile class designation.			

The Erosion Control Geotextile class selection is appropriate for conditions of equal or less severity than either of the following:

- Armor layer stone weights do not exceed 220 lb, stone drop height is less than 3 ft, and no aggregate bedding layer is required.
- Armor layer stone weighs more than 220 lb, stone drop height is less than 3 ft, and the geotextile is protected by a 6" thick aggregate bedding layer designed to be compatible with the armor layer. More severe applications

require an assessment of geotextile survivability based on a field trial section and may require a geotextile of higher strength properties.

The Resident may specify a Class 2 geotextile based on one or more of the following:

- a. The Resident has found Class 2 geotextiles to have sufficient survivability based on field performance of the geotextile.
- b. The Resident has found Class 2 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.
- c. Armor layer stone weighs less than 220 lb, stone drop height is less than 3 ft, and the geotextile is protected by a 6" thick aggregate bedding layer designed to be compatible with the armor layer.
- d. Armor layer stone weights do not exceed 220 lb and stone is placed with a zero drop height.

Note: Section 703.25 - Stone Fill has stones up to 500 lb, Section 703.26 - Plain and Hand Laid Riprap has stones up to 200 lb, Section 703.27 - Stone Blanket has stones up to 3,000 lb, Section 703.28 - Heavy Riprap has stones up to 1000 lb.

722.04 **Separation Geotextile** - The Separation geotextile shall meet or exceed the requirements of Tables 5 and 6. All property values, with the exception of AOS, represent MARV in the weakest principal direction. Values for AOS represent maximum average roll values. (See Table 6 on next page.)

Both woven and non-woven geotextiles are acceptable.

TABLE 5 - SEPARATION GEOTEXTILE PROPERTY VALUES

Other Properties	Test Method	Requirements
Geotextile class		See Table 6
Permittivity	ASTM D4491	0.02/sec ^a
Apparent Opening Size (AOS)	ASTM D4751	0.60 mm(maximum)
Ultraviolet Stability (Retained Strength)	ASTM D4355	50% after 500 hours of exposure
^a Permittivity of the geotextile should be greater than that of the soil. The Resident may also require the permeability of the geotextile to be greater than that of the soil.		

TABLE 6 - REQUIRED DEGREE OF SURVIVABILITY AS FUNCTION OF SUBGRADE CONDITIONS, CONSTRUCTION EQUIPMENT, AND LIFT THICKNESS

Required Degree of Survivability as Function of Subgrade Conditions, Construction Equipment, and Lift Thickness^a	Low Ground-Pressure Equipment ≤3.6 psi	Medium Ground-Pressure Equipment >3.6 to ≤7.3 psi	High Ground-Pressure Equipment >7.3 psi
Subgrade has been cleared of all obstacles except grass, weeds, leaves, and fine wood debris. Surface is smooth and level so that any shallow depressions and humps do not exceed 18" in depth or height. All larger depressions are filled. Alternately, a smooth working table may be placed.	Low (Class 3)	Moderate (Class 2)	High (Class 1)
Subgrade has been cleared of obstacles larger than small to moderate -sized tree limbs and rocks. Tree trunks and stumps should be removed or covered with a partial working table. Depressions and humps should not exceed 18" in depth or height. Larger depressions should be filled.	Moderate (Class 2)	High (Class 1)	Very High (Class 1+)
Minimal site preparation is required. Trees may be felled, delimbed, and left in place. Stumps should be cut to Project not more than 6" above subgrade. Geotextile may be draped directly over the tree trunks, stumps, large depressions and humps, holes, stream channels, and large boulders. Items should be removed only if placing the geotextile and covering material over them will distort the finished roads surface.	High (Class 1)	Very High (Class 1+)	Not Recommended
^a Recommendations are for 6 to 12" initial lift thickness. For other initial lift thicknesses: • 12 to 18": reduce survivability requirement one level; • 18 to 24": reduce survivability requirement two levels; • >24": reduce survivability requirement three levels.			

For special construction techniques such as prerutting, increase the geotextile survivability requirement one level. Placement of excessive initial cover material thickness may cause bearing failure of the soft subgrade.

Class 1+ (extra high strength) geotextile properties are higher than Class 1 and shall meet the minimum requirements of Table 7.

TABLE 7 - CLASS 1+ GEOTEXTILE STRENGTH PROPERTY REQUIREMENTS

Class 1+ - Extra High Strength Geotextile	Test Method	Class 1+
Grab Strength - lb	ASTM D4632	375
Sewn Seam Strength ^a - lb	ASTM D4632	335
Tear Strength - lb	ASTM D4533	135
Puncture Strength - lb	ASTM D6241	745
^a When sewn seams are required		

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