STATE OF MAINE

Department of Transportation

Standard Specifications

Revision of December 2002

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Dual units, metric and US Customary, are presented.
Metric values no dot necessarily equal US Customary values.

FOREWARD

This edition of the State of Maine, Department of Transportation, Standard Specifications will be used on Projects designed and Bid in either metric or US Customary units. Individuals using these Standard Specifications must familiarize themselves with the proper units.

The metric units are listed first, with the US Customary units following in brackets. The Bidder shall be responsible for determining if metric or US Customary is used in the Schedule of Items and for determining the proper Bid for the units shown. All Projects will be built in the units shown on the Schedule of Items. An electronic version of these specification is available for reference purposes at www.state.me.us/mdot/project/design/homepage.htm

COMMON METRIC UNITS AND CONVERSION TO US CUSTOMARY

Unit	Multiply	By	To Get
Length	mi	1.609344	km
	ft	0.3048	m
	in	25.4	mm
Area	mi^2	2.5900	km^2
	acre	0.404856	ha
	yd^2	0.836127	m^2
	ft^2	0.092903	m^2
Volume	yd^3	0.764555	m^3
	ft^3	0.028317	m^3
	gal	3.78541	L
Mass	lb	0.453592	kg
	ton	0.907184	Mg
Mass/Unit Area	psf	4.88243	kg/m^2
Mass Density	pcf	16.0185	kg/m^3
Force	lb	4.44822	N
	kip	4.44822	kN
Force/Unit Length	klf	14.5939	kN/m
Pressure Stress Modulus of Elasticity	psf ksf psi ksi	47.8803 47.8803 6.89476 6.89476	Pa kPa kPa Mpa
Bending Moment / Torque	ft-lb	1.35582	Nm
Moment of Force	ft-kip	1.35582	kNm
Moment of Inertia	in^4	416231	mm^4
Section Modulus	in^3	16387.064	mm^3
Temperature	°F	5/9(°F-32)	°C

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100.1 Replacement of Former Standard Specifications and Standard Details This edition of the Maine Department of Transportation's Standard Specifications and Standard Details for Highways and Bridges, was drafted and adopted by the Department pursuant to the authority granted by 23 MRSA §753. These Standard Specifications and Standard Details for Highways and Bridges replace and supersede all previous editions of the Department's Standard Specifications and Standard Details for Highways and Bridges.

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
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
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
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 Preservers Association
AWS	American Welding Society
BMP	MDOT'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
LURC	Land Use Regulation Commission - Maine
MCTCB	Maine Concrete Technician Certification Board
MDEP	Maine Department of Environmental Protection
MDOT	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
OSHA	Occupational Safety and Health Administration
PIN	Project Identification Numbers
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
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, meaning MDOT)
SPCCP	Spill Prevention Control and Countermeasure Plan
SSPC	Steel Structures Painting Council
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

101.2 Definitions 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 Sections 109.7.3 - Compensable Items and 109.7.4 - Non-compensable Items.

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 d) other pre-execution requirements of the Contract, or 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.

Appendix A See Federal Contract Provisions Supplement.

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 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 it's 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.

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 Notice to Contractors, Plans and Specifications (including these Standard Specifications), 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 02.9 - 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 having a clear span of 20 feet or more measured horizontally at the elevation of the Bridge seats along the centerline of the Road or in case of multiple spans when the combined clear spans equal or exceed 20 feet.

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 clear opening of the structure.

B. Roadway Width The clear 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 less 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
Federal form PR 47 (Only on National Highway Projects which exceed $850,000)
A letter stating the amount of monies paid to DBE Subcontractors to meet Contract DBE goals
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 to use or control property, outside of the established Right-of-Way.

Construction Limit Line A line, usually outside of the Right-of-Way, within which the Contractor may Work and outside of which Work may not be performed.

Contract All documents affecting the respective rights and responsibilities of the Department and the Contractor. These documents include, but are limited to, the Contract Agreement, 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/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.

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. Alternatively, "Contractor," with a lower case "c," may mean a firm engaged in construction Work.

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.

Culvert Any structure not defined as a Strut or Bridge that provides a Drainage opening under the Roadway or approaches to the Roadway.

Days 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 §4202 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 is 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 753A.

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.

Dispute Review Board (DRB) A panel of three experienced persons that the parties may agree to use to make recommendations regarding the resolution of Disputes. Upon mutual Agreement, a single individual may act as a DRB. For a related provision, see Section 111.4 - Dispute Review Board.

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) "Dredge materials" means 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.

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 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.

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

Federal Contract Provisions Supplement Appendix A to these Standard Specifications, which set 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, foundation design reports, hazardous waste assessments, and other records or reports 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 Year's Day, Martin Luther King Day, President's Day, Patriot's Day, Memorial Day, Independence Day, Labor Day, Columbus 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.

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.

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 two 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.

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. Said amount is 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.

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 it's 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 (1) Natural Resources Protection Act (NRPA) permit from MDEP and (2) Army Corps of Engineers Permit 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, Standard Details, Supplemental Standard Details, 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 Bureau of Project Development within which a particular Department project is developed, designed, and administered. Such Programs include the Regional Program, Urban and Arterial Highway Program, Urban and Federal Bridge Program, and Multimodal Program.

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 or Construction Limit Lines shown on the Plans or otherwise indicated in the Contract. If no Project Limits are indicated in the Contract, the Project Limits shall be the area actually occupied by the Bridge, Highway, or other infrastructure before construction extending to and including (A) the area outside the Shoulders and ditch lines and within any landmarks or historic features such as fences, fence posts, tree rows, stone walls, corner stones, or other monuments indicating the boundary line, or (B) in the absence of any landmarks or historic features, Sidewalks, Shoulders, and ditch lines to the top of cuts or toe of fills. 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, and 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 specifies the actions, inspection, sampling, and testing necessary to keep production and placement operations within Specifications, including provisions to quickly determine when an operations becomes out of control and those actions that the Contractor will take to restore compliance.

Received or Receipt When considering documents, unless the context indicates otherwise, Receipt by regular US mail, overnight courier, service in hand, or by fax or electronic transmission with confirmation of Receipt originating from the recipient (which may be a telephone confirmation). If Delivered by regular US mail, notices that are

properly addressed will be deemed Received three 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 A general term denoting land, property, or interest therein, usually in the form of a strip, acquired for or devoted to the Project or other purposes.

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 list of items of Work provided in the Bid Documents for which the Contractor must provide prices.

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 The Standard Specifications for Construction published and approved by the Department pursuant to 23 MRSA § 753 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 Any structure not defined as a Culvert or Bridge that provides a Drainage opening under the Roadway or approaches to the Roadway, that is over 1.5 M [5 ft] but less than 6.1 M [20 ft] in nominal diameter.

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 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 prime 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 The portion of the Structure above the bearings of simple and continuous spans, Skewbacks of arches and top of footings of rigid frames, excluding backwalls, wingwalls, and wing protection railing.

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 Specification 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.

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.

Working Day A calendar day, exclusive of Saturdays, Sundays, holidays and the period from November 15th to May 15th inclusive, on which weather and other conditions not under the control of the Contractor will permit construction operation to proceed for 70% of the hours of the usual working day with normal working force.

Saturday shall be considered one half of a working day if the Contractor works 2 or more hours during the forenoon. If the Contractor works after 12 o'clock noon, it shall be considered as one working day. If after approval, work is performed on a Sunday or Holiday, the day shall be considered a working day. Work necessary either for the safety of the traveling public or maintenance, performed on Sundays or Holidays, which is neither caused by nor resulting from any fault of the Contractor, shall not be considered a working day.

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) comply with the Prequalification Procedure adopted by the Department, (B) not have been debarred or suspended from Bidding, and (C) 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 two 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", Maine Department of Transportation 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.

102.4 Estimated Quantities Quantities shown in the Bid Documents are estimates only to be used for the preparation and comparison of Bids. They may be increased, decreased, or eliminated in their entirety. 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 in writing/facsimile and must be received 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.

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, PIN, and the words “Bid Enclosed”. For a related provision, see Section 102.11 - "Bid Responsiveness".

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 Appendix A 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.

A. 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.

B. The Bidder is not eligible to Bid as set forth in Section 102.1 - Eligibility to Bid.

C. The Bid is not signed by a duly authorized representative of the Bidder.

D. A Bid Guaranty Conforming to Section 102.6 - Bid Guaranty is not submitted.

E. The unit or lump sum price for any item is not provided or is illegible as determined by the Department.

F. The Bidder fails to indicate the Bidder's choice where the Bid Documents clearly require a choice.

G. The Bid contains any conditional or alternate Bidding language including the right to accept or reject an Award of the Contract.

H. 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.

I. The Department has substantial evidence of collusion by the Bidder.

J. The Bidder fails to comply with any provision in the Bid Documents that expressly indicates that such non-compliance will cause Bid rejection.

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.

A. The Bidder only signs one of the Contract Agreement Offer & Award forms.

B. The Bid is not submitted on forms provided by the Department or identical copies thereof.

C. Missing total sum of the items provided in the Schedule of Items.

D. The prices or signatures on the Bid or Bid Guaranty are not in ink or other non-erasable substance.

E. Failure to acknowledge Receipt and consideration of all Bid Amendments.

F. 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

103.1.1 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, which 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, which 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 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 Notice and Information Gathering After Bid Opening and as a condition for Award of a Contract that did not require pre-Bid qualification, the Department may require an Apparent Successful Bidder that was not prequalified pursuant to the Contractor's Prequalification Procedure 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 to pay or settle all bills for labor, Materials or services on past or current Contracts.

C. Failure to provide Closeout Documentation on past or current Contracts.

D. Failure to fulfill warranty obligations on past or current Contracts.

E. Failure to comply with directives of the Department on past or current Contracts.

F. "Below Standard" performance as determined from the Department's Contractor's Performance Rating process.

G. Inability of the Contractor to obtain or retain performance or Payment Bonds meeting MDOT requirements.

H. Failure to accept an Award of a Contract made by the Department to the Contractor.

I. Making materially false, deceptive, or misleading Statements or omissions, whether or not under oath, regarding a claim on prior Contracts or on the Contractor's Prequalification Application.

J. Failure to provide information requested by the Department pursuant to this Section 103.3.

K. 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).

L. Debarment or suspension 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.

M. Other 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.

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 to Bid on future Department Contracts until the Bidder is prequalified pursuant to the Department's Prequalification Procedure.

103.4 Notice of 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. Once these pre-execution conditions are met, the Department will 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 30 days of receipt of the proper bonds and insurance, the Apparent Successful Bidder may withdraw its Bid without forfeiture of its Bid Guaranty or Bidding eligibility. The Notice of Intent to Award will set forth and/or reference the conditions that the Bidder must fulfill before Contract Execution. 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.

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 person 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 which (A) is not licensed to do business within the State of Maine, or (B) 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 which 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 Rule 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 two 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 Execution of Contract by Department The Commissioner or the Commissioner's authorized agent will execute the Contract within 14 Days of the fulfillment of all Award Conditions. After execution by the Department, one of the original Contracts will be returned to the Contractor. If the Department fails to execute the Contract within said time, 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 function within all applicable laws, statutes, regulations, and Contract provisions; avoid hindering each other's performance; fulfill all obligations diligently; and cooperate in achievement of the intent of the Contract.

104.2 Department's General Authority and Responsibilities

104.2.1 Furnishing of Right-of-Way 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 and 105.4.5 - Special Detours.

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 a related provision, 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 Project Manager and Resident After Contract Execution, the Project Manager and/or 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 Project Manager or 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 Project Manager and/or the Resident have 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 Project 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 - 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 that are required to the Project or temporary Structures 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 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 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 Right-of-Way, 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 Subcontractor.

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 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 105.2.3 - Joint Duty Regarding 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 their 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 three years after Final Acceptance or for any applicable warrantee 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 federal and State laws, rules, regulations, orders, and decrees ("Law") affecting the Work including all environmental, wage, labor, equal opportunity, safety, patent, copyright, or trademark laws. If provided by Contract, the Contractor must also comply with local Law. The Contractor indemnifies the Department and holds the Department harmless 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 by 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 M.R.S.A. § 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 M.R.S.A. § 1303 does not apply. For a related provision, see 23 CFR 635.117.

104.3.9 Patents and Copyrights The Contractor must provide proof of legal Agreement with the patentee or 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 indemnifies and holds harmless the Department and any affected third party or political subdivision from all claims of infringement that arise from use of any patented or copyrighted item listed above.

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 Insurance.

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 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 until Final Acceptance. 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 or otherwise make any good losses that arise from such damage ("rebuilding, etc."). If the Contractor fails to commence and continue such rebuilding, etc. in a timely manner, 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.

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, 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 and/or the Resident 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 Conference After the Contract has been executed and before the start of on-site construction by the Contractor, the Project Manager and/or the Resident will schedule a preconstruction conference that must be attended by the Superintendent. Others may be invited to attend, including Subcontractors, FHWA, local government representatives, environmental regulators, public relations firms, emergency service personnel, Utility Companies, municipal officials, impacted business representatives and/or landowners, or other Project stakeholders.

The agenda of the preconstruction conference may include the following.

A. Bid Amendments

B. Project Specific Permit Requirements
C. Special Provisions
D. Review of Plans and Notes on Plans
E. Pre-Construction Submittals
(1) Bonds - 103.5.1, 110.2.1
(2) Insurance Certificates - 103.5.2, 110.3
(3) Safety Program Information -105.2.1
(4) Emergency Contact List - 105.2.2
(5) Traffic Control Plan (if required) - 652
(6) Certification of Installation of Initial Traffic Controls (if required)
(7) Schedule of Work - 107.4.2
(8) Projected Payment Schedule - 107.4.3
(9) Soil Erosion and Water Pollution Control Plan - 656
(10) Certification of Installation of Initial Erosion Controls - 656.4.2
(11) Subcontractor's List and Certifications - 104.5.3
(12) Quality Control Plan - 106.4
(13) On-the-Job training letter of intent
F. Utility Coordination - 104.4.6
G. Bridge Restriction Notification (if required) - 104.4.10
H. Wage Rates - 104.3.8
I. DBE Requirements
(1) Reporting - 105.10.2(E)
J. Communications
(1) Outstanding Contractor request for information (RFIs), if any - 104.4.4
(2) Anticipated issues, Disputes, or claims (if any) - 104.4.5

The Project Manager or the Resident will prepare minutes of the preconstruction conference and distribute them to all attendees. 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 meeting.

For related provisions, see Sections 104.4.6(A) - Preconstruction Utility Conference; 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. The Resident and the Superintendent will co-chair Progress Meetings. All personnel of the Department and the Contractor who have significant information relevant to agenda items shall attend. Others may be invited to attend including Subcontractors, FHWA, municipal officials, environmental regulators, emergency service personnel, Utility Companies, impacted landowners, impacted business representatives, public relations firms, or other Project stakeholders.

The Co-Chairs shall agree upon the Agenda for each Progress Meeting, which may include:

A) Progress of Project since the last Progress Meeting
B) Expected activities before the next Progress Meeting
C) Contractor's Schedule of Work
D) Progress Payments
E) Field observations
F) Project control logs
G) Anticipated Traffic Delays or Related Issues
H) Working Drawing Submittals
I) Updates to Pre-Construction Submittals (if any)
J) Contract Modifications, RFIs, correspondence (if any)
K) Issues, Disputes, claims and resolutions (if any)

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 (letter, fax, or e-mail) 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.

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 in good faith 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.

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 Conference 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 conference provided by Section 104.4.2 - Pre-construction Conference 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 for the Project, the Project Manager, the 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 Conference(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) 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 three Business Days before the date a Utility Company will have to support any pole.

2) 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 M.R.S.A. § 3360-A, entitled "Protection of Underground Facilities," Maine's "Dig Safe" statute.

3) 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 M.R.S.A. § 3360-A(4).

4) The Contractor must cooperate with Utility Companies in their relocation or operations so that these operations proceed in a logical sequence, minimize duplication of Work, and avoid unnecessary interruptions to utility service.

5) 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.

6) 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 conference, and such failure impacts 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.

7) 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 notice of at least 4 Days before removing or trimming any trees or other vegetation.

8) 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.

9) If the Contractor actually observes a Utility Company Working within the Project Limits in a manner that (a) obviously 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.

10) 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 is provided or referenced in the Bid Documents or is otherwise known or foreseeable to the Contractor, then the Contractor assumes all risks and liability associated with such other Work and shall indemnify 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 clearly 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 is provided or referenced in the Bid Documents or is otherwise known or foreseeable to the Contractor, then the Contractor assumes all risks and liability associated with said requirements and the Contractor shall indemnify 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 Bridge Closure/Bridge Width Restriction Notification When a bridge closure or width restriction is allowed by the Contract, prior to a bridge closure or to a bridge width restriction to a single lane less than 4.6 meters (15 ft.), the Contractor shall notify effected 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.

A Public Notice shall be published in a local newspaper ten days prior to and then again the day before, the beginning of the closure/restriction.

The closure/restriction announcement shall be placed on a local radio station during the week preceding commencement of the closure/restriction. The announcement shall run a minimum of three times daily.

The Contractor shall notify the following public officials, agencies and organizations ten days prior to, and then again the day before, of the date of the beginning of the closure/restriction and the anticipated length of the closure/restriction. When the 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)

County Commissioners (If Unorganized Townships)
County Sheriff's Department
Fire Department
Police Department
State Police
Rescue Service
School Department
Post Office
Chamber of Commerce
Any Large Employers
Mobile Home Movers, Manufacturers and Dealers
Department of Motor Vehicle- Commercial Vehicle Center (207-626-8630)
MDOT Maintenance Division Office

All newspaper notices, radio announcements and any notifications will be subject to the approval of the Engineer and all costs 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 percentage performed by Disadvantaged Business Enterprises in satisfaction of specific Contract goals (if any).

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 The Contractor is responsible for assuring that its Subcontractors have sufficient skill and experience to perform the Work properly and for coordinating and managing it's Subcontractors to achieve the intent of the Contract. Except as provided otherwise in this Contract, the Contractor waives all claims arising from failure to coordinate and manage its Subcontractors and indemnifies and hold harmless the Department from any such claims. Subcontracting does not alter 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 Within 21 Days of Contract Execution and before any Work is performed by a Subcontractor, the Contractor shall provide the Department.

A. A list of all Subcontractors that the Contractor anticipates will be providing Work within the Project Limits and a general description of the items of Work that will be performed by each Subcontractor; and

B. A written certification by the Contractor that (1) no Subcontractors are debarred from Bidding by the Federal Government or any agency of the State of Maine, (2) that no Subcontractor will utilize motor carriers that receive an unsatisfactory rating from the

Federal Motor Carrier Safety Association, and (3) all subcontracts with Subcontractors contain or incorporate by reference all applicable portions of the Contract including the federal provisions contained in Appendix A, if applicable.

The Contractor shall continuously update the list referenced in (A) above and provide it to the Department throughout the duration of the Project.

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. The Contractor may omit, remove or obscure any Unit Prices shown in the copy of the subcontract submitted to the Department.

104.5.4 Discharge of Subcontractors The Department, upon written notice to the Contractor, may require that the Contractor discharge any Subcontractor that the Department determines jeopardizes safety of any person or the Project 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.

104.5.5 Prompt Payment of Subcontractors

A. Pay When Paid The Contractor shall pay Subcontractors 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.

B. 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.

104.5.6 Subcontractor Claims for Payment The Contractor agrees to notify all Subcontractors of the claim filing procedure contained in 23 MRSA § 52-A(2). As provided in this statute, the Department may use retainage to discharge Subcontractor claims.

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 indemnifies and hold harmless the Department against any and all claims or liabilities arising from the failure to include such flow down provisions.

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.

104.5.9 Landscape Subcontractors The Contractor shall retain only Landscape Subcontractors that are certified by the Department's Environmental Office's Landscape Unit and that obtain a Performance, Warranty, or Maintenance Bond covering the Landscape Subcontractor's obligations under the Contract, including Landscape Establishment Period Obligations. The Bond must name the "Treasurer-State of Maine" as an obligee and must otherwise comply with Section 110.2.3 - Bonding with Landscape Contractors. The Contractor shall provide a copy of said bond to the Department before final acceptance. The Contractor agrees that all subcontracts with Landscape Subcontractors will include or incorporate all Contract provisions applicable to Landscape Items, including Landscape Establishment Period Obligations. The Contractor hereby authorizes the Department to directly contact Landscape Subcontractors and/or its Surety in the event a failure to perform Landscape Establishment Period Obligations.

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 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 Appendix A.

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 Contractor's Safety Program Beginning February 1, 2003 and thereafter, a copy of the Contractor's 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 indemnifies and holds harmless the Department from all claims and damages arising from such non-compliance.

105.2.2 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.

105.2.3 Joint Duty Regarding Safety 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.

105.2.4 Compliance with Health and Safety Laws The Contractor shall comply with all applicable federal, State, and local laws governing safety, health, and sanitation including all applicable laws and regulations of OSHA.

105.2.5 Safety and Convenience of the Public 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.

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.

For related provisions, see Sections 105.2.3 - Joint Duty Regarding Safety, 105.3 - Traffic Control and Management, and 105.4 - Maintenance of Work.

105.2.6 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 (1) a pre-blast survey, (2) a blasting plan and procedure including shot-size composition, frequency, and special problems, (3) seismography readings prior to and during the blast, (4) blasting logs, and (5) 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. For related provisions, see Sections 104.4.6(C)(8) - Blasting Notice, 104.3.11 - Responsibility for Property of Others, and 110.1 - Indemnification.

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 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 - written warning
Second and subsequent - liquidated damages will be charged for one 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 three inches 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. 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, 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 of Bridges, 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.

On 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, the State or local governmental agency responsible for winter maintenance will plow, sand, and salt.

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 analyzed in accordance with Section 109.5 - Adjustments for Delay.

For related provisions, see Sections 104.2.6 - Right to Suspend Work and 107.5 - Suspension of Work.

105.4.5 Special Detours When the Contract contains a Pay Item for "Special Detours," the payment of such item shall cover all costs for constructing, repairing, maintaining, and removing the detour or detours, including all temporary Bridges and accessory features and obliteration of the detour Road. The Department will furnish right-of-Way for temporary detours or Bridges or both unless indicated otherwise on the Plans or Stated in the Special Provisions.

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 kilometer of traveled length. The face value for such bond shall not exceed $10,000 per kilometer [$16,000/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 6 m [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.

105.6 Construction Surveying

105.6.1 Department Provided Services The Department will provide the Contractor with the description and coordinates of vertical and horizontal control points in the Project area.

105.6.2 Contractor Provided Services The Contractor is responsible for all other survey Work and construction layout necessary or appropriate to complete the Work including reestablishing all points provided by the Department, establishing additional control points, staking out of the Work on the site, running axis lines, layout and maintenance of all other lines, grades, or points, and quality control to assure accuracy. When new 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.

105.6.3 Quality Assurance The Department may check the Contractor's construction layout and survey Work. The Contractor is responsible to correct any errors discovered by the Department. The cost of correction will be Incidental to the Contract.

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 indemnifies and holds harmless the Department from all claims to reestablish 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.

105.7 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 Workings 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 1/2 day per drawing, whichever is greater.

Each subsequent submission: 10 Days or 1/2 day per drawing, whichever is greater.

The above review times shall double for submittals that require 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 3 sets of Drawings to the Department.

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 2 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 impact a regulated resource such as waterbodies 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 waterbodies 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 Structures that are in place longer than 7 months, temporary Structures that are not pile or similarly supported, or fill that involves 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 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 Requirements

A. General Pits 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 pits 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.

B. 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 3 M [10 ft] inside of a property line of a deposit, even though the Material within the pit may have a steeper angle of repose. The exception may be 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.

C. 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, pits, including loam fields, shall be rehabilitated as provided below and in Section 657 - Rehabilitation of Pits.

1. Newly opened pits and loam fields from which any Material has been removed for the Project shall be completely rehabilitated, as defined below.

2. Areas of extensions of existing pits from which common borrow, granular borrow, gravel borrow, rock borrow, or loam have been removed for the Project shall be completely rehabilitated.

3. Areas of extensions of existing pits that have become depleted, as defined below, by the removal of other gravel, sand, Aggregate items, or loam for the Project shall be completely rehabilitated.

4. Areas of extensions of pits which have not become depleted by the removal of other gravel, sand, Aggregate items, or loam shall be rehabilitated to the extent of grading the slopes to 1 horizontal to 1 vertical or flatter.

For the purposes of this Section 105.8.6, the following definitions apply:

"Completely Rehabilitated" means grading all areas disturbed as a result of the MDOT Project and treating of the ground surface in accordance with Section 657 - Rehabilitation of Pits.

"Depleted" means when the only remaining Material is within 3 M [10 ft] of a property line on a 1 horizontal to a 1 vertical slope or when the character of the Material so radically changes that it can no longer be used as originally anticipated.

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.

105.9 Historic and Archeological Considerations Unless expressly provided otherwise by the Contract, the Maine State Historic Preservation Office has determined that the Project will have no effect upon any site of historic or archaeological significance, as identified by the National Historic Preservation Act of 1966 and the Archaeological and Historic Preservation Act of 1974.

If the Contractor discovers any object of potential archaeological, paleontologic, or other historic interest, all Work that could disturb said object shall immediately cease and shall not be resumed until an investigation of the object and related deposits have been completed and the removal of articles of interest has been accomplished. Should such a deposit be discovered, the Contractor shall notify the Department immediately.

The first indication of archaeological deposits may be the burial grounds or campsites of Native Americans that reveal the bones of the dead and the people’s implements. The first indications of paleontologic deposits may be the exposure of marine fossils or shells found mainly in clay deposits. Indications of deposits of more recent historic interest may be the exposure of dumps in landfill areas, abandoned campfire sites, and building foundations.

Any Delay of the Contractor's operations resulting from the above will be analyzed in accordance with Section 109.5 - Adjustments for Delay, except that in no event will such Delay be a Compensable Delay.

The Contractor is notified of a Maine statute, 27 MRSA §371, which States that artifacts, specimens, and material, which are public property by virtue of having been found on, in, or beneath State controlled lands, and places Ownership of the same in the State of Maine.

105.10 Equal Opportunity and Civil Rights

105.10.1 Requirements Applicable to Federally Funded Contracts Unless expressly provided otherwise in the Bid Documents, the provisions contained in Section 2 - Federal Equal Opportunity & Civil Rights Requirements of Appendix A are incorporated into the Bid Documents and Contract.

These provisions include requirements regarding Non-discrimination & Civil Rights - Title VI, Non-discrimination and Affirmative Action - Executive Order 11246, Goals for Employment of Women and Minorities, On-the-Job Training (OJT) Requirements, and Disadvantaged Business Enterprise (DBE) Requirements.

105.10.2 Requirements Applicable to All Contracts Unless expressly provided otherwise in the Bid Documents, the provisions contained in this Section 105.10.2 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 M.R.S.A. §781, et seq., and all regulations promulgated thereunder. This Code, at 5 M.R.S.A. §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, physical handicap, or mental handicap. 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, religious creed, sex, national origin, ancestry, age, physical handicap, or mental handicap.

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."

B. Maine Human Rights Act The Contractor must comply with the provisions of Maine's Human Rights Act, 5 M.R.S.A. §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, except when based on a bona fide occupational qualification.

C. EEO Notice to Labor Sources Pursuant to Maine's Code of Fair Practices and Affirmative Action and federal law, all Contractors and Subcontractors engaged in Work on this Project must notify each union and/or the Maine Department of Labor Career Center Job Service Centers from which the Contractor intends to obtain labor, and pledge to provide equal employment opportunities without regard to race, color, religion, sex, national origin, or disability. This notice must consist of the letter shown on this page below. The letter must be written on the Contractor's or Subcontractor's letterhead stationery and sent to the applicable union or agency. A list of Maine Department of Labor Career Center Job Service Centers follows the letterform.

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, 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 Career Center
2 Anthony Ave.
Station #109
Augusta, ME 04333-0109
Toll Free Phone: 1-800-760-1573
Local Phone: 624-5120
Fax No: 624-5133

Bangor Job Service
45 Oak Street
PO Box 402
Bangor, ME 04402-0402
Toll Free Phone: None
Local Phone: 561-4650
Fax No: 561-4666

Belfast Career Center
9 Field Street
Suite 309
Belfast, ME 04915-6663
Toll Free Phone: 1-877-421-7917
Local Phone: 338-5158
Fax No: 338-5000

Brunswick Job Service
310 Bath Road
Brunswick, ME 04011-2619
Toll Free Phone: None
Local Phone: 721-1420
Fax No: 721-1411

Calais Career Center
13 Beech Street
PO Box 415
Calais, ME 04619-0415
Toll Free Phone: 1-800-543-0303
Local Phone: 454-7551
Fax No: 454-0349

Dover-Foxcroft Career Center
Dover Plaza, Guilford Road
PO Box 360
Dover-Foxcroft, ME 04426-0360
Toll Free Phone: 1-800-350-4165
Local Phone: 564-8358
Fax No: 564-3263

Ellsworth Career Center
248 State Street
Suite 3A
Ellsworth, ME 04605-1850
Toll Free Phone: 1-800-371-7543
Local Phone: 664-2300
Fax No: 667-4789

Houlton Career Center
91 ½ Military Street
Houlton, ME 04730-2421
Toll Free Phone: None
Local Phone: 532-9526
Fax No: 532-4170

Lewiston Career Center
5 Mollison Way
Lewiston, ME 04240-5805
Toll Free Phone: 1-800-741-2991
Local Phone: 753-9000
Fax No: 783-5301

Machias Career Center
7 Free Street
Machias, ME 04654-1146
Toll Free Phone: 1-800-292-8929
Local Phone: 255-0130
Fax No: 255-3091

Millinocket Job Service
215 Penobscot Avenue
Millinocket, ME 04462
Toll Free Phone: None
Local Phone: 723-8321
Fax No: 723-4707

Portland Career Center
185 Lancaster Street
Portland, ME 04101-2453
Toll Free Phone: 1-877-594-5627
Local Phone: 771-5627
Fax No: 822-0221

Presque Isle Job Service
38 North Street
Suite A
Presque Isle, ME 04769-2268
Toll Free Phone: None
Local Phone: 764-2150
Fax No: 764-2159

Rockland Career Center
116 Tillson Avenue
Rockland, ME 04841-3424
Toll Free Phone: 1-877-421-7916
Local Phone: 594-9576
Fax No: 594-1428

Saco Career Center
110 Main Street
Suite 1400
Saco, ME 04072-3504
Toll Free Phone: 1-800-760-1570
Local Phone: 286-2650
Fax No: 286-2655

Sanford Career Center
63 Main Street
Sanford, ME 04073-3505
Toll Free Phone: 1-800-343-0151
Local Phone: 324-5460
Fax No: 324-7069

Skowhegan Career Center
140 North Avenue
PO Box 749
Skowhegan, ME 04976-0749
Toll Free Phone: 1-800-760-1572
Local Phone: 474-4950
Fax No: 474-4914

Waterville Career Center
100 JFK Plaza
Waterville, ME 04901-5015
Toll Free Phone: None
Local Phone: 872-5516
Fax No: 873-5804

Wilton Career Center
865 US Route 2E
PO Box 784
Wilton, ME 04294-0784
Toll Free Phone: 1-800-982-4311
Local Phone: 645-5800
Fax No: 645-2093

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 which 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 which cause discomfort, humiliation, or are in any way offensive to the recipient, or which 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. Contractors, under Maine State Law, are responsible for ensuring and maintaining a Work environment, which is free from sexual harassment.

2. Any Contractor whose employee sexually harasses another employee shall be subject to disciplinary action. Contractors who 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 which 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. DBE Reporting Requirements The Contractor must submit quarterly reports of actual dollars paid to Disadvantaged Business Enterprises (DBE's) on this Contract to the MDOT Office of Human Resources by the end of the first week of January, April, July, and October for the period covering the preceding three months considered Federal Fiscal Year quarters. The reports will be submitted directly to the Office of Human Resources on the form provided in the latest version of the DBE Program Manual. The Department may withhold Progress Payments if the Contractor fails to submit the report.

F. 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 and minorities as journeyed trade workers. Contractors not having achieved company-wide trade employment goals of 6.9% for females and 0.8% for minorities will, where indicated by Contract and to the maximum extent practical, comply with Section 660 - On-the-Job Training.

105.11 Other Federal Requirements Unless expressly otherwise provided in the Bid Documents, the provisions contained in Section 3 - Other Federal Requirements of Appendix A are hereby incorporated into the Bid Documents and Contract.

These provisions include Buy America requirements regarding steel procurement, material requirements, and Standard FHWA Contract Provisions (FHWA-1273) governing Non-discrimination, Non-segregated Facilities; Payment of Predetermined Minimum Wage, Statements and Payrolls; Record of Materials, Supplies, and Labor; Subletting or Assigning the Contract; Safety and Accident Prevention; False Statements Concerning Highway Projects; Implementation of Clean Air Act and Federal Water Pollution Control Act; Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion; and Certification Regarding Use of Contract Funds for Lobbying. For a related provision, see Section 104.3.8 - Wage Rates and Labor Laws.

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 financial incentives and disincentives.

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 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. MDOT
B. AASHTO
C. ASTM
D. AREMA
E. Standard conditions and special conditions contained in any permit
F. Manual on Uniform Traffic Control Devices (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 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 State of Maine, Department of Transportation, 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 test proposed sources of materials, and materials shall not be used in the work until passing results are obtained.

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, testing equipment, and material samples as the Department may require to collect and forward Acceptance and IA samples, and conduct related field tests.

The Contractor shall supply materials and perform work using methods and equipment in a manner, which 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 for furnishing facilities, testing equipment, and samples for the Department's Acceptance and IA activities is 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 List of Pre-Approved Materials (available on the MDOT internet site - www.State.me.us/mdot), if a list is established for that type of product or material.

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 or 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. 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. The provisions of this Section shall not apply to the stripping and storing of topsoil or to other materials salvaged from the work.

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 con-forming 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 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.

The Department will randomly sample and test items designated for Acceptance under Method A 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, which 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 by Special Provision, 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.

Upon final approval of the QCP, the Contractor shall provide 5 bound copies to the Department. All Contractor QC personnel shall also be issued their own copy of the approved 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 end result 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 as determined by the Department, instead of making adjustments 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
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 records of all inspections and tests. 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.

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 that are not certified as required or that 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 PM 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 the following actions:

1st Incident: Written warning. If the Contractor does not take corrective action upon receipt of written warning, the Department will escalate immediately to the 2nd Incident.

2nd Incident: Mandatory work suspension until compliance and loss of 1% of the Bid Price of all Pay Items covered by the QCP, as described in this Section.

3rd Incident: Mandatory work suspension until compliance and loss of an additional 2% of the Bid Price of all Pay Items covered by the QCP, as described in this Section.

4th and subsequent Incidents: Mandatory work suspension until compliance and loss of an additional 3% of the Bid Price (each occurrence) of all Contract Pay Items covered by the QCP, as described in this Section.

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.

Disincentives for failure to comply with the approved QCP are additive, and the Department will deduct any disincentives due from amounts otherwise due the Contractor. These disincentives are intended to encourage the Contractor to comply with its approved QCP, and are not 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.
-Random inspection of work previously inspected by the Contractor.
-Randomly accompanying the Contractor's inspector during QC Inspections/Testing.

-Acceptance 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, which 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 that the Contractor will take. The Contractor shall schedule the corrective work with the Resident, and both the QC and Department's Inspectors will witness the corrective work. 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 this happen. 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 materials.

B. The Department shall have full access at all times to the parts of the plant that concern 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 Statistical Acceptance, Method B, or Method C (Small Quantity - Product Verification) 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 1000 megagrams [1100 ton] per Hot Mix Asphalt Pavement item, and Method B will be utilized when there are less than or equal to 1000 megagrams [1100 ton] per Hot Mix Asphalt Pavement item.

Acceptance of structural concrete will be based on Method A Statistical Acceptance, Method B Small Quantity-Product Verification, 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 utilized when there are more than 10 cubic meters [13 yd^3] and Method C will be used when there are 10 cubic meters [13 yd^3] or less.

The Department may reject material, which appears to be defective based on visual inspection. No payment will be made for the materials rejected by the Department unless the Contractor requests the material be tested. If so requested prior to disposal, the Department will obtain and test three representative samples. The test results will be statistically evaluated in accordance with Section 106.7 - Quality Level Analysis. If the analysis yields a Pay Factor of less than 0.80, the material may be rejected and the Contractor will bear the cost of the sampling, testing, and evaluation.

Prior to knowledge of the sample location, the Contractor may remove and replace defective material at no cost to the Department. This will not preclude visual rejection of obviously defective material. The Department will sample, test, and evaluate new material for acceptance.

A. Methods A and B 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.

Pay Items specified to be sampled and tested under Method A and B provisions 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.

At the Department's sole discretion, a lot with a Pay Factor of less than 0.80 for Method A or 0.83 for Method B 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 Pay Factor at or above these

levels, but such material will be removed and replaced by the Contractor at the Department's expense.

B. Method C utilizes Product Verification testing to validate the quality of the material incorporated into the Project. 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 proper-ties noted in Table 1 of Section 502 - Structural Concrete or Table 9 of Section 401.20 - Acceptance. Material will be subject to rejection as noted in Structural Concrete Section 502.0504 - Quality Assurance Method C Concrete or Hot Mix Asphalt, Section 401.203 - Quality Assurance Method C.

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 values

$\bar{x}$ = 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):

$$Q_L = \frac{\overline{X}\text{-LSL}}{s}$$

Where LSL = lower specification limit.

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

Note: If a USL is not specified, P_U will be 100.

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

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

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

Quality Level = $(P_U + P_L) - 100$

H. Determine the Pay Factor (PF) for the lot using the Quality Level from Step G.

Method A: PF = [55 + (Quality Level * 0.5)] * 0.01
Method B: PF = [70 + (Quality Level * 0.33)] * 0.01

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

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

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 Department's Testing Section will investigate the

outlying value to determine if it should be retained or discarded. The investigation will include but not be limited to: 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 106.7 B 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:

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

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 106.7 A - Quality Level Analysis by the Standard Deviation Method

PU Or PL %*	Upper Quality Index QU or Lower Quality Index QL														
	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8	n = 9	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
100	1.16	1.50	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	1.40	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	1.20	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	1.00	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	0.41	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	0.20	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 QU or QL, PU or PL is equal to 100 minus the table value for PU or PL. If the value of QU or QL does not correspond exactly to a figure in the table, use the next higher figure.

* Within limits for positive values

Table 106.7 B - 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

106.8 Non-Conforming Work

106.8.1 Substantially Conforming Work If the Department determines that non-conforming work substantially conforms to the Contract, the Department may accept the non-conforming work, provided that the Department 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 uncovered 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 uncovered 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 one year from the date of Final Acceptance. Final Acceptance includes receipt of all conforming closeout documentation. For a related provision, see Section 107.9.5 - Final Acceptance.

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 104.5.9 - Landscape Subcontractors.

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 Conditions that result from material, manufacture, or workman-ship 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 an emergency, "Promptly" means in the first construction season after the Contractor has been notified of the defect(s), but always within one year of such notice. In case of 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 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 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 Contract 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 one 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.

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) 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 Within 21 Days of Contract Execution 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 or Work shall show the major Work activities, milestones, durations, 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 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. The Contractor will make the requested changes to the schedule and issue the finalized version to the Department.

107.4.3 Projected Payment Schedule Within 21 Days of Contract Execution, the Contractor shall also provide the Department with a 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 revise the Projected Payment Schedule to reflect the actual progress of the Work.

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.

107.4.5 No Separate Payment Unless expressly provided otherwise, the cost for providing a Schedule of Work, a Projected Payment Schedule, and all revisions and updates is 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 1st 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 1 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 Except as expressly provided otherwise in this Contract, the Contractor shall owe the Department the per diem amount specified in Section 107.7.2 - Schedule of Liquidated Damages for each Day that any portion of the Work remains incomplete after the Contract Time has expired. Liquidated Damages will be deducted from amounts otherwise due the Contractor. 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.

Permission for the Contractor or the Surety to continue and finish Work after the Contract Time has expired shall not waive the Department's rights to assess Liquidated Damages.

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
From More Than	To and Including	Calendar Day
0	$100,000	$100
$100,000	$300,000	$175
$300,000	$500,000	$250
$500,000	$1,000,000	$325
$1,000,000	$2,000,000	$500
$2,000,000	$4,000,000	$750
$4,000,000	and more	$1,000

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 will 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 Closeout Documentation is received from the Contractor. The Contractor shall Deliver all Closeout Documentation, exclusive of the All Bills Paid and Request for Final Payment Letters, to the Department within 30 Days of receiving the above notification. Liquidated Damages will cease upon the physical completion of the Work. For a related provision, see Section 101.2 - Definition of Closeout Documentation.

107.9.5 Final Acceptance Upon receipt of the Closeout Documentation, exclusive of the All Bills Paid and Request for Final Payment Letters, the Department will notify the Contractor in writing that the Project is Complete and finally accepted ("Final Acceptance"), subject to the Contractor's warranty obligations set forth in the Contract. Within 75 Days of the receipt of the

documents required by Section 107.9.4, 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 Payment.

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. The Contractor shall accept such payment as full and complete compensation for that item without physical measurement. Upon mutual written Agreement by the Department and the Contractor, 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 International System of Units (SI) for all measurements unless the Contract utilizes the U.S. Customary system. 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. Each is payment per complete unit.

Length Length is defined as linear measurement parallel to the item base or foundation. A station is 1 kilometer [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 meter [1 yd^2] 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 their water level 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 cubic meter [gal] with calibrated tanks, distributors, certified scale weights or water meters.

Measure bituminous Materials by the liter [gal] or megagram [ton]. Measure liquid volumes at 15.5°C [60°F] or correct to volume at 15.5°C [60°F] under ASTM D1250 or ASTM D633.

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 cubic meter [board ft]. Base measurement on nominal widths and thicknesses and individual maximum lengths.

Mass A metric ton is 1000 kilograms or 1 megagram [1 ton]. 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 kilogram [lb] or metric ton [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 and 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, which 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 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 him/her 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 1 kg [2 lb] or 300 kg [1000 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 percent 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 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 10 kg [20 lb]. All weighing shall be read and recorded to the nearest 10 kg [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 which 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 percent or less, the fact will be so noted in the project records.

However, if the variation exceeds 0.2 percent, 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, which has moved off the weighing system, will be intercepted, directed back to the scales, and reweighed under supervision of a State Inspector.

3) At least twice during 5 days of production, in the presence of a State Inspector, a truck which 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.

5) Although 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. Out-of-state weighing, in order to be approved, must be performed by a Licensed Public Weighmaster or a person of equal authority in the State concerned, on scales accepted in the State concerned and meeting the requirements of this Section.

(F) Delivery Slips Serially prenumbered 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) Project number
4) Identification of material:
    a) Source location of supplier
    b) Type and grade
    c) Tank number from which loaded, if liquid
5) Quality information as necessary for bituminous liquids
    a) Specific gravity at 15°C [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) The Viscosity of the material: if asphalt cement, in poises at 60°C [140°F] and in centistokes at 135°C [275°F]; if other bituminous liquid, the specified viscosity according to the type and grade shown in Section 702

6) Quantity information as necessary: gross, tare and net weights, volume of load if not material requiring weighing, net liters [gal] at 15°C [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 liter [gal] or megagram [ton]. Volumes will be measured at 15°C [60°F] or will be corrected to the volume at 15°C [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 liters [gal] at 15°C [60°F] by a conversion factor expressed in kilograms per liter [lb/gal].

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 two 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.

The Contractor elects or 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 107.9.5 - Final Acceptance, 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. The maximum amount that the Department will pay for Mobilization is 10% of the Bid less the amount bid for Mobilization. The Department will pay any amounts in excess of 10% upon Final Acceptance.

Upon approval of all pre-construction submittals required for approval by this Contract including those listed in Section 104.4.2 - Preconstruction Conference, the Contractor will receive payment of 50% of the Lump Sum price for Mobilization, not too exceed 5% of the Bid less the amount bid for Mobilization. After the Department determines that the Work is 50% complete, the Contractor will receive the other 50% of the Lump Sum price for Mobilization, not too exceed 5% of the Bid less the amount bid for Mobilization. Any remaining Mobilization will be paid upon Final Acceptance.

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 reasonably believes that retainage will be insufficient to cover all Contractor obligations under this Contract, the Department may increase the retainage to up to 5% of the Contract amount.

The Department may hold, temporarily or permanently, retainage as needed to reflect amounts due the Department under the Contract and to assure timely Completion of the Work in Conformity with the Contract. The Department may also disburse retainage to Subcontractors pursuant to 23 M.R.S.A. § 52-A(2). For a related provision, see Section 104.5.6 - Subcontractor Claims for Payment.

The Contractor may withdraw retainage by depositing certain securities with the Treasurer of State as provided by 23 M.R.S.A. § 52-A(1).

Upon Completion of Physical Work, the Contractor may request that the Department reduce retainage. The Department may grant or deny such request as it deems desirable and prudent. Otherwise, retainage will be held until Final Acceptance. For related provisions, see Sections 107.9.5 - Final Acceptance and 108.8 - Final Payment.

108.4 Payment for Materials Obtained and Stored Acting upon a request from the Contractor and accompanied by 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 Delivered on or near the Work site at acceptable storage places. The Department will not make payment on living or perishable Materials until acceptably planted in their final locations.

Materials paid for by the Department are the property of the Department, but the risk of loss shall remain with the Contractor. 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 all contracts with hot mix asphalt in excess of 5000 Mg total, a price adjustment for performance graded binder will be made for the following pay items:

Item 403.206 Hot Mix Asphalt - 25 mm [1 in]
Item 403.207 Hot Mix Asphalt - 19 mm [3/4 in
Item 403.208 Hot Mix Asphalt - 12.5 mm [½ in]
Item 403.209 Hot Mix Asphalt - 9.5 mm (sidewalks, drives, & incidentals) [3/8 in]
Item 403.210 Hot Mix Asphalt - 9.5 mm [3/8 in]
Item 403.211 Hot Mix Asphalt - Shim
Item 403.212 Hot Mix Asphalt - 4.75 mm [3/16 in]
Item 403.213 Hot Mix Asphalt - 12.5 mm [½ in] (base and intermediate 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 in excess of 5 percent between the base price and the period price of asphalt cement. Adjustments will be made upward or downward, as prices increase or decrease.

Item 403.206: 4.5%	Item 403.210: 6.0%
Item 403.207: 4.8%	Item 403.211: 6.0%
Item 403.208: 5.3%	Item 403.212: 6.5%
Item 403.209: 6.0%	Item 403.213: 5.3%

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 N.E. Barge Price, FOB, 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 N.E. Barge Price, FOB, listed in the Asphalt Weekly Monitor current with the pay period ending date of the progress estimate.

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,
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.

Most items are exempt from Maine sales tax. The Contractor shall Bid in accordance with the Maine statutory exemption from sales tax located at 36 M.R.S.A. §1760, subsections (2) and (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 the Federal Highway Administration to participate in certain costs for reasons due to the Contractor's performance, 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-Conformity is corrected.

108.8 Final Payment Upon Final Acceptance, the Department will prepare a final Invoice 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. The Department will make final payment in the amount of the Work done, less all previous payments and all amounts to be retained or deducted under the provisions of the Contract. For a related provision, see Section 107.9.5 - Final Acceptance.

The Acceptance by the Contractor of the final payment, as evidenced by cashing of the final payment check, constitutes a release to the Department from all claims and liability under the Contract. Upon Final Acceptance, the Contractor is released from further obligation, except for warranty obligations provided for in this Contract.

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 claim. For related provisions, see Sections 107.9.5 - Final Acceptance and 108.8 - Final Payment.

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.

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 pay 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 herein. 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 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 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 of compensable items listed in Section 109.7.3 - Compensable Items 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 listed in Section 109.7.3 - Compensable Items, subsections (A) - (E) 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 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 Department receives federal emergency disaster relief funds, (2) an Uncontrollable Event caused by a Utility Company or other third party (not Subcontractors) Working on Project-related Work within the Project Limits if, and only if, the Utility Company or such other third party offers the Department reimbursement for such Delay, or (3) acts by the Department that are in violation of applicable laws or the Contract.

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. If an Excusable Delay, the Contractor is entitled to an extension of time, but no additional compensation.

2. If 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.

3. If 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 impacted 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 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 only entitled to 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 Part 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 109.7.3 - Compensable Items, 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 a 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 based upon the Contractor's best knowledge and belief.

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. Identification of Prior Similar VECPs If the VECP was submitted previously on another Departmental Project, the date, PIN, and the action taken by the Department should be indicated.

4. Known Use or Testing A description of any previous use or testing of the concept(s) included in the VECP that is known to the Contractor, including the tester, the conditions, and the results.

5. Estimate of Net Savings An estimate of the Net Savings as defined in Section 109.6.4(C) - Contract Modification - Amount of Payment below.

6. Estimate of Development Costs A scope of Work and related cost estimate to develop and submit a Detailed VECP and, if desired by the Contractor, a request for the Department to share such costs.

7. 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 Promptly.

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, in 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.

Except under extraordinary circumstances, such reimbursement will range up to 50% of such development costs to a maximum Stated upset amount.

109.6.3 Detailed VECP

A. Submittal If invited by the Department as provided by Section 109.6.2(B) - Conceptual Review and Response, the Contractor may submit a "Detailed VECP" within the time specified by the Department. The Detailed VECP shall contain the following Materials and 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 elsewhere, a detailed computation of the estimated Net Savings to be generated as defined in 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 VECP's 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 use its best effort to 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 was necessary to properly evaluate the VECP. Such response will include a brief description of the Department’s reason(s) for its decision. The Department, in its sole discretion, will either approve the Detailed VECP, approve it with conditions, or rejected 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 Promptly request that the Department reconsider certain portions of the decision. If requested, the Department will Promptly reconsider its decision. After reconsideration, the Department's decision is final and 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 all VECP development costs that the Department agreed to pay as provided in Section 109.6.2(B) - Conceptual Review and Response, if any.

109.6.4 Contract Modification - Amount of Payment If the VECP was approved, or if it was 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 credit due the Department calculated as the difference between the cost of performing the Work, as originally specified, and the amount payable to the Contractor for the revised work. This revised Work payment will only include the following amounts:

A. The cost of performing the Work as revised by the VECP at agreed upon unit or lump sum prices.

B. The VECP development costs that the Department agreed to reimburse the Contractor as provided in Section 109.6.2(B) - Conceptual Review and Response, if any.

C. Fifty percent (50 %) of the Net Savings generated by the VECP (NS) as determined by the Department, calculated as follows.

$$NS = EGS - CUDC - DVEC$$

Where:

NS = Net Savings generated by the VECP

EGS = Estimated Gross Savings is an agreed upon 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.

CUDC = Contractor's Unreimbursed Development Costs related to the preparation of the Detailed VECP including costs of the Contractor's design subconsultants and Subcontractors, but excluding all such costs paid by the Department under Section 109.6.4(B) above.

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.

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 were greater than set forth in the Contract Modification, the increased savings will be shared equally by the parties. If the net savings were less than set forth in the Contract Modification, the reduction in savings will be borne equally by the parties by a reduction of amounts otherwise due the Contractor.

109.6.6 General Conditions Regarding VECP's

A. VECP's 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 MDOT Projects without notice, cost, or liability to the Contractor.

B. Only the Contractor may submit VECP's. 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

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 Equitable Adjustments will be established by mutual Agreement based upon Unit or Lump Sum Prices, which include Labor, Materials, Mark-up, Equipment, Overhead, and Time. If Agreement cannot be reached, the Contractor shall accept payment on a Force Account basis as provided in Section 109.7.5 - Force Account Work below as full and complete compensation for all Work relating to the Equitable Adjustment.

109.7.3 Compensable Items

A. General The Contractor is entitled to the additional, documented, and Actual Costs directly relating to the following items:

1. Labor expenses for non-salaried Workers and salaried foremen ,

2. Costs for Materials,

3. A 15 % markup on the total of Items 1 and 2 of this subsection 109.7.3(A) for home office overhead and profit of the Contractor, its Subcontractors and suppliers, and any lower tier Subcontractors or suppliers. There will be no markups on markups.

4. Costs for Equipment. Equipment costs will be calculated using Blue Book rates as set forth below in Section 109.7.5(C) - Force Account Work, Equipment, unless the Department determines the Contractor's Actual Costs are lower than such rates. If requested by the Department, the Contractor will produce all records that are relevant to the Actual Costs including rental Receipts, acquisition costs, financing documents, lease Agreements, and maintenance and operation cost records.

5. Costs of extended job-site overhead.

6. Time

B. Subcontractor Quoted Extra Work Notwithstanding Section 109.7.3(A) - Compensable Items - General, when accomplishing Extra Work that is priced using a Subcontractor quotation, the Contractor will be allowed a maximum markup of five percent (5%) for profit and overhead.

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

A. Profit or home office overhead in excess of that provided in Section 109.7.3(A)(3) above,

B. Lost profits or lost opportunity costs,

C. Labor inefficiencies,

D. Consequential damages, including but not limited to loss of bonding capacity, loss of Bidding opportunities, and insolvency,

E. Indirect costs or expenses of any nature,

F. Dispute resolution costs of any nature including attorneys fees, claims consultant fees, expert witness fees, claims preparation expenses, and costs related to DRB proceedings, mediation, arbitration, or litigation, and

G. Interest.

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

A. Labor The Contractor will receive the actual hourly wages paid to Workers actually engaged in the changed Work and the foreman in direct charge of the changed Work as determined from certified payrolls, plus 90 percent 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 percent 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 percent 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.

Equipment leased by the Contractor for Force Account Work and actually used on the Project, the Department will pay for the actual Invoice amount, plus 10% for administrative costs. 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 percent
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 suitable rate for such Equipment. The Contractor may furnish cost data to assist the Department in the establishment of such rental rate.

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.

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 Modification s 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 indemnifies, defends, and holds 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 and 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 indemnity 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 Payments 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 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".

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 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 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 Subcontractors The Landscape Subcontractor shall provide a signed, valid, and enforceable Performance, Warranty, or Maintenance Bond complying with the Contract.

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."

The bonds shall each be in the full Subcontract 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 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 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.

The Landscape Subcontractor shall pay all premiums and take all other actions necessary to keep said bond in effect for the duration of the Landscape Subcontractor's obligations. 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.

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 use of explosives, collapse, and underground coverage if the Work involves such exposures.

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 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 with a minimum limit of liability of $500,000.00. "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.

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 Environmental Impairment If required by Special Provision, the Contractor shall carry Environmental Impairment 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 Administrative & General Provisions

A. Additional Insured Each policy with the exception of Workers' Compensation and Professional Liability insurance shall name 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.

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.

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. An "Issue," as used in Sections 111.1 through 111.3 below, is a matter that may give rise to a Dispute, but has not yet been negotiated as provided in Section 104.4.5 - Early Negotiation.

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, (C) next, if the parties consent, through a Dispute Review Board as provided in Section 111.4 - Dispute Review Board, and (D) 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. Such waiver of claims shall not be affected by the Department's willingness to enter into discussions or negotiations regarding Issues or Disputes for which the Contractor failed to provide proper notice.

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.

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 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 that is 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;
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 109.7.3 - Compensable Items.

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 and/or request a Dispute Review Board (DRB) proceeding as provided in Section 111.4 - Dispute Review Board below.

111.4 Dispute Review Board If the Contractor wants additional consideration and the Director has not requested a DRB proceeding, the Contractor may Deliver a written request for a DRB proceeding to the Director within fourteen 14 Days of receiving the Director's decision as provided in Section 111.3.3 - Decision by Director.

Within 14 Days of receiving a request for a DRB proceeding ("DRB Consent Period"), the non-requesting party shall notify the other as to whether or not it consents to a DRB proceeding. If both parties consent, a DRB proceeding shall take place and shall conform to the Dispute Review Board Rules agreed upon by the Department and the Associated Constructors of Maine. If either party does not consent within the DRB Consent Period and the Contractor wants additional consideration, the Contractor must file an Appeal with the Commissioner as provided in Section 111.5.1 - Filing of Appeal. For a related provision, see Section 101.2 - Definition of Dispute Review Board.

The purpose of the DRB is to assist consenting parties in resolving Disputes in a manner that complies with the Contract and that is fair, impartial, less expensive, and less formal than litigation. The DRB will do so by issuing non-binding recommendations, unless the parties mutually agree in writing at the time of consenting to a DRB proceeding that such recommendations will be binding.

111.5 Appeal to Commissioner

111.5.1 Filing of Appeal If a DRB proceeding did not occur and the Contractor wants additional consideration, the Contractor must file an "Appeal of the Director's Decision" to the Commissioner within 14 Days of the expiration of the DRB Consent Period. If a DRB proceeding did occur and failed to resolve the Dispute and/or the Contractor or the Director

want additional consideration, that party must file an "Appeal of DRB Recommendation" to the Commissioner within 30 Days of the date the DRB's recommendation is final. At a minimum, the Appeal must contain:

A. If a DRB proceeding did not occur, all Materials submitted to the Director and all decisions by the Director;

B. If a DRB proceeding did occur, all Materials submitted to the Dispute Review Board and all recommendations from the Dispute Review Board;

C. The specific findings of the Director and/or the Dispute Review Board that the appealing party claims are contrary to law and/or fact;

D. Any other pertinent new documentary evidence;

E. Any written arguments the appealing party wishes the Commissioner to consider; and

F. The specific relief sought.

Unless directed otherwise by the Commissioner, review of the Appeal will be limited to the documentation submitted.

111.5.2 Rebuttal Information The non-appealing party will have 14 Days of receiving notice that an Appeal was filed with the Commissioner to submit written rebuttal information.

111.5.3 Time and Alternatives for Commissioner Action Within 30 Days of receiving an Appeal Conforming to Section 111.5.1 - Filing an Appeal or, if applicable, the Receipt of the rebuttal information allowed by Section 111.5.2 - Rebuttal Information, the Commissioner will:

A. In writing, affirm the recommendation(s) of the Dispute Review Board or the decision of the Director, as applicable;

B. In writing, revise, amend, or reverse the recommendation(s) of the Dispute Review Board or the decision of the Director, as applicable; or

C. In writing, submit the claim to binding or non-binding alternative Dispute resolution.

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 submits the Dispute to alternative Dispute resolution, the date of final agency action will be established by the mediator, arbitrator, or other Dispute resolution neutral by written notice to the parties. If the Commissioner takes no action within such 30-day period, the DRB’s final recommendation (if one exists) or the decision of the Director (if a DRB recommendation does not exist) shall be final agency action upon the expiration of said 30-day period.

111.6 Judicial Review The Contractor must comply with all of the notice and Dispute resolution provisions of this Contract in order to pursue judicial review. For related provisions, see Sections 111.1.2 - Escalation Process and 111.1.4 - Mandatory Notice.

All Bidders and the Contractor agree that any judicial review of any claim or cause of action arising from the Bid and/or the Contract must be commenced in the Superior Court of Maine, Kennebec County. Any petition for review must be in accordance with the Maine Administrative Procedure Act, 5 M.R.S.A. §11001, et seq. and Rule 80C of the Maine Rules of Civil Procedure.

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:

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 which 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 ten 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 Cost 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

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 2 below.
- Certification Regarding Non-segregated Facilities as provided by FHWA Form 1273, section III set forth on page 19 below.
- "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion" as provided by FHWA Form 1273, section XI set forth on page 27 below.
- "Certification Regarding Use of Contract Funds for Lobbying" as provided by FHWA Form 1273, section XII set forth on page 30 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. 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 then 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."

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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.

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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 Office of Human Resources - Equal Employment Opportunity 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.

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 that one 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 .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.

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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" means the Federal Social Security number" means the Federal Social Security number used o 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-.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.

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 one 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 make 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 through 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 sat 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
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D. Disadvantaged Business Enterprise (DBE) Requirements The Department has established an annual Disadvantaged Business Enterprise aspirational goal to be achieved through race neutral means. This goal will adjusted periodically and will be provided by Supplemental Provision. Unless otherwise specifically provided in the Contract, there are no specific percentage requirements for use of DBEs for individual construction contracts. The Contractor shall comply with all provisions of this section regarding DBE participation and the Department's latest version of the Disadvantaged Business Enterprise Program Manual, said Manual being incorporated herein by reference. In the case of conflict between this Contract and said Manual, this Contract shall control. The Department reserves the right to adjust DBE goals on a project-by-project basis by addendum.

Policy. It is the Department's policy that DBEs as defined in 23 CFR Part 26 and referenced in the Transportation Equity Act for 21st Century of 1998, as amended from the Surface Transportation Uniform Relocation Assistance Act of 1987, and the Intermeddle Surface Transportation Efficiency Act of 1991. The intent hereto remains to provide the maximum opportunity for DBEs to participate in the performance of contracts financed in whole or in part with federal funds.

The Department and its Contractors shall not discriminate on the basis of race, color, national origin, ancestry, sex, age, or disability in the award and performance of DOT assisted contracts.

Disadvantaged Business Enterprises are those so certified by the Maine Department of Transportation Office of Human Resources prior to bid opening date.

The Department has determined that elements of a good faith effort to meet the contract goal include but are not limited to the following:

1. Whether the Contractor advertised in general circulation, trade association, and minority/women's-focus media concerning the subcontracting opportunities;

2. Whether the Contractor provided written notice to a reasonable number of specific DBEs that their interest in the contract is being solicited;

3. Whether the Contractor followed up on initial solicitations of interest by contacting DBEs to determine with certainty whether the DBEs were interested;

4. Whether the Contractor selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the DBE goals;

5. Whether the Contractor provided interested DBEs with adequate information about the plans, specification and requirements of the contract;

6. Whether the Contractor negotiated in good faith with interested DBEs, not rejecting the DBE as unqualified without sound reasons based on a thorough investigation of their capabilities;

7. Whether the Contractor made efforts to assist interested DBEs with other appropriate technical/financial assistance required by the Department or Contractor;

8. Whether the Contractor effectively used the services of available minority/women's community organizations, minority/women's business assistance offices; and other organizations that provide assistance in the recruitment and placement of DBEs.

Substitutions of DBEs. The following may be acceptable reasons for Office of Human Resources approval of such a change order:

- The DBE defaults, voluntarily removes itself or is over-extended;
- The Department deletes portions of the work to by performed by the DBE.

It is not intended that the ability to negotiate a more advantageous contract with another certified DBE be considered a valid basis for such a change in DBE utilization once the DBE Bid Submission review has been passed. Any requests to alter the DBE commitment must be in writing and included with the change order.

Failure to carry out terms of this Standard Specification shall be treated as a violation of this contract and will result in contract sanctions which may include withholding of partial payments totaling the creditable dollars amount which would have been paid for said DBE participation, termination of this contract or other measures which may affect the ability of the Contractor to obtain Department contracts.

Copies of the Maine Department of Transportation's DBE Program may be obtained from:
Maine Department of Transportation
Office of Human Resources
#16 State House Station
Augusta, Maine 04333-0016
tel. (207) 624-3050

Quarterly Reporting Requirement. The Contractor must submit quarterly reports of actual dollars paid to Disadvantaged Business Enterprises (DBE's) on this Project to the MDOT Office of Human Resources by the end of the first week of January, April, July and October for the period covering the preceding three months considered Federal Fiscal Year quarters. The reports will be submitted directly to the Office of Human Resources on the form provided in the latest version of the DBE Program Manual. Failure to submit the report by the deadline may result in a withholding of approval of partial payment estimates by the Department.

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

If the cost of products purchased for permanent use in this project which are manufactured of steel, iron or the application of any coating to products of these materials exceeds 0.1 percent of the contract amount, or $2,500.00, whichever is greater, the products shall have been manufactured and the coating applied in the United States. The coating materials are not subject to this clause, only the application of the coating. In computing that amount, only the cost of the product and coating application cost will be included.

Ore, for the manufacture of steel or iron, may be from outside the United States; however, all other manufacturing processes of steel or iron must be in the United States to qualify as having been manufactured in the United States.

United States includes the 50 United States and any place subject to the jurisdiction thereof.

Products of steel include, but are not limited to, such products as structural steel, piles, guardrail, steel culverts, reinforcing steel, structural plate and steel supports for signs, luminaries and signals.

Products of iron include, but are not limited to, such products as cast iron grates.

Application of coatings include, but are not limited to, such applications as epoxy, galvanized and paint.

To assure compliance with this section, the Contractor shall submit a certification letter on its letterhead to the Department stating the following:

> "This is to certify that products made of steel, iron or the application of any coating to products of these materials whose costs are in excess of $2,500.00 or 0.1 percent of the original contract amount, whichever is greater, were manufactured and the coating, if one was required, was applied in the United States."

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. 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 MDOT 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 MDOT or from sources designated by MDOT. 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 MDOT 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 MDOT 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 MDOT, 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.

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Start of FHWA 1273 REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS(As revised through March 10, 1994)

I. GENERAL

1. 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.

2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.

3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.

4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

   Section I, paragraph 2;
   Section IV, paragraphs 1, 2, 3, 4, and 7;

Section V, paragraphs 1 and 2a through 2g.

5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 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 DOL, or the contractor's employees or their representatives.

6. Selection of Labor: During the performance of this contract, the contractor shall not:

   a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or

   b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

II. NONDISCRIMINATION (Applicable to all Federal-aid construction contracts and to all related subcontracts of $10,000 or more.)

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 (28 CFR 35, 29 CFR 1630 and 41 CFR 60) 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 Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 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 State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.

   b. The contractor will accept as his 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, 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, preapprenticeship, and/or on-the-job training."

2. EEO Officer. The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO 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 who 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.

   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 minority group employees.

   d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

   e. 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 minority groups 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 minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group 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, he is expected to observe the provisions of that agreement to the

extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group 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, national origin, age or disability. The following procedures shall be followed:

   a. The contractor will conduct periodic inspections of project sites to insure 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 his 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 his avenues of appeal.

6. Training and Promotion.

   a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

   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. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special

provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.

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 minority group and women employees 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 his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. 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 best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.

   b. The contractor will use best 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, national origin, age or disability.

   c. 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 SHA 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 minority and women 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, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) 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 SHA.

8. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment. The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin,

age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.

a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.

b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.

c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.

9. 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 completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number of minority and non-minority 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;
(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and

(4) The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.

b. All such records must be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the MDOT and the Federal Highway Administration.

The Contractor will submit to the MDOT a report for the month of July, indicating the total hours worked by minority, women and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form PR-1391. If on-the-job training is being required by "Training Special Provision," the Contractor will be required to furnish Form FHWA-1409. The report is required for week ending July 15 and can be obtained from MDOT, is due by week ending August 20th. This report is to be furnished directly to MDOT - Office of Civil Rights.

III. NONSEGREGATED FACILITIES (Applicable to all Federal-aid construction contracts and to all related subcontracts of $10,000 or more.)

a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.

b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of $10,000 or more and that it will retain such certifications in its files.

IV. PAYMENT OF PREDETERMINED MINIMUM WAGE (Applicable to all Federal-aid construction contracts exceeding $2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

1. General:

   a. All mechanics and laborers employed or working upon the site of the work 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 (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c)] the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall 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. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, 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 shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.

b. 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.

c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

2. Classification:

a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.

b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:

(1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;

(2) the additional classification is utilized in the area by the construction industry;

(3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and

(4) with respect to helpers, when such a classification prevails in the area in which the work is performed.

c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification 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 shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage

and Hour 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.

d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional 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 shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said 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

e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

3. Payment of Fringe Benefits:

a. 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 or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.

b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a 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, 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.

4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:

a. Apprentices:

(1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in

such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in 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 the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

(3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall 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 for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

(1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.

(2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training

Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.

(4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Helpers. Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under a approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

5. 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. 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 journeymen shall not be greater than permitted by the terms of the particular program.

6. Withholding. The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or

mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, 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.

7. Overtime Requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. Violation. Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. 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, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of $10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. Withholding for Unpaid Wages and Liquidated Damages. The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or 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, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

V. STATEMENTS AND PAYROLLS (Applicable to all Federal-aid construction contracts exceeding $2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. Compliance with Copeland Regulations (29 CFR 3). The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. Payrolls and Payroll Records:

a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.

b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found 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 Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.

c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;

(2) that such laborer or mechanic (including each helper, apprentice, and trainee) employed 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 the Regulations, 29 CFR 3;

(3) that each laborer or mechanic has been paid not less that the applicable wage rate and fringe benefits or cash equivalent for the classification of worked performed, as specified in the applicable wage determination incorporated into the contract.

e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.

f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.

g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions 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 may be grounds for debarment action pursuant to 29 CFR 5.12.

VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

1. On all Federal-aid contracts on the National Highway System, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than $1,000,000 (23 CFR 635) the contractor shall:

   a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.

   b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.

   c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data required in paragraph 1b relative to materials and

supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.

2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

VII. SUBLETTING OR ASSIGNING THE CONTRACT

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. 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).

   a. "Its own organization" shall be construed to include only workers employed and paid directly 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, assignee, or agent of the prime contractor.

   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 on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII 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. 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 SHA 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 SHA 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 SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

VIII. SAFETY: ACCIDENT PREVENTION

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 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA 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.

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 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. 333).

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. 333).

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS 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, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS

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 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more that $10,000 or imprisoned not more than 5 years or both."

X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (Applicable to all Federal-aid construction contracts and to all related subcontracts of $100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.

2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.

3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.

4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

1. Instructions for Certification - Primary Covered Transactions:

   (Applicable to all Federal-aid contracts - 49 CFR 29)

a. By signing and submitting this proposal, the prospective primary 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 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 primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.

d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.

f. The prospective primary 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.

g. The prospective primary 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 Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

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. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.

i. 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.

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.

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Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--
Primary Covered Transactions

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

b. Have not within a 3-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;

c. 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 1b of this certification; and

d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

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2. Instructions for Certification - Lower Tier Covered Transactions: (Applicable to all subcontracts, purchase orders and other lower tier transactions of $25,000 or more - 49 CFR 29)

a. By signing and submitting this proposal, the prospective lower tier 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.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

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.

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.

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 may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

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.

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Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--
Lower Tier Covered Transactions:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

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XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING
(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 - 49 CFR 20)

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 his or her bid or proposal that he or she 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.

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, 300 mm [12 in] or more in its average diameter measured, as specified in Subsection 201.09 - Method of Measurement, and taller than 1.5 m [5 ft] measured from the ground at the base of the tree.

2. A stump is defined as the remains of a single tree 300 mm [12 in] or more at its average diameter from which the toppings have been removed and which is less than 1.5 m [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 6 m [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, by burning or by burying under soil in approved areas.

All live hardwood stumps, 25 mm [1 in] 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 25 mm [1 in] 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 600 mm [24 in] 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 600 mm [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 may be allowed when so provided by Special Provision.

a. Chipping Wood chippers shall reduce woody material to chips, not over 6 mm [¼ in] thick by not over 200 mm [8 in] long, and the chips shall be spread uniformly over the ground or as directed. For a related provision, see Code of Maine Regulations 401 Section 7.

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 1 horizontal to 1 vertical extending from the edge of the shoulder to the existing ground and covering with a minimum of 600 mm [2 ft] of earth. Excavation or borrow used to cover the brush and logs in the slopes may be placed in layers at least 600 mm [2 ft] thick and compacted only to the extent that the stability of the slope is assured. For a related provision, see Code of Maine Regulations 102 Section 3.

c. Burning A Special Provision will state when burning is allowed. Logs, brush and other refuse produced as a result of clearing, may be disposed of by burning, provided pollutant type material is not used to start or maintain the fire. All fires shall be started with natural material and the fire maintained in such a manner that minimum of visible smoke is produced.

Special attention shall be given to wind direction to assure no nuisance results from smoke. Burning shall be done in accordance with applicable laws and ordinances and under the direction of competent workers. Extreme care shall be taken to control the fires. Fires will not be allowed where there is any possibility of burning, scorching, overheating or otherwise jeopardizing trees, shrubs, surrounding forest cover, adjacent property or buildings nor where there is a possibility of damaging overhead wires and cables. Fires will not be allowed where undisturbed ground is to remain exposed nor on areas which have been seeded to grass or other plants.

The Contractor will be held responsible for any damage caused by fires built in the construction of the project. Such responsibilities shall include removing and disposing of burned material, replacing trees, shrubs, fences or any other material or object which has been designated to remain and seeding, fertilizing and mulching the burned areas. At the option of the Resident, a cash settlement or a combination of replacement and cash settlement may be assessed in lieu of replacing all damaged trees and plants. When directed, the Contractor may be required to perform such work beyond the Right-of-Way lines.

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 hectare [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 1.4 m [4½ feet] 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 300 mm [12 in] 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 hectare [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	hectare [Acre]
201.12	Selective Clearing and Thinning	hectare [Acre]
201.23	Removing Single Tree Top Only	Each
201.24	Removing Stump	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, portland cement 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.

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 in the Special Provision.

Written notice will be given the Contractor when any building becomes available before the date specified. 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 authorized.

If, during the negotiations between the Department and the owners of the building specified under this section, agreements are made with the owners to move, remove or raze the buildings, the Department reserves the right to remove any or all items from the contract upon written notice to the Contractor and no payment will be made for the items. Removal of debris, when

necessary under such conditions, will be accomplished under Section 629 - Hand Labor and Section 631 - Equipment Rental.

All debris and unusable materials shall be removed to an approved dump or waste area and buried. No material shall be disposed of by burning. For a related provision, see Code of Maine Regulations 401.

202.03 Removing Existing Superstructure, Structural Concrete, Railings, Curbs, Sidewalks 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 on the plans and shall be accomplished without damage to the portion of the structure to remain.

Removing existing bridge shall be to the limits shown on the plans.

Existing concrete curbs, granite curbs, and concrete sidewalks shall be removed to the limits shown on the plans using a chipping hammer or pavement breaker 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, the fascia removal line, as indicated on the plans, shall be saw cut to a depth of 25 mm [1 in] minimum. Care shall be taken not to damage any reinforcing steel that is to remain in the bridge.

When the material from an existing structure is to be retained by the Department, the Contractor shall carefully dismantle it, and all materials, except those that may be specified to be reused in the new structure, shall be loaded on trucks supplied by the Department or carefully stored by the Contractor within the right-of-way. 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 especially provided, include the removal of all bolts and rivets necessary to disconnect the members and the matchmarking of these members for future reassembling.

When the material from an existing structure is designated to become the property of the Contractor, it shall be entirely removed and disposed of out of sight of the highway and beyond the limits of the right-of-way. Such material 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 dump or other 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 placing the new

work. If this is not feasible, the work shall be done only when approved and entirely at the Contractor's risk.

202.031 Removing Existing Bituminous Pavement and Concrete Wearing Surface from Bridges and Scarifying the Top of Deck 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 damaged by the Contractor, which is not specified to be scarified or rehabilitated, shall be repaired. Such repair shall be at the expense of the Contractor.

When rehabilitation of the top of the deck is called for on the plans, the work will be done in accordance with Section 518 - Rehabilitation of Structural Concrete Bridge Decks.

When scarifying the top of the deck is called for, the specified depth of material shall be removed from curb to curb for the entire length of the bridge. Removal shall be accomplished by an approved scarifying machine. Areas that cannot be removed by a scarifying machine, such as adjacent to curbs, drains, and armored joints, shall be removed by using a maximum 16 kg [35 lb] chipping hammer or pavement breaker.

202.04 Removing Portland Cement Concrete Pavement All Portland cement concrete pavement and Portland cement concrete base course designated for removal shall be broken into pieces suitable for use in construction or 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, dispose of material in approved waste areas and replace with an equivalent volume of granular borrow at no cost to the State.

202.05 Removing Manholes or Catch Basins Where the manhole or catch basin is under a roadway of embankment, the sides shall be removed to a depth of at least 600 mm [2 ft] below subgrade. When the plans 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.

202.06 Removing Bituminous Concrete Pavement The equipment for removing the bituminous pavement shall be capable of scarifying 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.

202.061 Removing Pavement Surface The equipment for removing the bituminous surface shall be a power operated planing machine or grinder capable of removing bituminous concrete pavement to the required depth. The equipment shall be capable of accurately establishing

profile grades by referencing either from the existing pavement or from an independent grade control and shall have a positive means for controlling cross slope elevations.

The Contractor shall locate and remove all objects in the pavement through the work area that would be detrimental to the planing or grinding machine.

The finished milled surface will be inspected before being accepted, and any deviations in the profile exceeding 12 mm [½ in] under a 5 meter [16 ft] string line or straightedge placed parallel to the centerline will be corrected. Any deviations in the cross-slope that exceed 10 mm [⅜ in] under a 3 meter [10 ft] stringline 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 Resident's satisfaction before the area is accepted.

202.062 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, 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.

202.07 Method of Measurement Removing buildings, removing existing superstructures, and removing existing bridges will each be measured by the lump sum. Removing Portland cement concrete pavement, removing bituminous concrete pavement, pavement butt joints, and removing pavement surface will be measured by the square meter [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 meter [cubic yard] in place before work starts on the particular portion of the structure to be removed or by the lump sum as specified. Remove existing railings will be measured by the meter [foot] in place along the grade and line of the railing from outside to outside of end posts or rail projections, whichever is greater.

The removing of existing bituminous pavement, removing existing concrete wearing surface, removing of existing concrete curbs and sidewalks from bridges, and scarifying of the concrete deck will each be measured for payment as one lump sum unit, complete, and accepted.

The removing of existing manholes and catch basins will be measured by the unit.

202.08 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 directed by the Resident. Removing Portland cement concrete pavement will be paid for at the contract unit

price per square meter [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 meter [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 meter [foot] of railing removed and disposed of.

Removing and scarifying existing concrete, removing existing concrete wearing surface, and removing existing bituminous pavement from bridges will be paid for at the contract lump sum price for the respective contract pay item involved. Removing membrane waterproofing, if present on the existing deck, shall be incidental to the removing of bituminous pavement.

The containment and disposal of pollutants during the removal of materials from an existing bridge will not be paid for directly but shall be incidental to the related contract Pay Item. These payment provisions shall prevail over those of Section 656 - Temporary Soil Erosion and Water Pollution Control, for this work only. The payment for each contract pay item will be full compensation for furnishing all materials, labor, equipment for all formwork, and for all other incidentals necessary to complete the work.

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 plans 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 on the plans.

Removing bituminous concrete pavement will be paid for at the contract unit price for the number of square meters [square yards] removed as required by the plans 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 meter [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 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 meter [square yard]. This price will be full compensation for removing the material to the required depth, profile and cross slope, complete cleaning of the milled surface suitable for paving, and for salvaging, hauling, and stockpiling excess material to an approved designated area. Locating and removing objects, and additional milling and paving required to correct deviations will not be paid for separately but will be included in the contract unit price per square meter [square yard].

When the pay item calls for material to be retained by the Department, payment shall include the salvage of these materials, custody, preservation, and storage on the right-of-way and disposal as provided herein. When the proposal 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 Portland cement concrete pavement will be paid as provided in Section 203 - Excavation and Embankment.

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 Portland Cement Concrete Pavement	Square Meter [Square Yard]
202.12	Removing Existing Structural Concrete	Cubic Meter [Cubic Yard]
202.121	Removing Existing Concrete	Lump Sum
202.123	Scarifying Concrete Deck - Top mm [inch]	Lump Sum
202.127	Removing of Existing Bituminous Pavement	Lump Sum
202.128	Removing of Existing Concrete Curbs & Sidewalks	Lump Sum
202.13	Removing Existing Railings - Retained by Department	Meter [Foot]
202.14	Removed Existing Railings - Property of Contractor	Meter [Foot]
202.15	Removing Existing Manhole or Catch Basin	Each
202.17	Removing Existing Structural Concrete	Lump Sum
202.19	Removing Existing Bridge	Lump Sum
202.20	Removing Bituminous Concrete Pavement	Square Meter [Square Yard]
202.202	Removing Pavement Surface	Square Meter [Square Yard]
202.203	Pavement Butt Joints	Square Meter [Square Yard]
202.30	Removing Existing Concrete Wearing Surface	Lump Sum

SECTION 203 - EXCAVATION AND EMBANKMENT

203.01 Description This work shall consist of removing, hauling, disposing and compacting, if required, of all material not being removed under some other item, encountered for the construction of the project in accordance with the specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established. Excavation, except structural excavation, will be classified as common excavation,

rock excavation, unclassified excavation, as hereafter defined. Material not classified as excavation that is required to construct embankments, backfill trenches and holes shall be classified as borrow.

a. Common Excavation shall consist of removing all material encountered in grading the project within the limits of construction and in driveways, which is not otherwise classified and paid for. Common excavation shall include the removing and disposing of boulders, solid mortared stone masonry, and concrete masonry when each is less than 2 m^3 [2 yd^3] in volume and all soft and disintegrated rock 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 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, channel widening or straightening, when designated on the Plans, outside the limits of structural excavation or other classifications.

b. Rock Excavation shall consist of removing hard igneous, metamorphic and sedimentary rock which cannot be excavated without drilling and blasting or drilling and splitting and all boulders, solid mortared stone masonry, concrete masonry, each having a volume of 2 m^3 [2 yd^3] or more.

c. 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 and shall be obtained from beyond the limits of the required cut slopes. Unless otherwise designated in the contract, the Contractor shall make their own arrangements for obtaining borrow and shall pay all costs involved. No material shall be removed from an approved borrow pit except for use under this contract.

Material shall meet the requirements of the following Subsections of Division 700 - Materials:

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 or aggregate for subbase, Type D specified in Subsection 703.06 - Aggregate for Base and Subbase, as directed.

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, 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 permission. Excavating operations shall be conducted so that material outside of the limits of slopes will not be disturbed.

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 waste areas as directed.

Suitable material taken from excavation shall be used in the construction of embankment, subgrade, and for backfilling as indicated on the plans, or as directed, except that if the volume of suitable excavated material exceeds that required to construct the embankments to the grades indicated, the excess shall be used as directed or wasted.

The Contractor shall give the Resident sufficient time before beginning excavation to take necessary cross section elevations and measurements. The Contractor shall not excavate beyond the dimensions, slopes and elevations established, and no material shall be removed prior to the staking out and cross sectioning the site. Unless otherwise authorized, borrow material shall not be placed until after all suitable excavation has been placed in the embankment unless the use of granular borrow is called for on the plans or required for use under embankments or 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 115% 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 ledge 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 ledge.

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 at the Contractor's expense.

Excavating for obliterating old roadways or salvaging material from old roadways shall include all grading operations necessary to incorporate the old roadway into the new roadway and surroundings or placing salvaged material in a stockpile as directed.

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 150 mm [6 in] above or below the grade called for on the cross sections 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. All provisions for measurement and payment limits shall remain in force and no payment will be made for unauthorized work done beyond authorized pay limits.

Unstable slopes subject to sliding and slumping shall be excavated to the lines and grades shown or as directed. Immediately after each location is excavated approved stone or granular slope blanket backfill material shall be placed and shaped to match the adjacent slopes.

Ledge slopes shall be scaled (cleaned of all loose material) immediately as the excavation proceeds. The ledge 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 pay for any temporary protection required for the construction of the project.

203.041 Salvage of Existing Bituminous Pavement All existing bituminous pavement designated to be removed under this contract must be salvaged for utilization. Existing bituminous pavement material shall not be deposited in any waste area or be placed below subgrade in any embankment.

Methods of utilization may be any of the following:

1. Used in the upper 150mm [6 in] of travelways and full depth in driveways as aggregate base or subbase provided the material contains no particles greater than 75 mm [3 inch] in any dimension.

(a) Placing, shaping, compacting, stabilizing, and surface tolerance shall be in accordance with applicable provisions of Section 304 - Aggregate Base and Subbase Course, except that the material shall be placed in a layer of uniform thickness not to exceed 150 mm [6 in] and compacted to the extent that the material is stabilized and keyed together. No more than one layer may be used.

(b) If the material is blended, it must be blended with an aggregate that meets the gradation and quality requirements for Aggregate Subbase Course, Gravel - Type D noted in Subsection 703.06.

2. Used as a replacement for untreated aggregate surface course on entrances provided the material contains no particles greater than 50 mm [2 in] in any dimension. Payment will be made under Pay Item 411.09 Untreated Aggregate Surface Course. Paragraphs 1(a) and 1(b) of this provision will apply or as directed by the Resident.

3. Recycled as stabilized base or plant mix pavement if so designated in the contract.

4. Stockpiled at commercial or approved sites for commercial or MDOT use.

5. Other approved methods proposed by the Contractor, which will assure proper use of the existing bituminous pavement.

The cost of salvaging bituminous material will be included for payment under the applicable pay item, with no additional allowances made, which will be full compensation for removing, temporarily stockpiling, and rehandling, if necessary, and utilizing the material in the roadway or stockpiling at an approved site as described above. The material will also be measured and paid for under the applicable Pay Item for which it is reused.

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 and no direct compensation for cost of pumping will be made.

Muck shall be removed in such a manner 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 shown on the plans or as otherwise directed. When muck is encountered that was not contemplated on the plans, it shall be disposed of as indicated above.

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. 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 shown on the plans 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 rock 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 150 mm [6 in] above or 150 mm [6 in] below the lines designated, but in no case shall projections of rock extend over 150 mm [6 in] 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 obstructions, as specified in Section 104.3.13 - Materials and Items Found on the Project, located within the designated limits of the work, shall be removed as part of the applicable excavation item for type of work being performed. Buried structures and obstructions 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.

203.06 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. 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 required permits 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. Seed and mulch shall be applied in accordance with Section 618 - Seeding.

Entrances to waste areas located within wooded areas shall be in accordance with Subsection 203.07 - Haul Roads.

When waste areas are located within wooded areas, a screen of trees at least 30 m [100 ft] wide shall be maintained between the nearest edge of the waste area and the right-of-way line or the construction limit line.

The entrances to waste areas shall be treated in the same manner as the waste area except that if entrances in wooded areas exceed 5 m [16 ft] in width the ground shall also be replanted with trees compatible with the type growth in adjacent area. These plantings shall extend for a length of 30 m [100 ft] along the entrance road or as otherwise directed.

All trees that are damaged, uprooted or otherwise moved as a result 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 Special Provisions or on the plans.

Waste material shall not be disposed of in wetlands without prior approval and the acquisition by the Contractor of all necessary Federal, State and local permits.

"Wetlands" are those areas that are 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. The Contractor shall be solely responsible for delays and costs resulting from or associated with the proposed disposal of waste material in wetlands.

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 The location of all borrow pits and rock borrow quarries shall be approved in accordance with Section 105.8.6 - Pit Requirements and Section 657 - Rehabilitation of Pits.

The Contractor shall notify the Resident sufficiently in advance of opening any borrow areas so that cross section elevations and measurements of the ground surface after stripping may be taken and the borrow material can be tested before being used. Existing pits shall, when directed, be graded and shaped by the Contractor before being cross-sectioned for original measurements.

Borrow pits shall be excavated to neat lines and all slopes shall be dressed uniformly and left in a neat condition. Before the completion of the project, all borrow pits and haul roads shall be graded to blend with adjacent ground, loamed if necessary, seeded and mulched. When practicable, the bottom of all pits shall be graded to drain the pit.

203.09 Preparation of the Embankment Area When the depth of the embankment, measured vertically below subgrade, does not exceed 1.5 m [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 1.5 m [5 ft], as measured above, all vegetation in the embankment area shall be cut as specified in Section 201 - Clearing Right-of-Way.

When embankment is to be placed and compacted on hillsides or where new embankment is to be compacted against existing embankment, slopes steeper than 1 vertical to 2 horizontal shall be continuously benched by excavating steps into the existing material 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. When such benching is required, it will be as indicated on the plans, called for in the special provisions or as directed.

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. Except for the first layer over swampy ground and cleared areas, roadway embankment of earth material shall be placed in layers not exceeding 200 mm [8 inches], loose measure, unless otherwise approved and the material compacted as specified before the next layer is placed.

When it is impractical to construct layers over the full width of the cross section, partial width layers may be authorized.

Effective spreading equipment shall be used on each layer to obtain uniform thickness. Each layer shall be crowned and maintained free of ruts and ridges to provide direct drainage of water from the embankment. As the compaction of each layer progresses, grading and manipulating will be required to assure uniform density. Construction equipment shall be routed uniformly over the entire surface of each layer.

Embankments within 15 m [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.

Water shall be added or removed, if necessary, in order to obtain required compaction. Aeration of excavated roadway materials to reduce the moisture content to within specified limits shall be as specified under Section 631.04 - Aerating.

When placing layers of specified thickness is not feasible, such as filling in water or over swampy ground, 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 600 mm [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 with suitable leveling equipment and 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 200 mm [8 in]. The layers so constructed shall not be placed above an elevation 600 mm [2 ft] below the finish subgrade. The remainder of the embankment shall be composed of suitable material smoothed and placed in layers not exceeding 200 mm [8 in], loose thickness, and compacted as specified for earth embankments.

Where guardrail is to be installed, rock shall not be placed in the embankment under the location of the guardrail to an elevation 1.2 m [4 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 the nearest available waste areas. When it is impossible to dispose of all material in the manner described, the remainder shall be disposed of in approved waste areas.

When material obtained from roadway excavation is unsatisfactory for use in the formation of embankments due to excessive moisture content, can be rendered satisfactory for such use by combining it with granular material, the unsatisfactory material shall be combined with granular borrow or granular excavation when and as directed 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, rolled and sealed against infiltration of water.

The portion of the embankment and subbase outside a 1 vertical to 1½ horizontal slope extending from the edge of the finished shoulder to the existing ground, as shown on the Standard Detail entitled "Disposal of Waste Materials", 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 200 mm [8 in] 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 1725 kPa [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 200 mm [8 in] and less than 600 mm [24 in], loose measure, providing the specified compaction requirements are obtained and the Contractor agrees to make necessary test excavation for the Resident to determine density.

The Contractor will be required to demonstrate that the compaction equipment and methods are obtaining satisfactory compaction.

Satisfactory compaction for the purpose of the demonstration is defined as not less than 90% of the maximum density. The maximum density shall be determined in accordance with AASHTO T180, Method C or D, corrected by the Soils Laboratory Adjustment Chart, available at the MDOT Central Laboratory, Bangor, Maine. Field density tests will be made in accordance with AASHTO T191, adjusted to include only the material passing a 19 mm [¾ inch] sieve or by an approved method using a calibrated nuclear device.

203.12 Construction of Earth Embankment with Moisture and Density Control The contract 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 shall be determined in accordance with AASHTO T180, Method C or D, corrected by the Soils Laboratory Adjustment Chart available at the MDOT Central Laboratory, Bangor, Maine. Field density tests will be made in accordance with AASHTO T191, adjusted to include only the material passing a 19 mm [¾ inch] sieve or by an approved method using a calibrated nuclear device.

All material in embankments above the elevation designated on the plans for moisture density control shall be placed at a moisture content suitable to obtain the required density. Each layer placed with controlled moisture shall be compacted to not less than 90% of the maximum density.

Density requirements will not apply to the portions of embankments constructed of material which cannot be tested in accordance with AASHTO T191 or when the material contains more than 30% material retained on a 50 mm [2 in] square mesh sieve.

203.15 Construction of Rock Embankments The material for rock embankment shall be placed in compacted layers not exceeding 1 m [3 ft] in depth. Depositing the rock directly over the end of the fill from the hauling equipment will not be permitted; 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 1.2 m [4 ft] in depth. In no case shall the rock embankment be placed within 300 mm [1 ft] of subgrade unless authorized.

When structures are located under rock embankment, they shall be covered with not less than 600 mm [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 placed in the core embankment. The construction of embankments may continue during cold weather only when all frozen material in the top of the core embankment or the existing ground is moved to the waste area before placing additional material. When this procedure results in additional borrow quantity the additional borrow will not be paid for directly.

Compaction shall be in accordance with the specified method of embankment construction. When the prevailing temperatures are below -1°C [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.

The embankment shall not be constructed upon frozen material except that such construction of embankments may be allowed providing the total depth of the added fill, including bases, plus the depth of the frozen material beneath does not exceed 1.5 m [5 ft]. Frozen material may be left in the embankment only if it has been compacted as specified before freezing. The Contractor shall not resume construction of any embankments built in this manner until all frozen material has thawed. If test holes are required to make this determination they shall be dug and backfilled with satisfactory compaction at the Contractor's expense. Before additional material is added, uncompacted material on the surface of such embankments shall be either recompacted in accordance with the specified method of embankment construction or removed.

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 operation and shall be maintained to no tolerance above or 75 mm [3 in] 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 as a result 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 150 mm [6 in] 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 meters [cubic yards] measured in its original position by cross sectional elevations of the area excavated. Measurements will include slides in common excavation and unclassified excavation, not attributable to carelessness of the Contractor, and authorized excavation of earth, rock, 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 on the plans, the quantity measured for payment will be that portion of the number of cubic meters [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 ledge, the quantity measured will be what is actually placed to maximum allowable horizontal dimensions shown on the plans.

b. When changes to the plans are made by the Resident.

Muck excavation, to be measured for payment as common excavation, will be the number of cubic meters [cubic yards] of material acceptably excavated from areas shown on the plans or other authorized areas not shown on the plans or placed in waste storage areas or hauled to an approved waste area. Muck excavation shall be measured in its original position by cross sectional elevations and the volume computed by the average end area method. 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 approved waste areas will not again be measured for payment.

When it is impractical to measure excavation by the cross sectional method due to the erratic location of isolated deposits, acceptable methods involving three-dimensional measurements may be used. When small quantities of borrow are involved and it is impractical to measure in its original position a quantity not exceeding 2,000 m^3 [2,500 cubic yards] per item for a single project may be measured in vehicles at the point of delivery and a quantity not exceeding 5,000 m^3 [6,500 cubic yards] per item for a single project may be measured in place. When measured in vehicles the quantity for payment shall be 90% of the quantity determined for earth and 75%

of the quantity determined for rock as shown on delivery slips. When measured in place the amount for payment shall be 115% of the quantity so measured for earth material and 75% 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 gravel blanket will be measured by the cubic meter [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 ¼ 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 150 mm [6 in] beyond the neat line of embankment slope or 300 mm [12 in] 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.

The elevations for final cross sections for excavation shall be determined at the surface of the finished ground with no additional allowance for thickness of loam, sod, riprap, temporary erosion control blanket, hay mulch or other type ground surface except that excavation for slope gravel blanket will be measured by the cubic meter [cubic yard].

Measurements will be made for unsuitable materials actually excavated and removed to obtain proper compaction in cut sections and in foundations for fill sections.

Aeration of excavated materials to reduce moisture content to specified limits will be measured as specified under Section 631 - Equipment Rental.

203.19 Basis of Payment The accepted quantity of excavation and borrow will be paid for at the contract unit price per cubic meter [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, 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.

Haul, connected with the disposal of waste or surplus material or both, shall be limited to a maximum distance of 600 m [2,000 ft] beyond the limits of the project for disposal in flattening slopes or other roadway work. If no disposal areas are designated the haul shall be made to an approved waste area supplied by the Contractor.

Payment for removal of unstable material below subgrade in cuts will be paid at the contract unit price per cubic meter [cubic yard] for Common Excavation or Unclassified Excavation whichever is appropriate.

Payment for placing and compacting any backfill, except Special Backfill, placed in accordance with Section 206 - Structural Excavation, 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 rock is encountered and no item is included in the contract for its removal, the excavation of the rock will be paid for at 6 times the contract unit price for common excavation.

The furnishing and placing of backfill material between the rock remaining and the normal subgrade line of 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.

Earth material from beyond the designated slope lines on earth cut slopes as specified in Section 203.18 - Method of Measurement, and when authorized, may be paid for, when used to construct embankments, at the contract unit bid price for excavation or borrow, whichever is less. 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 the case may be, for each handling approved. 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 304.11 - Basis of Payment.

Excavation for benching to receive embankments will not be paid for directly but shall be incidental to the other contract items.

Water added to embankment material to aid in compaction will not be paid for directly but shall be considered included in the 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 included in the other 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 hay mulch waste areas and haul roads to and from waste areas to eliminate unsightly conditions and to control erosion will not be paid for directly but will be considered included in the work of the various classifications of excavation all as specified in Section 203.06 - Waste Areas.

Stripping pits to obtain necessary borrow will not be paid for separately but will be considered included in the other 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.

Unless otherwise provided in contracts with common excavation, rock excavation or unclassified excavation items, grading, furnishing and placing loam, seed and mulch in waste areas shall be considered incidental to the contract and no separate payment will be made.

In Contracts that do not contain Common Excavation or Unclassified Excavation items, grading, furnishing and placing loam, seed and mulch in waste areas will be paid for under applicable pay items of the contract.

Payment will be made under:

Pay Item		Pay Unit
203.20	Common Excavation	cubic meter [Cubic Yard]
203.2001	Common Excavation - Plan Quantity	cubic meter [Cubic Yard]
203.21	Rock Excavation	cubic meter [Cubic Yard]
203.22	Unclassified Excavation	cubic meter [Cubic Yard]

203.221	Unclassified Excavation - Plan Quantity	cubic meter [Cubic Yard]
203.24	Common Borrow	cubic meter [Cubic Yard]
203.25	Granular Borrow	cubic meter [Cubic Yard]
203.26	Gravel Borrow	cubic meter [Cubic Yard]
203.27	Rock Borrow	cubic meter [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 703.06 b. - 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 703.06 b. - 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 100 mm [4 in], 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 100 mm [4 in] 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 100 mm [4 in] 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 100 mm [4 in], 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 100 mm [4 in] 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 100 mm [4 in] 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 10 mm [⅜ in].

The completed surface of the add shoulder aggregate shoulder shall be shaped and maintained to a uniform machine finish.

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 meters [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 meter [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 meter [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 meter [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 meter [Square Yard]
204.41	Rehabilitation of Existing Shoulder, Plan Quantity	square meter [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 703.06 a. - 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 19 mm [¾ in]. 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 10 mm [⅜ in].

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 meters [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.

205.11 Basis of Payment The accepted quantity of reconstruct existing shoulder will be paid for at the contract unit price per square meter [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 meter [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 meter [Square Yard]
205.51	Widening of Existing Shoulder, Plan Quantity	square meter [Square Yard]

SECTION 206 - STRUCTURAL EXCAVATION

206.01 Description This work shall consist of excavating, hauling and backfilling or disposing 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, grade and typical cross sections shown on the plans or established. Excavating for structures below designated excavation limits as specified or shown on the plans will be included under this Section. Material, which is required to be excavated under another item, shall not be included under this item.

Ditches at inlets and outlets of culverts, special ditches and outlet ditches, all as shown on the plans, shall be constructed and paid for under Section 203 - Excavation and Embankment.

a. Drainage and Minor Structures shall include pipe culverts, pipe arches, underdrains, catch basins, manholes, structural plate units, box culverts, culvert end walls, concrete steps and other minor structures.

b. Major Structures shall include abutments and piers for bridges, rigid frame structures, and masonry retaining walls.

c. Special backfill shall consist of obtaining, hauling, and placing selected material suitable for the location where it is to be used. Structural backfill as a contract item will be called for on the plans or in the proposal.

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 rock is encountered which is to be removed, the Contractor shall uncover the rock and provide ample opportunity for the Resident to take the necessary measurements of the undisturbed rock. Soil erosion control devices shall be in place at this time.

When the foundation material is soft or otherwise unsatisfactory the excavation shall be carried to a depth designated and the material removed below the elevation shown on the plan and shall be replaced with approved granular material, thoroughly compacted, or a lower elevation for the bottom of the structure shall be established.

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 allowances for payment will be made. Unsuitable or surplus material shall be disposed of as directed.

When the foundation is to be placed on solid rock, 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. 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 rock, special 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 to the extent directed by the Resident.

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 structures, bridge structures and other permanent structures up to the elevation of the existing ground or other elevations shown on the plans or designated. 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 75 mm [3 in], frozen lumps, chunks of clay, mineral matter or any other objectionable material. Backfill material for major structures shall be granular borrow or other material designated on the plans and shall be at or near optimum moisture content and shall not contain stones larger than 75 mm [3 in], frozen lumps, chunks of clay, mineral matter or any other objectionable matter.

Backfill shall not be placed against gravity sections of masonry abutments, wing walls, box culverts or other structures requiring forms, until the masonry has been in place at least 7 days or until concrete cylinders cured with the structure establish that design strength has been reached. For reinforced sections, no backfill shall be placed until the masonry has been in place at least 14 days or until concrete cylinders cured with the structure establish that design strength has been reached. Backfilling around pipes, catch basins and manholes, the joints of which are made with portland cement mortar, shall not be done 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 200 mm [8 in] 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 so conducted 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 specifically provided in the contract. Structural plate units shall be backfilled in accordance with Section 509 - Structural Plate Pipes, Pipe Arches, Arches, and Metal Box Culverts.

Unless otherwise indicated on the plans 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.

206.04 Method of Measurement Structural excavation will be measured by the number of cubic meters [cubic yards] of material removed, measured in its original position acceptably excavated in conformity with the plans 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.

a. Drainage and Minor Structures For these structures there will be no measurement for structural earth excavation except excavation required below a plane parallel with and 300 mm [12 in] below the bottom of the aforementioned structures, as shown on the plans, hereafter called 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 horizontal dimensions do not exceed those bounded by vertical surfaces 375 mm [15 in] from the structure, except 450 mm [18 in] outside the lines of the base of catch basins, manholes, structural plate units, and box culverts, and to the vertical neat lines of underdrain trenches, as shown on the plans.

When rock is required to be excavated for installation of these structures, the depth for measurement will be the actual depth required in accordance with the construction specifications or as otherwise designated for a maximum vertical dimension of 300 mm [1 ft] below the bottom of the invert of the pipe for culvert pipe and for underdrain and 300 mm [1 ft] below the bottom of the base for catch basins and manholes. The quantity of rock will be the number of cubic meters [cubic yards] actually removed provided the maximum allowable horizontal dimensions do not exceed those bounded by vertical surfaces specified in the preceding paragraph. Any removal of solid rock for leveling, stepping or serrating, as shown on the plans, Standard Details, or determined, shall be measured within the aforementioned limits.

b. Major Structures For major structures, the quantity measured for payment will be the number of cubic meters [cubic yards] shown on the Schedule of Items in the contract.

This quantity is considered final, and no adjustments will be made except under the following conditions:

1. When the structure is founded on ledge, the quantity measured will be what is actually excavated to the top of the ledge and to maximum allowable horizontal dimensions bounded by vertical surfaces 450 mm [18 in] outside the neat lines of the base as shown on the plans.

2. When changes to the plans 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 rock is required to be excavated for the construction of major structures to definite elevations as shown on the plans, 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 300 mm [12 in] below the elevation shown or designated.

Removal of solid rock, for leveling, stepping or serrating, as shown on the plans 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 rock and will be so measured for payment.

c. Special Backfill The quantity of Special Backfill to be measured for payment as a contract item will be the number of cubic meters [cubic yards] of material acceptably placed and measured in place, but will not include replacement of material excavated beyond the specified pay limits for structural excavation.

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 meter [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 meter [cubic yard].

When rock 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 meter [cubic yard] for Common Excavation.

When rock is encountered and no Structural Rock Excavation - Major Structures or Structural Rock Excavation - Piers is included in the contract, the excavation of the rock will be paid for at 6 times the contract unit price for structural earth excavation of the corresponding classification.

When it is necessary to excavate below the elevation shown on the plans for abutments, masonry retaining walls, piers or rigid frame 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 included in the payment for the related contract item(s).

When no bid item appears in the contract for clearing drainage ways, maintenance of traffic, special detours or cofferdams, any necessary work of this type will not be paid for directly but

will be considered incidental to the work. Unless otherwise specified, payment under the pertinent contract items shall include costs of all pumping, bailing, drainage, sheeting, bracing and incidentals required for proper execution of the work.

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.

Excavation for channels, berm ditches and cut slope downspouts will be paid for under Section 203 - Excavation and Embankment.

Special backfill will be paid for at the contract unit price per cubic meter [cubic yard].

Payment will be made under:

Pay Item		Pay Unit
206.061	Structural Earth Excavation - Drainage Minor Structures Below Grade	cubic meter [Cubic Yard]
206.07	Structural Rock Excavation - Drainage & Minor Structures	cubic meter [Cubic Yard]
206.082	Structural Earth Excavation - Major Structures, Plan Quantity	cubic meter [Cubic Yard]
206.092	Structural Rock Excavation - Major Structures	cubic meter [Cubic Yard]
206.10	Structural Earth Excavation - Piers	cubic meter [Cubic Yard]
206.11	Structural Rock Excavation - Piers	cubic meter [Cubic Yard]
206.14	Special Backfill	cubic meter [Cubic Yard]

SECTION 207 - BRUSH MATTING

Reserved

SECTION 208 - SAND DRAINS

Reserved

SECTION 209 - WICK DRAINS

Reserved

SECTION 210 - CRUSHED STONE WINDROWS

Reserved

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 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.

211.03 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 meter [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	Meter [Linear Foot]
211.21	Inslope Rehabilitation	Meter [Linear Foot]
211.22	Inslope Excavation - Guardrail	Meter [Linear Foot]
211.221	Inslope Excavation - Guardrail Plan Quantity	Meter [Linear Foot]
211.30	Ditch Excavation	Meter [Linear Foot]
211.40	New Ditch Excavation	Meter [Linear Foot]
211.41	New Ditch Excavation - Ledge	Meter [Linear Foot]

DIVISION 300 - BASES

SECTION 301 Through 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	703.06 a
Aggregate Subbase	703.06 b

Aggregate for subbase or base courses shall be material meeting the aggregate type requirements specified in the following table.

Material	Aggregate Type (Subsection 703.06)
Aggregate Subbase Course, Gravel Top 225 mm [9 in]	D
Aggregate Subbase Course, Gravel Below 225 mm [9 in]	[1]D or E
Aggregate Subbase Course, Granular	G
Aggregate Subbase Course, Sand	F
Aggregate Base, Course, Crushed	[2]A or B
Aggregate Base, Course, Screened	[2]B or C

1. Contractor's option
2. Will be designated on the plans

The portion of material passing a 75 mm [3 in] sieve, for the various classes of aggregate base and aggregate subbase, at the time it is deposited on the roadbed shall conform to the gradation requirements of the contract. Oversized stones shall be removed from the aggregate before depositing on the roadway. Oversized stones are stones that will not pass a 150 mm [6 in] square mesh sieve.

304.03 Placing The maximum compacted thickness of any aggregate subbase or aggregate base course layer shall not exceed 300 mm [12 in] unless the Contractor demonstrates by a test section that the required compaction can be obtained. If compacted layers more than 300 mm

[12 in] 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.

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.

Aggregate base and subbase courses may be placed upon frozen surfaces when such surfaces have been properly constructed.

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 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 T180, Method C or D, corrected by the Soils Laboratory Adjustment Chart available at the MDOT Central Laboratory Bangor, Maine. Field density tests will be made 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.

Fine material added to the base shall be uniformly blended into the top 225 mm [9 in] of the course being stabilized. The blended material shall meet the requirements of Section 304.02 - Aggregate.

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 aggregate 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 aggregate base or subbase course layer shall be scarified and loosened for a minimum depth of 25 mm [1 in] 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 bituminous 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.

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 10 mm [⅜ in].

304.06 Method of Measurement Except as otherwise provided, aggregate base course and aggregate subbase to the level of subgrade will be measured by the cubic meter [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 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 aggregate base and 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 meters [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 1,000 m^3 [1,250 yd^3] per contract, after shrinkage.

Pit measured items will be measured by the cubic meter [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 aggregate base course and aggregate subbase course of the type specified will be paid for at the respective contract unit price per cubic meter [cubic yard].

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 aggregate 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 aggregate subbase or aggregate base placed on rock subgrade shall include only that material placed above the normal subgrade line.

Furnishing and placing aggregate subbase or aggregate 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
304.08	Aggregate Base Course-Screened	cubic meter [Cubic Yard]
304.083	Aggregate Base Course-Screened, Truck Measure	cubic meter [Cubic Yard]
304.09	Aggregate Base Course-Crushed	cubic meter [Cubic Yard]
304.093	Aggregate Base Course-Crushed, Truck Measure	cubic meter [Cubic Yard]
304.10	Aggregate Subbase Course-Gravel	cubic meter [Cubic Yard]
304.102	Aggregate Subbase Course-Gravel, Pit Measure	cubic meter [Cubic Yard]
304.103	Aggregate Subbase Course-Gravel, Truck Measure	cubic meter [Cubic Yard]
304.104	Aggregate Subbase Course-Gravel, Plan Quantity	cubic meter [Cubic Yard]
304.11	Aggregate Subbase Course-Granular	cubic meter [Cubic Yard]
304.113	Aggregate Subbase Course-Granular, Truck Measure	cubic meter [Cubic Yard]

304.12	Aggregate Subbase Course-Sand	cubic meter [Cubic Yard]
304.123	Aggregate Subbase Course-Sand, Truck Measure	cubic meter [Cubic Yard]

SECTION 305 - PREMIXED BITUMINOUS BASE

Reserved

SECTION 306 - RECLAIMED MATERIAL FOR STABILIZED BASE

Reserved

SECTION 307 - FULL DEPTH RECYCLED PAVEMENT

307.01 Description This work shall consist of pulverizing a portion of the existing roadway structure into a homogenous mass, placing and compacting this material to the lines, grades, and dimensions shown on the plans or established by the Resident.

307.02 Pulverized Material Pulverized material shall consist of the existing bituminous pavement and, if specified, a designated portion of the underlying gravel, pulverized, and blended into a homogenous mass. Pulverized material will be processed to 100% passing a 50 mm [2 in] square mesh sieve.

307.021 New Aggregate and Additional Recycled Material New aggregate shall meet the requirements of Subsection 703.10 - Aggregate for Untreated Surface Course and Leveling Course.

Recycled material, if required, shall consist of material from the project or from off-site stockpiles that has been processed before use to 100% passing a 50 mm [2 in] 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 bituminous pavement.

307.03 Pulverizer The pulverizer shall be a self-propelled machine, specifically manufactured for cold in-place recycled type work and capable of reducing the required existing materials to a size that will pass a 50 mm [2 in] 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 Placement Equipment Placement of the Full Depth Reclamation recycled material to the required slope and grade shall be done with an approved highway grader or by another method approved by the Resident.

307.05 Rollers The Full Depth Reclamation recycled material shall be rolled with a vibratory pod/tamping foot roller with a minimum 1.4 m [54 in] diameter single drum. The drum shall have a minimum of 112 tamping feet, 75 mm [3 in] in height, and a minimum contact area per foot of 110 cm^2 [17 in^2]. Final rolling shall be accomplished by a minimum 2.15 m [84 in] width single drum vibratory soil compactor.

307.06 Pulverizing The entire depth of existing pavement shall be pulverized together with approximately 25 mm [1 in] 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 50 mm [2 in] square mesh sieve.

307.07 Weather Limitations Full Depth Reclamation work shall not be performed when weather conditions are such that proper pulverizing, spreading, or compaction of the pulverized material cannot be accomplished.

307.08 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 10 mm [⅜ inch].

307.09 Full Depth Reclamation Procedure 50 mm [2 in] square mesh sieve and then shaped and compacted to the cross-slope and grade shown on the plans, typicals, or as directed by the Resident.

Extra material will be added if required by the contract or Resident to restore cross-slope and/or profile grade before pulverizing; locations will be shown on the plans or described in the construction notes. The Resident may add or delete locations while construction of the project is in progress. All extra material, whether shown on the plans or added, will meet the requirements of Subsection 307.021 - New Aggregate and Additional Recycled Material, of this Special Provision. The Contractor will use recycled pavement to the extent it is available, in lieu of untreated aggregate surface course. The Contractor shall be responsible for re-establishing the existing profile grade as directed by the Resident.

In areas where a variable gravel course is called for or required, the contractor shall pulverize, grade, and compact the existing pavement to allow for a consistent thickness of gravel.

Density of the Full Depth Reclamation material will be determined by the Department using Nuclear Density Gauges. A 90 m [300 ft] section at the start of the pulverizing operations will be designated as the control section. The control section will be pulverized, have water added until testing indicates that optimum moisture has been obtained, and rolled as directed until the nuclear density readings show an increase in dry density of less than 16 kg/m^3 [1 lb/ft^3] for the final 4 vibratory roller passes. This density will be used as the target density for the recycled material. The remaining Full Depth Reclamation material shall be compacted to a minimum density of 98% of the target density as determined in the control section.

307.10 Method of Measurement Full Depth Reclamation will be measured by the square meter [square yard].

307.11 Basis of Payment The accepted quantity of Full Depth Reclamation will be paid for at the contract unit price per square meter [square yard], complete in-place which price will be full compensation for furnishing all equipment 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.

Payments will be made under:

Pay Item		Pay Unit
307.32	Full Depth Recycled Pavement (Untreated Maineline Travelway)	Square Meter [Square Yard]
307.33	Full Depth Recycled Pavement (Untreated Shoulder)	Square Meter [Square Yard]

SECTION 308 - FULL DEPTH RECLAMATION WITH STABILIZING ADDITIVES

Reserved

SECTION 309 - FOAMED ASPHALT

Reserved

SECTION 310 - BITUMINOUS STABILIZED BASE

Reserved

DIVISION 400 - PAVEMENTS

SECTION 401 - HOT MIX ASPHALT PAVEMENT

401.01 Description The Contractor shall furnish and place 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.

401.02 Materials Materials shall meet the requirements specified in Section 700 - Materials:

Asphalt Cement	702.01
Aggregates for HMA Pavement	703.07
HMA Mixture Composition	703.09
Mineral Filler	703.15

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 T312 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). The Contractor may use a maximum of 15% reclaimed asphalt pavement (RAP) in any base, binder, surface, or shim course. The Contractor may be allowed to use more than 15% RAP, up to a maximum of 25% RAP, in a base, binder, or shim course provided that PG 58-34 asphalt binder is used in the mixture.

The Contractor shall submit for Department approval a JMF to the Central Laboratory in Bangor for each mixture to be supplied. The Department may approve 1 active design per nominal maximum size, per traffic level, per plant, plus a 9.5mm "fine" mix @ 50 gyrations for shimming. The Department shall then have 15 calendar days in which to process a new design before approval. The JMF shall establish a single percentage of aggregate passing each required sieve size within the limits shown in Table 1. The general composition limits given in Table 1 indicate the control points of mixtures permissible under this specification. The JMF shall state the source, gradation, and percentage to be used of each portion of the aggregate and mineral filler if required. It shall also state the proposed PGAB content, the name and location of the refiner, the supplier, the source of PGAB submitted for approval, the type of PGAB modification if applicable, and the location of the terminal if applicable.

In addition, the Contractor shall provide the following information with the proposed JMF:

Properly completed JMF indicating all mix properties (Gmm, VMA, VFB, etc.)
Stockpile Gradation Summary
Design Aggregate Structure Consensus Property Summary
Design Aggregate Structure Trial Blend Gradation Plots (0.45 power chart)
Trial Blend Test Results for at least three different asphalt contents
Specific Gravity and temperature/viscosity charts for the PGAB to be used
Recommended mixing and compaction temperatures from the PGAB supplier

Material Safety Data Sheets (MSDS) For PGAB
Asphalt Content vs. Air Voids trial blend curve
Test report for Contractor's Verification sample

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 Mg [165 ton] for stone stockpiles, 75 Mg [80 ton] for sand stockpiles, and 50 Mg [55 ton] of blend sand before the Department will sample. The Department shall obtain samples for laboratory testing. 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. Before the start of paving, the Contractor and the Department shall split a production sample for evaluation. The Contractor shall test its split of the sample and determine if the results meet the requirements of the Department's written policy for mix design verification (Available at the Central Laboratory in Bangor). If the results are found to be acceptable, the Contractor will forward their results to the Department's Lab, which will test the Department's split of the sample. The results of the two split samples will be compared and shared between the Department and the Contractor. If the Department finds the mixture acceptable, an approved JMF will be forwarded to the Contractor and paving may commence. 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 within 24 hours of receipt of the first Acceptance test result. Adjustments will be allowed of up to 2% on the percent passing the 2.36 mm [No. 8] sieve through the 0.075 mm [No. 200] and 3% on the percent passing the 4.75 mm [No. 4] or larger sieves. Adjustments will be allowed on the %PGAB of up to 0.2%. Adjustments will be allowed on GMM of up to 0.010. Pay factors on in-place material shall be based on the original JMF. The revised JMF shall be used for all subsequent mix.

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 adjusted up to 5 percentage points from the amount listed on the JMF but shall not exceed the maximum allowable percentage for RAP for the specific application.

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 [1 inch]	19 [¾ inch]	12.5 [½ inch]	9.5 [⅜ inch]	4.75 [#4]		
<0.3	≤91.5	96.0	≤98.0	12.0	13.0	14.0	15.0	16.0	70-80	0.6-1.2
0.3 to <3	≤90.5								65-78	
3 to <10	≤89.0								65-75*	
10 to <30										
≥ 30										

*For 9.5 mm [⅜ in] nominal maximum aggregate size mixtures, the maximum VFB is 76.
*For 4.75 mm [#4] nominal maximum aggregate size mixtures, the maximum VFB is 80.

401.04 Temperature Requirements After the JMF is established, the temperatures of the mixture shall conform to the following tolerances:

In the truck at the mixing plant	+/-10°C [20°F]
At the Paver	+/-10°C [20°F]

The JMF and the mix subsequently produced shall meet the requirements of Tables 1 and Section 703.07. Under no circumstances will the Department accept HMA (unless the binder has been modified) that has been heated to temperatures over 179°C [340°F].

401.05 Performance Graded Asphalt Binder Unless otherwise noted in Special Provision 403 - Hot Bituminous Pavement, PGAB shall be 64-28, except that for mixtures containing greater than 15% but no more than 25% RAP the PGAB shall be PG 58-34. The PGAB shall meet the applicable requirements of AASHTO M320 - Standard Specification for PGAB. The Contractor shall provide the Department with an approved copy of the Quality Control Plan for PGAB in accordance with AASHTO R 26-01 Certifying Suppliers of PGAB.

401.06 Weather and Seasonal Limitations The State is divided into two paving zones as follows:

a. Zone 1 Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais.

b. Zone 2 Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.

The Contractor may place Hot Mix Asphalt Pavement for use other than a traveled way wearing course in either Zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer (placed in the shade at the paving location) is 4°C [40°F] or higher and the area to be paved is not frozen. The Contractor may place Hot Mix Asphalt Pavement as traveled way wearing course in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th, provided the air temperature determined as above is 10°C [50°F] or higher. For the purposes of this Section, the traveled way includes truck lanes, ramps, approach roads and auxiliary lanes.

Hot Mix Asphalt Pavement used for curb, driveways, sidewalks, islands, or other incidentals is not subject to seasonal limitations, except that conditions shall be satisfactory for proper handling and finishing of the mixture. Unless otherwise specified, the Contractor shall not place Hot Mix Asphalt Pavement on a wet or frozen surface, and the air temperature shall be 4°C [40°F] or higher.

401.07 Hot Mix Asphalt Plant

401.071 General Requirements HMA plants shall conform to AASHTO M156. The HMA plant shall include an efficient dust collecting system to prevent loss of fine material. The material collected may be returned to the mixture at a uniform rate and/or be discarded.

a. Truck Scales When the hot mix asphalt is to be weighed on scales meeting the requirements of Section 108 - Payment, the scales shall be inspected and sealed by the State Sealer as often as the Department deems necessary to verify their accuracy.

b. Performance Graded Asphalt Binder The Contractor shall provide a valve for sampling the PGAB, located in a circulating feed line connecting the storage tank with the HMA plant or in a line of the storage circulation system. The valve shall be in a readily accessible location offering protection from damage. The Contractor shall maintain this valve in a workable condition and provide a drainage receptacle.

c. Plant Scales Plant scales shall meet the following requirements:

Aggregate Scales

Minimum Graduations = (Batch Size) x 0.0025
Sensitivity = (Batch Size) x 0.00125
Accuracy = (Batch Size) x 0.005

Asphalt Scales

Minimum Graduations = (Batch Size) x 0.0005
Sensitivity = (Batch Size) x 0.00025
Accuracy = (Batch Size) x 0.001

Poises shall be designed to lock in any position to prevent unauthorized change of position.

Plant scales shall be checked prior to the start of the paving season. Subsequent check will be made as determined by the Resident. The Contractor will have at least ten 23 kg [50 lb] masses for scale testing.

401.072 Automation of Batching Batch plants shall be automated for weighing, recycling, and monitoring the system. In the case of a malfunction of the printing system, the requirements of Section 401.074 c. of this specification will apply.

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.

Tolerances are based on the total batch weight of the Hot Mix Asphalt Pavement. The batch plant shall be able to automatically or manually adjust for all desired batch sizes. The first or last bin drawn shall be the sand bin. Allowable tolerances are as follows:

Each aggregate component	+/-1.5% from the cumulative target, each bin
Last Bin Drawn	+/-1.5%
Mineral Filler	+/-0.5%
Performance Graded Asphalt Binder	+0.25%, -0.15%
Zero Return (aggregate)	+/-0.5%
Zero Return (bituminous material)	+/-0.1%

All plants shall be equipped with an approved digital recording device. 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 401.073

401.073 Automatic Ticket Printer System on Automatic HMA Plant An approved automatic ticket printer system shall be used with all approved automatic HMA 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 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 below).

c. The MDOT designation for the JMF.

Automatic HMA plants shall have the scales sealed by the State Sealer of Weights and Measures within a period of 12 months preceding the date of any weighing and after each change of location. The Contractor shall make checks on the accuracy and sensitivity of the aggregate and asphalt plant scales as specified in Section 401.074 in the presence of a representative of the Department, at intervals not exceeding 60 days.

401.074 Weight Checks on Automatic HMA Plant 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. Whenever the discrepancy in net weights is greater than 1.0%, but does not exceed 1.5%, the plant inspector will notify the producer to take corrective action; payment will still be governed by the printed ticket. The producer will be allowed a period of two days to make any needed repairs to the plant and/or platform scales so that the discrepancy in net weights between the two is less than 1.0%. 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. Effective corrective action shall be taken within two working days.

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.

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 two working days, providing total weights of each batch are recorded on weight tickets and certified by a Licensed Public Weighmaster.

401.08 Hauling Equipment Trucks for hauling Hot Mix Asphalt Pavement shall have tight, clean, and smooth metal dump bodies, which have been thinly coated with a small amount of lime solution or an approved soap solution or detergent to prevent the mixture from adhering to the bodies.

All truck dump bodies 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 loaded truck except when unloading.

All truck bodies 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 300 mm [12 in] above the bed.

401.09 Pavers Pavers shall be a Highway Class, self-contained, self-propelled unit with an activated screed (heated if necessary) capable of placing courses of Hot Mix Asphalt Pavement in full lane widths on the main line, shoulder or similar construction.

On projects with no price adjustment for smoothness, 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 3000 mm [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 9 m [30 ft], a non-contact grade control with a minimum span of 8 m [24 ft], except that a 12 m [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 401.101 - 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 necessary.

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 MDOT projects. On a daily basis, the Contractor shall perform nuclear density testing across the mat being placed, at 300 mm [12 in] intervals. If the values vary by more than 2.0% from the mean, the Contractor shall make adjustments 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 quality control violation resulting in possible monetary penalties as governed by section 106 - Quality

401.10 Rollers Rollers shall be static steel, pneumatic tire, 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 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. At least one roller shall be a 14.5 Mg [16 ton] pneumatic-tired on bridges and variable depth courses as well as the first lift of pavement over gravel, a reclaimed pavement, or other irregular surface. When required by the Resident, the roller shall be ballasted to 18.1 Mg [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.

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.

401.101 Surface Tolerances The Department will check surface tolerance with a 4.9 m [16 ft] straightedge or string line placed parallel to the centerline of pavement and with a 3 m [10 ft] straightedge or string line placed transverse to the centerline of pavement. The Contractor shall correct variations exceeding 6 mm [¼ in] by removing defective work and replacing it with new material as directed by the Department. The Contractor shall furnish a 3 m [10 ft] straightedge for the Departments use.

401.11 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.

401.12 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.

401.13 Preparation of Aggregates 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.

401.14 Mixing The Contractor shall combine the dried aggregate in the mixer in the amount of each fraction of aggregate required to meet the JMF. The Contractor shall measure the amount of PGAB and introduce it into the mixer in the amount specified by the JMF.

The Contractor shall produce the HMA at the temperature established by the JMF.

The Contractor shall dry the aggregate sufficiently so that the HMA will not flush, foam excessively, or displace excessively under the action of the rollers. The Contractor shall introduce the aggregate into the mixer at a temperature of not more than 14°C [25°F] above the temperature at which the viscosity of the PGAB being used is 0.150 Pa•s [0.1008 Lbm/sec*ft].

The Contractor shall store and introduce into the mixer the Performance Graded Asphalt Binder at a uniformly maintained temperature at which the viscosity of the PGAB is between 0.150 Pa•s [0.1008 Lbm/sec*ft] and 0.300 Pa•s [0.2016 Lbm/sec*ft]. The aggregate shall be coated completely and uniformly with a thorough distribution of the PGAB. The Contractor shall determine the wet mixing time for each plant and for each type of aggregate used.

401.15 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.

On roads opened to two-way traffic, the Contractor shall place each course over the full width of the traveled way section being paved that day, unless otherwise noted by the Department in Section 403 - Hot Bituminous Pavement.

401.16 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.

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.

401.17 Joints The Contractor shall construct wearing course transverse joints in such a manner that minimum tolerances shown in Section 401.101 - Surface Tolerances are met when measured with a straightedge.

The paver shall always maintain a uniform head of HMA during the joint construction. The HMA shall be free of segregation and meet temperature requirements. 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 Department may allow feathered or "lap" joints on lower courses or when matching existing low type pavements.

Longitudinal joints shall be constructed in a manner that will best ensure joint integrity. Methods or activities that prove detrimental to the construction of sound longitudinal joints will be discontinued.

The Contractor shall apply a coating of emulsified asphalt immediately before paving all joints to the vertical face and 75mm [3 in] 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 one 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.

401.18 Quality Control Method A & B 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 paving operations until the Department approves the QCP in writing.

Prior to placing any mix, the Department and the Contractor shall hold a Pre-paving 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 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 field and plant supervisors including the responsible onsite paving supervisor shall attend this meeting.

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 a minimum 2 day stockpile)
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 and a daily paving report
m. Silo management and details (can show storage for use on project of up to 36 hours)
n. Provisions for varying mix temperature due to extraordinary conditions
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 MDOT/ACM procedures
r. A note detailing conditions under which the percent of RAP will vary from that specified on the JMF.

The QCP shall include the following technicians together with these 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 Plant Technician or Paving Inspector 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. 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 sample, test, and evaluate Hot Mix Asphalt Pavement in accordance with the following minimum frequencies:

TABLE 2 : 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 (Surface)	1 per 125 Mg [135 ton] (As noted in QC Plan)	ASTM D2950
%TMD (Base)	1 per 250 Mg [275 ton] (As noted in QC Plan)	AASHTO T269

Fines / Effective Binder	1 per 500 Mg [550 ton]	AASHTO T 312
Gradation	1 per 500 Mg [550 ton]	AASHTO T30
PGAB content	1 per 500 Mg [550 ton]	AASHTO T164 or T308
Voids at N_{design}	1 per 500 Mg [550 ton]	AASHTO T 312
Voids in Mineral Aggregate at N_{design}	1 per 500 Mg [550 ton]	AASHTO T 312
Rice Specific Gravity	1 per 500 Mg [550 ton]	AASHTO T209
Coarse Aggregate Angularity	1 per 6000 Mg [6600 ton]	ASTM D5821
Flat and Elongated Particles	1 Per 6000 Mg [6600 ton]	ASTM D4791
Fine Aggregate Angularity	1 Per 6000 Mg [6600 ton]	AASHTO T304

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.

The Contractor shall submit all Hot Mix Asphalt Pavement plant test reports, inspection reports and updated pay factors in writing, signed by the appropriate technician and present them to the Department by 1:00 P.M. on the next working day, except when otherwise noted in the QCP due to local restrictions. 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 QA inspections of the HMA production facility. Test results of splits that do not meet the Dispute Resolution Variance Limits in Table 9 shall trigger an investigation by the MDOT Independent Assurance Unit, and may result in that lab losing NETTCP certification and the ability to request a dispute [Section 401.223 - Process for Dispute Resolution (Methods A and B 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 presented to the Department by 1:00 p.m. the next working day.

The Contractor shall have a testing lab at the plant site, equipped with all testing equipment necessary to complete the tests in Table 2. The Contractor shall locate an approved SHRP Gyratory Compactor at the plant testing lab or within 30 minutes of the plant site.

The Contractor shall fill all holes in the pavement resulting from cutting cores by the Contractor or the Department with an 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. On surface courses, cores shall not be cut except for Verification of the Nuclear Density Gauge, at a rate not to exceed 3 per day or 2 per 1000 Mg [1100 ton] placed.

The Contractor shall monitor plant production using running average of three control charts as specified in Section 106 - Quality. Control limits shall be as noted in Table 3 below.

TABLE 3: Control Limits

Property	UCL and LCL
Passing 4.75 mm [#4] and Nominal Max sieves	Target +/-4.0

Passing 2.36 mm [#8] sieve	Target +/-2.5
Passing .075 mm [#200] sieve	Target +/-1.2
PGAB Content*	Target +/-0.2
Voids in the Mineral Aggregate	JMF Target +/-0.9
% Voids at N_{design}	JMF Target +/-0.9

*Based on AASHTO T 308

The Contractor shall cease paving operations whenever one of the following occurs on a lot in progress:

a. The Pay Factor for VMA, Voids @ N_d, Percent PGAB, composite gradation, VFB, fines to effective binder or density using all Acceptance or all Quality Control tests for the current lot is less than 0.85.

b. The Coarse Aggregate Angularity or Fine Aggregate Angularity value falls below the requirements of Table 3: Aggregate Consensus Properties Criteria for the design traffic level.

c. Each of the first 2 control tests for the lot fall outside the upper or lower limits for VMA, Voids @ Nd, or Percent PGAB. This includes any case where both tests are out on the same, or different properties.

d. The Flat and Elongated Particles value exceeds 10% by ASTM D4791.

e. There is any visible damage to the aggregate due to over-densification other than on variable depth shim courses.

f. The Contractor fails to follow the approved QCP.

g. The Contractors control chart shows the process to be out of control on any property listed in Table 3: Control Limits.

Paving operations shall not resume until the Contactor and the Department determines that material meeting the Contract requirements will be produced. The Department will consider corrective action acceptable if the pay factor for the failing property increases, based on samples already in transit, or a verification sample is tested and the property falls within the upper and lower specification limits.

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.

401.19 Quality Control Method C For Items covered under Method C, 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. All mix designs (JMF) shall be approved and verified by

MDOT prior to use. Certified QC personnel shall not be required. The Contractor shall certify the mix and the test results for each item by a Certificate of Compliance.

401.20 Acceptance

401.201 Method A This method 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 sublot on a statistically random basis, test, and evaluate in accordance with the following Acceptance Criteria:

TABLE 4: ACCEPTANCE CRITERIA

PROPERTIES	POINT OF SAMPLING	LOT SIZE	SUBLOT SIZE	TEST METHOD
Gradation	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T30
PGAB Content	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T308
%TMD (Surface)	Mat behind all Rollers	JMF*	250 Mg ** [275 ton]	AASHTO T269
%TMD (Base or Binder)	Mat behind all Rollers	JMF*	500 Mg ** [550 ton]	AASHTO T269
Air Voids at N_d	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T 312
%VMA at N_d	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T 312
Fines to Effective Binder	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T 312
%VFB	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T 312

* Not to exceed 6,000 Mg [6,600 ton], unless an unplanned overrun less than 3,000 Mg [3,300 ton], or agreed to at the Pre-Construction Conference.

** Minimum of five tests are required (a minimum of three tests required for a terminated LOT).

On the first day of production in the current calendar year, or the first day of production of a new JMF the Department will take three random samples, which will be used to calculate the quality level of the in-place material in the event the lot is terminated prematurely. Only one of the three will be tested, the other two will be held onsite until at least three random samples have been taken, at which time the other two will be discarded.

a. Lot Size For purposes of evaluating all acceptance test properties, a lot shall consist of the total quantity represented by each item listed under the lot size heading in the table above. Each lot will be divided into a minimum of four sublots for mix properties and five sublots for percent TMD.

In the event that the Department decides to terminate a lot prematurely, the samples from the first days production will be used to calculate a volumetric pay factor, and a minimum of three cores will be used for a density pay factor, if applicable, for quantities placed to date.

b. Sublot size The quantity represented by each sample will constitute a sublot. The size of each sublot shall be as listed under the sublot size heading in the table above. If there is insufficient quantity in a lot to make up at least four sublots, then the lot quantity will be divided into four equal sublots for mix properties and five sublots for percent TMD.

If there is less than one-half of a sublot remaining at the end, then it shall be combined with the previous sublot. If there is more than one-half sublot remaining at the end, then it shall constitute the last sublot 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.

c. Acceptance Testing The Department will obtain samples of Hot Mix Asphalt Pavement in conformance with AASHTO T168 Sampling Bituminous Paving Mixtures, and the MDOT/ ACM Sampling Policy, which will then be transported by the Contractor to the designated MDOT Laboratory, as directed by MDOT in approved transport containers to be provided by the Department, unless otherwise directed by the Resident. The Department will take the sample randomly within each sublot. Target values shall be as specified in the JMF. The Department will use Table 5 for calculating pay factors for gradation, PGAB Content, Air Voids at N_{design}, VMA, Fines to Effective Binder and VFB. 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.

d. 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 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, 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 50 m [150 ft].

TABLE 5: METHOD A ACCEPTANCE LIMITS

Property	USL and LSL
Passing 4.75 mm [No. 4] and larger sieves	Target +/-7%
Passing 2.36 mm [No. 8] to 1.18 mm [No. 16] sieves	Target +/-4%
Passing 0.60 mm [No. 30]	Target +/-3%
Passing 0.30 mm [No. 50] to 0.075 mm [No. 200] sieve	Target +/-2%
PGAB Content	Target +/-0.4%
Air Voids	4.0% +/-1.5%
Fines to Effective Binder	0.6 to 1.2
Voids in the Mineral Aggregate	LSL Only from Table 1
Voids Filled with Binder	Table 1 values plus a 4% production tolerance for USL only

e. Pavement Density The Department will measure pavement density using core samples tested according to AASHTO T-166. The Department will randomly determine core locations. The Contractor shall cut 150 mm [6 in] diameter cores at no additional cost to the Department by the end of the working day following the day the pavement is placed, and immediately give them to the Department. The cores will be placed in a transport container provided by the Department and transported by the Contractor to the designated MDOT Lab as directed by the Department. Pre-testing of the cores will not be allowed. At the time of sampling, the Contractor and the Department shall mutually determine if a core is damaged. If it is determined that the core(s) is damaged, the Contractor shall cut new

core(s) at the same offset and within 1 m [3 ft] of the initial sample. At the time the core is cut, the Contractor and the Department will mutually determine if saw cutting of the core is needed, and will mark the core at the point where sawing is needed. The core may be saw cut by the Contractor in the Department's presence onsite, or in an MDOT Lab by The Department, without disturbing the layer being tested to remove lower layers of Hot Mix Asphalt Pavement, gravel, or RAP. 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.

TABLE 6: METHOD A DENSITY ACCEPTANCE LIMITS
75 Gyration or more Design

	TARGET	LSL	USL
Percent of Maximum Theoretical Density	95.0	92.5	97.5

50 Gyration Design

	TARGET	LSL	USL
Percent of Maximum Theoretical Density	95.5	93.0	98.0

Cores for acceptance testing shall be cut such that the nearest edge is never within 0.225 m [9 in] of any joint.

There shall be no bonus for density on shoulders unless otherwise noted in Section 403 - Hot Bituminous 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.

401.202 Method B Note: Paragraphs c., d., and e. from Section 401.201 - Method A, also apply to Method B, except that Table 5: Method A Acceptance Limits is replaced by Table 7: Method B and C Acceptance Limits and the results will not be examined for outliers.

This method utilizes Quality Level Analysis and pay factor specifications. Aggregates and mix shall meet the gradation ranges and Volumetric Properties in Table 7: Method B and C Acceptance Limits, utilizing the testing methods and sampling procedures in Table 4: Acceptance Criteria.

Density testing: Unless waived in Section 403 - Hot Bituminous Pavement, density shall be tested by cutting three 150 mm [6 in] diameter cores at random locations. The cores will be tested and statistically evaluated for pay factors as described in Section 106.7 - Quality Level Analysis, using the density requirements listed in Table 7: Method B and C Acceptance Limits. The Department will pay the Contractor the price calculated as described in Section 401.22 - Basis of Payment.

PGAB Content, Gradation, and Volumetric properties testing: Unless waived in Section 403 - Hot Bituminous Pavement, the Department shall take three random samples. The samples will be tested and statistically evaluated for pay factors as described in Section 106.7 - Quality Level Analysis, using the specification limits shown in Table 7: Method B and C Acceptance Limits. The Department will pay the Contractor the price calculated as described in Section 401.22 - Basis of Payment.

TABLE 7: METHOD B AND C ACCEPTANCE LIMITS

Property	USL and LSL	
	Method B	Method C
Percent Passing 4.75 mm [No. 4] and larger sieves	Target +/-7	Target +/-7
Percent Passing 2.36 mm [No. 8] to 1.18 mm [No. 16] sieves	Target +/-5	Target +/-5
Percent Passing 0.60 mm [No. 30]	Target +/-4	Target +/-4
Percent Passing 0.30 mm [No. 50] to 0.075 mm [No. 200] sieve	Target +/-3	Target +/-3
PGAB Content	Target +/-0.5	Target +/-0.5
Air Voids	4.0% +/-2.0	Not Applicable
Fines to Effective Binder	0.6 to 1.4	Not Applicable
Voids in the Mineral Aggregate	LSL from Table 2	Not Applicable
Voids Filled with Binder	Table 1 plus a 4% production tolerance for USL.	Not Applicable
In-place Density	92.0 to 98.0	92.0 Minimum

401.203 Method C Note: Paragraphs c., d., and e. from Section 401.201 - Method A, also apply to Method C, except that Table 5: Method A Acceptance Limits is replaced by Table 7: Method B and C Acceptance Limits and the results will not be examined for outliers.

For hot mix asphalt items designated as Method C in Section 403 - Hot Bituminous Pavement, one sample will be taken from the paver hopper or the truck body per 250 Mg [275 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 7: Method B and C Acceptance Limits, Method C the Department will pay the contract unit price. If the test results for each 250 Mg [275 ton] increment are outside these limits, the following deductions (Table 7b) shall apply to the HMA quantity represented by the test. A second consecutive failing test shall result in cessation of production.

TABLE 7b

PGAB Content	-5%
2.36 mm [#8] sieve	-2%
0.30 mm [#50] sieve	-1%
0.075 mm [#200] sieve	-2%
Density	-10%*

*Only applies when called for in Section 403 - Hot Bituminous Pavement. Contractor shall cut two 150 mm [6 in] cores, which shall be tested for percent TMD per AASHTO T-269. If the average for the two tests falls below 92.0% the disincentive shall apply.

401.21 Method of Measurement The Department will measure Hot Mix Asphalt Pavement by the Mg [megagram] in accordance with Section 108.1 - Measurement of Quantities for Payment.

401.22 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 401.11, 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.

When work is to be accepted under Method A provisions, the Department will make a pay adjustment for quality above (or below) the minimum acceptable level, as specified below.

When work is to be accepted under Method B provisions, the Department will make a pay adjustment for quality below the minimum acceptable level, as specified below. When work is to be accepted under Method C provisions, the Department will make a pay adjustment for quality below the minimum acceptable level, as specified on Table 7b.

The maximum composite pay factor for mixes evaluated under Method B or C testing shall be 1.00. If price adjustments apply to both Density and Volumetric Properties, they shall be cumulative and they shall be based upon the original Contract unit price.

401.221 Price Adjustment for the Quality of Hot Bituminous Pavement (Methods A & B) 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.

401.222 Pay Factor (PF) (Methods A and B) The Department will use density, Performance Graded Asphalt Binder content, voids @N_d, VMA, VFB, F/B^e, and the screen sizes listed in Table 8 for the type of HMA represented in the JMF. The Department will evaluate materials using the following price adjustment factors under Section 106.7 - Quality Level Analysis.

The Department will apply price adjustments to the appropriate Hot Mix Asphalt Pavement pay items. Price adjustments shall be applied based on test results for each lot. If any pay factor for any single property (or composite gradation) falls below 0.85, the Contractor shall shut down the HMA plant. If any single pay factor for PGAB Content, VMA, or Air Voids falls

below 0.80 for Method A or 0.83 for Method B, the composite pay factor for PGAB Content, VMA, and Air Voids shall be 0.55 for Method A or 0.70 for Method B.

If the pay factor for Density falls below 0.80 for Method A or 0.83 for Method B, all of the cores will be randomly recut 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 below 0.83 for Method B, the entire Lot shall be removed and replaced with material meeting the specifications at no additional cost to the Department. Pay factors equal to or greater than the reject level will be paid accordingly.

TABLE 8: TABLE OF GRADATION COMPOSITE "F" FACTORS
(Methods A and B)

Constituent		"f" Factor			
		19 mm [¾ inch]	12.5 mm [½ inch]	9.5 mm [⅜ inch]	4.75 mm [#4]
Gradation	25 mm [1 inch]	-	-	-	-
	19 mm [¾ inch]	4	-	-	-
	12.5 mm [½ inch]		4	4	-
	9.50 mm [⅜ inch]				4
	2.36 mm [No. 8]	6	6	6	8
	1.18 mm [No. 16]				
	0.60 mm [No. 30]	2	2	2	2
	0.30 mm [No. 50]	2	2	2	2
	0.075 mm [No. 200]	6	6	6	8

For each lot of material, the Department will determine a price adjustment as follows:

Gradation The Department will determine a composite pay factor (CPF) using applicable price adjustment factors “f“ from Table 8: Table of Gradation Composite “F” Factors, and acceptance limits from Table 5: Method A Acceptance Limits, for Method A or Table 7: Method B and C Acceptance Limits, for Method B. The Department will not make price adjustments for gradations, but will monitor them as shutdown criteria.

VFB and Fines to Effective Binder The Department will determine a pay factor (PF) using acceptance limits from Table 5: Method A Acceptance Limits, for Method A or Table 7: Method B and C Acceptance Limits, for Method B. The Department will not make price adjustments for VFB or Fines to Effective Binder, but will monitor them as shutdown criteria.

Density For mixes having a density requirement, the Department will determine a pay factor using acceptance limits from Table 6: Method A Density Acceptance Limits, for Method A or Table 7: Method B and C Acceptance Limits, for Method B. The Department will calculate the price adjustment for density as follows:

$$PA = (\text{density PF} - 1.0)(Q)(P)x0.50$$

Where

PA = Price Adjustment
Q = Quantity represented by PF in Mg [ton]

P = Contract price per Mg [ton]
PF = Pay Factor

The maximum pay factor for Density shall be 1.025.

PGAB Content, VMA and Air Voids For mixes having a Volumetric Properties requirement, the Department will determine a pay factor using acceptance limits from Table 5: Method A Acceptance Limits, for Method A or Table 7: Method B and C Acceptance Limits, for Method B. The Department will calculate the price adjustment for Volumetric Properties as follows:

PA = (voids @ N_d PF- 1.0)(Q)(P)x0.20 + (VMA @ N_d PF- 1.0)(Q)(P)x0.20 + (PGAB PF- 1.0)(Q)(P)x0.10,

Where

PA = Price Adjustment
Q = Quantity represented by PF in Mg [ton]
P = Contract price per Mg [ton]
PF = Pay Factor

The maximum Composite Pay Factor for mixes having only a Volumetric requirement shall be 1.025.

401.223 Process for Dispute Resolution (Methods A & B only)

a. Dispute Resolution sampling 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 may 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 Department's dispute resolution split sample will be properly labeled and stored for a period of not more than two weeks, or until the sample is tested.

b. Disputing Acceptance results The Contractor may dispute the Department's Acceptance results and request (Method A or Method B) that the dispute resolution split sample be tested by notifying the Department's Resident and the QA Engineer at the Central Laboratory in Bangor in writing within two working days after receiving the results of the Acceptance test. 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 MDOT) of their split of the Acceptance sample indicating that the variances in Table 9: Dispute Resolution Variance Limits, for the specific test result(s) or property(ies) were exceeded.

c. Disputable items The Contractor may dispute any or all of the following test results when the difference between the Department's value and the Contractor's value for that test equals or exceeds the corresponding allowable variation in Table 9: Dispute Resolution Variance Limits, PGAB content, G_{mb}, and G_{mm}. In addition, if the allowable variation for these tests is not met or exceeded, the Contractor may dispute either or both of the following material properties provided the difference between results for them equals or exceeds the corresponding allowable variation in Table 9: Voids at N_{design}, and VMA.

d. Outcome 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. 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.

TABLE 9: DISPUTE RESOLUTION VARIANCE LIMITS

PGAB Content	+/-0.4%
G_{mb}	+/-0.030
G_{mm}	+/-0.020
Voids @ N_d	+/-0.8%
VMA	+/-0.8%

SECTION 402 - PAVEMENT SMOOTHNESS

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 meters/kilometer (inches/mile).

402.02 Lot Size Lot size for smoothness will be 1000 lane-meters [3000 lane-feet]. A sublot will consist of 20 lane-meters [50 lane-feet]. Partial lots will be included in the previous lot if less than one-half the size of a normal lot. If 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 60 meters (200 ft) of bridge joints)
Acceleration and deceleration lanes
Shoulders and ramps
Side streets and roads
Within 60 m [200 ft] of transverse joints at the beginning and end of the project
Within 60 m [200 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.

ACCEPTANCE LIMITS

Roadway Type	USL
Interstate Highways	1.25 m/km (79.15 in/mile)
Other Highways	1.40 m/km (88.65 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 0.75, 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 401.111 Surface Tolerances.

Payment will be made under:

Pay Item	Pay Unit
402.10 Incentive/Disincentive - Pavement Smoothness	Lump Sum

SECTION 403 - HOT BITUMINOUS PAVEMENT

403.01 Description This work shall consist of constructing one or more courses of bituminous 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 bituminous pavement shall be composed of a mixture of aggregate, filler if required, and bituminous 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.

In addition, hot bituminous pavement placed on bridges shall also conform to the following requirements.

a. The mixture shall be placed in courses as specified in the Special Provisions.

b. The bottom course shall be placed with an approved rubber mounted bituminous paver of such type and operated in such a manner that the membrane waterproofing will not be damaged in any way.

c. The top course shall not be placed until the bottom course has cooled sufficiently to provide stability.

d. The Contractor will not be required to cut sample cores from the compacted pavement on the bridge deck.

e. After the top course has been placed, the shoulder areas shall be sealed 1 m [3 ft] wide with two applications of an emulsified bituminous sealer meeting the requirements of 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.

f. The furnishing and applying of the required quantity of sealer for the bridge shoulder areas shall be incidental to placing the hot bituminous pavement.

g. The atmospheric temperature for all courses on bridge decks shall be 10°C [50°F] or higher.

403.04 Method of Measurement Hot bituminous pavement will be measured as specified in Section 401.21- Method of Measurement.

403.05 Basis of Payment The accepted quantities of hot bituminous pavement will be paid for at the contract unit price per megagram [ton] for the bituminous mixtures, including bituminous material complete in place.

Method A, Method B, and Method C shall be used for acceptance as specified in Section 401 - Hot Mix Asphalt Pavements. (See Complementary Notes, Section 403 - Hot Bituminous Pavement, for Method location).

Payment will be made under:

Pay Item		Pay Unit
403.102	Hot Mix Asphalt Pavement for Special Areas	Megagram [Ton]
403.206	Hot Mix Asphalt, 25 mm Nominal Maximum Size	Megagram [Ton]
403.207	Hot Mix Asphalt, 19.0 mm Nominal Maximum Size	Megagram [Ton]
403.208	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size, Surface	Megagram [Ton]
403.209	Hot Mix Asphalt, 9.5 mm Nominal Maximum Size (sidewalks, drives, islands & incidentals)	Megagram [Ton]
403.210	Hot Mix Asphalt, 9.5 mm Nominal Maximum Size	Megagram [Ton]
403.211	Hot Mix Asphalt (shimming)	Megagram [Ton]
403.212	Hot Mix Asphalt, 4.75 mm Nominal Maximum Size	Megagram [Ton]
403.213	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size, Base	Megagram [Ton]

SECTION 404 - 408 VACANT

SECTION 409 - BITUMINOUS TACK COAT

409.01 Description This work consists of furnishing and applying one 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 Limitation Bituminous material shall not be applied on a wet surface, after sunset or before sunrise, or when the atmospheric temperature is below 10°C [50°F] in a shaded area at the job site, or when weather conditions are otherwise unfavorable to proper construction procedures.

409.05 Equipment The Contractor shall provide necessary equipment to properly apply the bituminous material.

The distributor 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 4.5 m [15 ft] at readily determined and controlled rates from 0.05 to 2.0 L/m² [0.01 to 0.5 gal/yd²], with uniform pressure and with an allowable variation from any specified rate not to exceed 0.05 L/m² [0.01 gal/yd²]. Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices, or a calibrated tank and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically. Approved fog type nozzles will be required.

All liquid and cement bituminous material bulk delivery vehicles and 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 liter [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 liter [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 liter [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.

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 10 mm [⅜ in] above or 10 mm [⅜ 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 meter [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 108.1.3 f.

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 meters [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 300 m^3 [400 yd^3] per contract.

Aggregate for crushed stone, surface will be measured by the Mg [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 meter [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 meter [cubic Yard]
411.10	Untreated Aggregate Surface Course, Truck Measure	cubic meter [cubic Yard]
411.12	Crushed Stone Surface	Megagram [Ton]

SECTIONS 412 - 418 VACANT

SECTION 419 - SAWING AND SEALING JOINTS IN BITUMINOUS PAVEMENT

Reserved

SECTION 420 - PORTLAND CEMENT CONCRETE PAVEMENT

Reserved

SECTIONS 421 THROUGH 423 - VACANT

SECTION 424 - CRACK SEAL

Reserved

SECTION 425 - RECYCLED BITUMINOUS PAVEMENT

Reserved

SECTIONS 426 THROUGH 459 - VACANT

SECTION 460 - HOT BITUMINOUS PAVEMENT FOR SPECIAL AREAS

Reserved

SECTION 461 - VACANT

SECTION 462 - MICROSURFACING

Reserved

SECTION 501 - FOUNDATION PILES

501.01 Description This work shall consist of furnishing and driving piles and casings, of the types and dimensions specified on the contract plans, to the required ultimate capacity. Piles shall conform to and be installed, as detailed in these specifications, in reasonably close conformity to the lines, grades, and locations 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 Division 700 - Materials:

Steel Pipe Piles	711.01
H-Beam Pile Tips	711.10
Structural Steel	713.01

H-beam piles shall be structural steel and shall meet the requirements of AASHTO M183/ 183M (ASTM A36/A36M). Mill test reports will be required. Notch toughness tests will not be required.

Concrete for Steel Pipe Piles and Steel Casings shall be Class S and shall meet the requirements of Section 502 - Structural Concrete.

Steel casings shall conform to the material requirements of Section 711.01 - Steel Pipe Piles.

Reinforcing steel for Steel Pipe Piles and Steel Casings when called for, shall meet the requirements of Section 503 - Reinforcing Steel.

501.021 Ordering Piles The Contractor shall order all pilings from an itemized list of order lengths provided by the Resident. When extensions of piles are necessary, the extension lengths will be ordered by the Contractor from a written list provided by the Resident.

501.03 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 900 and 1600 kg [2,000 and 3,500 lb] and the height of drop shall not exceed 5 m [15 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 insure concentric impact on the drive head.

With the written approval of the Resident, installation of non-displacement piles may be initiated with the use of 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 bearing capacity primarily from friction with the surrounding soils through the pile length. All piles initially driven using a vibratory hammer shall be driven to the required capacity in accordance with the approved refusal criteria using a power hammer.

The plant and equipment furnished for steam and air power 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 1/3 the weight of drive head and pile being driven.

Open-end (single acting) diesel power 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. In addition, 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 power 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. Also, 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 power hammers 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. The Contractor shall provide these refusal criteria to the Resident for approval. Refusal criteria shall be generated using the Wave Equation, if specified, and dynamic test results. 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 furnished by the Contractor shall be approved by the Resident prior to use. All pile driving equipment shall be sized such that the specified piles can be driven to the required ultimate capacity, without damage, as indicated on the plans. Approval of the pile driving equipment by the Resident will be based on the wave equation analysis unless The Alternate Approval Method, as described herein, is designated on the plans.

The Contractor shall submit to the Resident the necessary pile driving equipment information at least 14 days prior to driving piles. The Resident will respond in writing as to the adequacy of the Contractor's driving equipment proposal.

The Contractor will be notified of the acceptance or rejection of the driving system within 7 calendar days of the Resident's receipt of the Pile and Driving Equipment Data Form, available in Design and Construction of Driven Pile Foundations, FHWA-HI-97-013, Dec. 1996, page 12-11.

If the wave equation analyses show that the driving system is unacceptable, the Contractor shall modify or replace the proposed equipment, at its expense, until subsequent wave equation analyses indicate the piles can be driven to the desired ultimate capacity, without damage. The Resident will notify the Contractor of the acceptance or rejection of the revised driving system within 7 calendar days of receipt of a revised Pile and Driving Equipment Data Form.

The criteria that the Resident will use to evaluate the driving equipment from the wave equation results consists of both the required number of hammer blows per 25 mm [blows per in] at the required ultimate pile capacity and the pile stresses during driving. The required number of hammer blows indicated by the wave equation at the ultimate pile resistance shall be between 3 and 15 blows per 25 mm [3 and 15 blows per in] for the driving equipment to be acceptable. The wave equation analysis shall include a stopping criterion, where the number of blows per 25 mm [blows per in], for a number of 25 mm [1 in] intervals, is clearly defined. Stopping criteria shall be approved by the Resident.

In addition, for the driving equipment to be acceptable, the pile stresses indicated by the wave equation shall not exceed the values where pile damage is impending. The point of impending damage in steel piles is defined as a compressive driving stress of 90% of the specified yield stress of the pile material. For timber piles, the compressive driving stress shall not exceed three times the allowable working stress shown on the plans.

The Alternate Approval Method of driving will be used when specified on the plans. The Alternate Approval Method requires that the energy of the driving equipment submitted for approval on the Pile and Driving Equipment Data Form, be rated by the manufacturer at or above the appropriate minimum energy level in Table 1 corresponding to the ultimate pile capacity shown on the plans.

TABLE 1 ALTERNATE APPROVAL METHOD
Minimum Pile Hammer Requirements

Ultimate Pile Capacity		Minimum Manufacturer's Rated Hammer Energy	
(kN)	(Kips)	(kNm)	(Foot-pounds)
800 and under	(180 and under)	12.2	(9,000)
801 to 1334	(181 to 300)	20.3	(15,000)
1335 to 1868	(301 to 420)	27.1	(20,000)
1869 to 2400	(421 to 540)	32.5	(24,000)
2401 to 2669	(541 to 600)	35.3	(26,000)
2670 and over	(600 and over)		Wave Equation Required

During pile driving operations, the Contractor shall use the approved system. No variations in the driving system will be permitted without the Resident's written approval.

Any change in the driving system will be considered only after the Contractor has submitted a revised equipment data form. The Contractor will be notified of the acceptance or rejection of the driving system changes within 7 calendar days of the Resident's receipt of the requested change. The time required for submission, review, and approval of a revised driving system shall not constitute the basis for a contract time extension to the Contractor.

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 and to insure proper support of the pile during driving.

Followers Followers shall only be used when approved in writing by the Resident, or when specifically stated in the contract documents. 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 desired pile capacity. 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 reduction of hammer cushion thickness exceeding 25% 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 pro-vided in accordance with the manufacturer's recommendations so that the piles may be driven without damage.

501.04 Driving Procedures and Tolerances The sequence of driving piles in any unit shall be subject to the approval of the Resident. 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. 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 capacity of the pile shall not be taken until at least 300 mm [12 in] 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 relive 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 Contractors expense when the Resident determines that the damage impairs the strength of the pile.

The compressive stresses in steel piles during driving shall not exceed 90% if the yield stress, determined by Wave equation Analysis or Dynamic Pile Analyzer.

Jetting Jetting shall be done only with the permission of the Resident and must be addressed in the Contractor's 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 690 kPa [100 psi] pressure at two 19 mm [¾ in] 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 permitted, piles initially driven using a vibratory hammer shall be driven to the required capacity in accordance with the approved refusal criteria using a power hammer. When permitted, such equipment shall be used to installing production piles only after the pile tip elevation of the ultimate pile capacity is established by load testing and/or piles driven with an impact hammer. Vibratory hammers may be used to initially set a pile to a maximum distance of 6.1 m [20 ft] from the expected tip elevation, at which point a power hammer shall be employed. If the pile penetration rate is 300 mm [12 in] or less per minute, the use of a vibratory hammer should 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 leaders. The ultimate capacity of piles driven with

vibratory hammers shall be based on the driving resistance recorded during impact driving after the vibratory equipment has been removed. Vibrated piles not attaining the ultimate pile capacity at the ordered length shall be spliced, as required, at the Contractors cost, and driven with an impact hammer until the ultimate pile capacity is achieved as indicated by the appropriate criteria in Section 501.07. When the ultimate pile capacity is attained, the remaining piles shall be installed to similar depth with similar vibratory hammer power consumption and rate of penetration as the first pile.

Preaugering When necessary to obtain the specified pile penetration and when authorized by the Resident, the Contractor shall furnish the necessary drilling apparatus and drill holes, not greater that the least dimension of the pile top, to the proper depth and drive the piles therein. When specified in the contract documents, the Contractor shall prebore holes at pile locations and to the depths shown on the plans. Preaugered holes shall be of a size smaller than the diameter of diagonal of the pile cross section. If subsurface obstructions, such as boulders or rock layers are encountered, the hole diameter may be increase 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 used of spuds, which are driven and removed to make a hole for inserting a pile, shall not be permitted in lieu of preboring.

Concrete shall not be placed in pipe piles until pile driving has progressed beyond a radius of 5 m [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 as is satisfactory to the Resident.

Heaved Piles Piles that have heaved more than 5 mm [¼ in] during the driving of other piles in a group shall be reseated 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. Piles shall be driven with a variation of not more than 20 mm/m [¼ in/ft] 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 1.5 m [5 ft] of pile, or after installation is completed provided the exposed portion of the piles is not less than 1.5 m [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 shall not be out of position by more than 50 mm [2 in] from the dimensions shown on the plans. The cutoff elevation of piles, other than for trestle bents, shall not be out of position by more than 150 mm [6 in]. Actual embedment of the piles in the concrete shall be within 150 mm [6 in] 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 100 mm [4 in] from any edge of the

cap. Any increase in size of the pile cap to meet this edge distance requirement shall be at the Contractor's expense.

501.05 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 form the cleaning operation shall be covered in the Contractor's SEWPCP.

Pipe piles shall be inspected and approved by the Resident immediately before concrete is placed. 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 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 8 m [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.

Steel casings shall be driven over H-beam piles through steel templates located inside the casings. A reinforcing steel cage, when specified, shall be placed inside the casings with a minimum of 50 mm [2 in] coverage and the casings shall be filled with concrete to the elevation shown on the plans.

Full-length 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 casings shall be spliced by full penetration butt joint welds.

b. When the casings are to be spliced while in a vertical position the welds shall be single-bevel groove welds with the use of back-up rings. When the casings are to be spliced while in a horizontal position, the welds shall be single-vee groove welds with the use of back-up rings.

c. Welded joints shall conform to the Standard Details. Welding, including welder qualifications, shall comply with the requirements of AWS D1.1, Structural Welding Code - Steel.

501.06 Defective Piles and Corrective Measures The procedure incident to the driving of piles shall not subject the piles to excessive and undue abuse causing deformation. 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.

501.07 Driven Pile Capacity, 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 ultimate bearing capacity.

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.

In the case of Steel Pipe Piles, no load shall be placed on the pile for at least 7 days after the concrete has been placed in the shell.

Static loading testing shall be conducted under the direction of the Resident, but the Contractor shall furnish all labor and equipment.

A dynamic load test consists of mounting instruments on the pile and accurately recording the output during driving using Pile Dynamic Analysis (PDA) equipment.

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 300 mm [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 ultimate capacity as shown by the wave equation blows per 25 mm [blows/in] and the defined stopping criteria. The pile acceptance will be based on the ultimate pile capacity as determined by the wave equation analysis and the results of any dynamic or static pile tests, unless otherwise designated on the plans. When the Alternate Approval Method is specified on the plans, piles shall be driven to practical refusal of 10 blows per 25 mm [10 blows/in], or as approved by the Resident. Adequate pile penetration shall be considered to be obtained when the specified wave equation resistance criteria is achieved within 1.5 m [5 ft] of the pile toe elevation, based on ordered length. Piles not achieving the specified ultimate 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 ultimate pile capacity or 9000 kN [2023 kips], whichever is less, and that a load cell and a spherical bearing plate shall be used. The Contractor shall submit to the Resident for approval, 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 of a pile tested under axial compressive load is that load which produces a settlement at failure of the pile head equal to:

METRIC UNITS

For piles less than or equal to 610 mm in diameter or width:

$S_f = S + (4.0 + 0.008D)$

Where:

S_f = Settlement at failure in millimeters
D = Pile diameter or width in millimeters
S = Elastic deformation of total unsupported pile length in millimeters.

For piles greater than 610 mm in diameter or width:

$S_f = S + D/30$

US CUSTOMARY UNITS

For piles less than or equal to 24 inches in diameter or width:

$S_f = S + (0.16 + 0.008D)$

Where:

S_f = Settlement at failure in inches
D = Pile diameter or width in inches
S = Elastic deformation of total unsupported pile length in inches.

For piles greater than 24 inches in diameter or width:

$S_f = S + D/30$

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 5 mm [¼ in] 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 a dynamic load test is specified in the contract documents, dynamic measurements will be taken by the Contractor using procedures set forth in ASTM D-4945 during the driving of piles designated by the Resident as dynamic load test piles. The dynamic tests are to be made by the Contractor's Engineer who shall be a licensed Professional Engineer. The same Contractor's Engineer conducting the wave equation analysis shall perform the dynamic load tests. Each test shall also include a CAPWAP analysis in order to closely model actual field conditions the Contractor's Engineer shall be

experienced in the used of the Pile Dynamic Analysis (PDA) 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. Predriving 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 engineer with reasonable means of access to the pile for attaching instrument after the pile is place 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 ultimate pile capacity, as called for on the plans, has been achieved, unless 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 in Section 501.04. 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.

When directed to retap by the Resident, the Contractor shall wait up to 24 hours and, after the instruments are reattached, retap (redrive) the dynamic load test pile. A cold hammer shall not be used for the redrive. The hammer shall be warmed up before redrive begins by applying at least 20 blows to another pile. The maximum amount of penetration required during redrive shall be 150 mm [6 in] or the maximum total number of hammer blows required will be 50, whichever occurs first. After retapping, the Resident will either provide the cutoff elevation or specify additional pile penetration and testing. The Contractor shall supply the Resident with a report of the test results of each dynamically tested pile and a CAPWAP analysis within ten days of the completion of testing.

Ultimate Pile Capacity 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 ultimate pile capacity. The ultimate pile capacity shall be determined by the Engineer based on one of the methods listed in Section 501.07. The ultimate capacity of piles driven with vibratory hammers shall be based on the criteria in Section 501.04

501.08 Test Piles (Indicator Piles) When required, test piles shall be driven as shown on the plans at the locations and to the lengths specified by the Resident. This work shall be accomplished before pile driving is allowed to commence. All test piles shall be driven with power hammers unless specifically stated otherwise in the plans. In general, the specified length of test piles will be greater than the estimated length of production piles in order to provide for variation in soil conditions. The driving equipment used for driving test piles shall be identical to that which the Contractor proposed to use on the production piling. Driving equipment shall conform to the requirements of Section 501.03. The Contractor shall bring the ground at each test pile to the elevation of the bottom of the footing before the pile is driven.

Test piles shall be driven to the driving resistance corresponding to ultimate capacity, as determined with the wave equation by the Resident, at the estimated tip elevation. Test piles that do not attain the hammer blow count specified above at a depth of 300 mm [1 ft] below the estimated tip elevation shown on the plans shall be allowed to "set up" for 24 hours, before being redriven. A cold hammer shall not be used for redrive. The hammer shall be warmed up before driving begins by applying at least 20 blows to another pile. If the specified hammer blow count is not attained on redriving, the Resident may direct the Contractor to drive a portion or all of the remaining test pile length and repeat the "set up" redrive procedure. If the specified hammer blow count is not attained on redriving and the full length of the pile had been driven, the Contractor shall splice and drive additional pile as directed by the Resident.

501.09 Splicing Piles Full-length piles shall always be used wherever practicable. When splices are unavoidable for piles, their number, locations and details shall be subject to approval of the Resident. If full-length piles cannot be used, piles shall not be spliced unless approved by the Resident. Piles fabricated from multiple pieces will be acceptable only if they comply with the following:

Piles lengths up to and including 6 m [20 ft] long - no splices allowed.
Piles lengths over 6 m up to and including 12 m [20 ft to 35 ft] - 1 splice, maximum, per pile.
Piles lengths over 12 m up to and including 24 m [35 ft to 79 ft] - 2 splices, maximum.
For pile lengths exceeding 24 m [79 ft], one splice per 12 meters [40 ft] will be permitted.
Sections less than 3 m [10 feet] in length will not be spliced except as a final (top) section of the pile.

When pre-planned splicing is permitted, 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 authorized, piles shall be spliced as follows:

a. Damaged material shall be removed from the end of the driven pile. The ends of both sections to be spliced shall be cut off square with the longitudinal axis of the pile and scarifed as required. All cutting shall be done with the use of a mechanical guide and no free hand cutting will be allowed except for minor trimming.

b. A full penetration butt weld shall be used for the entire cross section of the pile.

c. All welding shall comply with the requirements of Section 504 - Structural Steel, except as modified hereinafter.

   1. No run-off tabs will be required for flange butt welds on H-beam Piles.
   2. No welding shall be done when the temperature in the immediate vicinity of the weld is below -20°C [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.
   3. The pile shall be preheated to and maintained at 65°C [150°F] minimum within 150 mm [6 in] from the weld while welding.
   4. The maximum electrode size shall be 4.76 mm [$^{3}/_{16}$ in].
   5. Formal welding procedures need not be submitted.

d. Welders shall be prequalified in accordance with Section 504 - Structural Steel.

e. The Contractor may use mechanical splices, if approved by the Resident, and if the splice can transfer the full pile strength in bending, compression, and tension. Any alternate splices, so authorized, shall be capable of developing the full bending strength of the pile on both the x-x and y-y axis. If an H-pile splice incorporates a prefabricated pile splicer, the splicer shall be installed and welded as recommended by the manufacturer of the splices and shall be supplemented with a partial penetration groove weld on each flange with a 45° bevel on the upper member of the splice and a groove depth of approximately 75% of the nominal flange thickness (AWS D1.1, BTC-P4-GF). All welding shall conform to the requirements of (c) above.

501.10 Prefabricated Pile Tips Steel H-beam piles shall be equipped with cast steel prefabricated pointed pile tips attached to the pile with a 8 mm [$^{5}/_{16}$ in] groove weld or equivalent along each flange. Welding shall be done using low-hydrogen electrodes and the base metal shall be preheated to 65°C [150°F] minimum.

Unless otherwise shown on the plans, steel pipe piles shall have pointed cast steel pile tips, welded as above specified for H-beam pile tips.

Pile tips for both H-beam and pipe piles shall be approved by the Resident.

Pile tips may be welded to the piles either by the supplier of the piles or in the field by the Contractor, at its option.

501.11 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 the entire pile driving equipment.

b. Piles Furnished The unit of measurement for furnishing casings, timber, and steel shall be the meter [linear foot]. The quantity to be paid for will be the sum of the lengths in meters [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 extensions of piles are necessary, the extension 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. If the piles are cutoff at a higher elevation, the portion between these elevations will be deducted from this Item.

c. Piles in Place Initiation of pile installation by use of a vibratory hammer, preboring, 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 Driven pay item.

The quantity of H-beam, cast-in-place pipe or shell concrete piles to be paid for will be the actual number of meters [linear feet] of steel pipe or shell piles driven, cast, and left in place in the completed and accepted work. Measurements will be made from the tip of the steel pipe, shell pile, or H-beam pile to the cutoff elevation as shown on the plans.

Unused pile cutoffs 6 m [20 ft] or more in length 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.

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.

The following are the locations and contact telephone numbers of all bridge maintenance yards throughout the State:

Division 1 New Limerick	Tel # 764-2060	Division 2 Hancock	Tel # 667-5556
Division 3 Carmel	Tel # 941-4553	Division 4 Skowhegan	Tel # 453-7377
Division 5 Washington	Tel # 596-2230	Division 6 Scarborough	Tel # 883-5546
Division 7 Farmington	Tel # 562-4228		

The Resident will contact the Bridge Maintenance Managers at the above listed telephone numbers so that proper arrangements can be made for delivery.

No separate measurement will be made for reinforcing steel, excavation, drilling, cleaning of drilled holes, 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.

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. Loading tests Load tests will be measured by the number of unit tests authorized and satisfactorily made.

g. Dynamic Load Test 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 retap done up to 24 hours after the initial driving

501.12 Basis of Payment. The accepted quantities of piles and casings will be paid for at the contract unit price per meter [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 the related Pay Items. Damaged pile lengths removed for pile splicing will be considered incidental to the related Pay Items.

Excavating and cleaning steel pipe piles and steel casings, furnishing and placing reinforcing steel and steel templates in steel pipe piles and steel casings will not be paid for separately, but will be considered as incidental to the related Pay Items.

Preboring, jetting or other methods used to facilitate the driving of piling wall not be paid for separately, but will be considered incidental to the contract pay item for pile in place

Full compensation for all jetting, drilling, providing special driving tips or heavier sections for steel piles or shells, or other work necessary to obtain the specified penetration and bearing value of the piles, for drilling holes through embankment and filling the space remaining around the pile with sand or pea gravel, for disposing of material resulting from drilling holes, and for all excavation and backfill involved in constructing concrete extensions as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer shall be considered as included in the contract unit price paid for drive pile or in the contract price paid per meter for cast-in-drilled-hole concrete piling, and no additional compensation will be allowed therefore.

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.

Pile load tests, pile tips, and pile splices will be paid for at the contract unit price each.

Payment for dynamic pile tests will be at the contract unit price per pile tested. The price shall be full compensation for performing and collecting measurements from initial dynamic test, restrike tests, and CAPWAP analyses. The price shall include the cost for all sensors and

wiring, monitoring equipment, setting up, monitoring personnel, and costs associated with the Contractors down time during regular working hours while setting up equipment and making dynamic measurements is being performed.

Payment will be made under:

Pay Items (as Furnished and in Place)		Pay Unit
501.230	Static Loading Test	Each
501.231	Dynamic Loading Test	Each
501.36	Steel H-beam Piles 53 kg/m (36 lb/ft), delivered	meter (Linear Foot)
501.361	Steel H-beam Piles 53 kg/m (36 lb/ft), in place	meter (Linear Foot)
501.38	Steel H-beam Piles 62 kg/m (42 lb/ft), delivered	meter (Linear Foot)
501.381	Steel H-beam Piles 62 kg/m (42 lb/ft), in place	meter (Linear Foot)
501.40	Steel H-beam Piles 79 kg/m (53 lb/ft), delivered	meter (Linear Foot)
501.401	Steel H-beam Piles 79 kg/m (53 lb/ft), in place	meter (Linear Foot)
501.42	Steel H-beam Piles 85 kg/m (57 lb/ft), delivered	meter (Linear Foot)
501.421	Steel H-beam Piles 85 kg/m (57 lb/ft), in place	meter (Linear Foot)
501.44	Steel H-beam Piles 93 kg/m (63 lb/ft), delivered	meter (Linear Foot)
501.441	Steel H-beam Piles 93 kg/m (63 lb/ft), in place	meter (Linear Foot)
501.46	Steel H-beam Piles 109 kg/m (73 lb/ft), delivered	meter (Linear Foot)
501.461	Steel H-beam Piles 109 kg/m (73 lb/ft), in place	meter (Linear Foot)
501.48	Steel H-beam Piles 110 kg/m (74 lb/ft), delivered	meter (Linear Foot)
501.481	Steel H-beam Piles 110 kg/m (74 lb/ft), in place	meter (Linear Foot)
501.50	Steel H-beam Piles 132 kg/m (89 lb/ft), delivered	meter (Linear Foot)
501.501	Steel H-beam Piles 132 kg/m (89 lb/ft), in place	meter (Linear Foot)
501.52	Steel H-beam Piles 152 kg/m (102 lb/ft), delivered	meter (Linear Foot)
501.521	Steel H-beam Piles 152 kg/m (102 lb/ft), in place	meter (Linear Foot)
501.54	Steel H-beam Piles 174 kg/m (117 lb/ft), delivered	meter (Linear Foot)
501.541	Steel H-beam Piles 174 kg/m (117 lb/ft), in place	meter (Linear Foot)
501.70	Steel Pipe Piles, delivered	meter (Linear Foot)
501.701	Steel Pipe Piles, in place	meter (Linear Foot)
501.72	Steel Casings, delivered	meter (Linear Foot)
501.721	Steel Casings, in place	meter (Linear Foot)
501.90	Pile Tips	Each
501.91	Pile Splices	Each
501.92	Pile Driving Equipment Mobilization	Lump Sum

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 Small Quantity Product Verification, 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 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 Portland Pozzolan Cement	701.01
Water	701.02
Air Entraining Admixtures	701.03
Water Reducing Admixtures	701.04
Water Reducing, High Range Admixture	701.0401
Set Retarding Admixtures	701.05
Curing Materials	701.06
Water stops	701.07
Smoothed Surfaced Asphalt Roll Roofing (Formerly Heavy Roofing Felt)	701.08
Fly Ash	701.10
Calcium Nitrite Solution	701.11
Silica Fume	701.12
Ground Granulated Blast Furnace Slag	701.13
Fine Aggregate for Concrete	703.01
Coarse Aggregate for Concrete	703.02
Alkali Silica Reactive Aggregates	703.0201
Preformed Expansion Joint Filler	705.01
Bridge Drains	711.04

502.04 Shipping and Storage Cement may be shipped in bags or in bulk from pre-tested and approved silos at the cement mill. The cement shall be completely protected from rain and moisture. Any cement damaged by moisture or which fails to meet any of the specified requirements shall be rejected and removed from the site. If requested by the Resident, cement stored for a period longer than 60 days shall be retested before being used in the work.

Bags of cement in shipment or storage shall not be piled more than 8 bags high. Bags of cement which for any reason have become partially set or which contain lumps of caked cement shall be rejected. Shipments of cement in bags shall be separately stored in a manner as to provide easy access for identification and inspection of each shipment.

Fly ash and Slag shall be stored in weather tight silos approved by the Resident. 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.

Fly ash or Slag remaining in bulk storage for a period greater than one year after completion of tests will be resampled and retested by the Department before shipment or use.

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 completely separate stockpiles on prepared bases constructed of the same material as that to be stockpiled, with a minimum thickness of 300 mm [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. Barge floors, 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 and materials as specified below for use by the Resident or their representative exclusively. The equipment shall be available and acceptable to the Resident one week prior to placing any concrete. All costs associated with providing and maintaining testing equipment 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 T152 (Type B) and all accessory pay items required for use with the particular design of apparatus. This shall include one 225 mm [9 in] mason trowel, one metal scoop 225 mm long x 125 mm wide [9 in long x 5 in wide], one tamping rod conforming to AASHTO T119, one rubber mallet as described in AASHTO T152, 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 pocket dial thermometers -20°C to +95°C, [0ºF to 200ºF] 25 mm [1 in] diameter dial, 125 mm [5 in] pointed stem, unbreakable poly carbonate crystal, stainless steel case, stem and bezel. Accuracy required is 1 percent over entire range.

C. "Contractors" rubber tired wheelbarrow.

D. Two D-handle square end shovels 240 mm wide [9 ½ in].

E. Two pair heavy duty, long cuff, rubber gloves.

F. Miscellaneous equipment: 500 mL [16 oz] plastic squeeze bottle, 19 L [5 gal] bucket, scrub brush, paper towels, folding rule, and rubber syringe.

G. Small rod - one tamping rod conforming to AASHTO T277.

H. 3 meter [10 ft] straightedge as required by Resident.

502.05 Composition and Proportioning Concrete shall be composed of a homogeneous mixture of Portland cement or Portland cement with Fly Ash, Silica Fume, or Ground Granulated Blast Furnace Slag, 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. For Method C concrete, the mix design proportions will be designated by the Resident or, alternately, the Contractor shall submit a mix design that meets the requirements of Table 1.

TABLE 1

Concrete CLASS	Minimum Specified Compressive Strength MPa (psi)	Method A Maximum Permeability (COULOMBS)	Method B Maximum Permeability (COULOMBS)	Method C Maximum Permeability (COULOMBS)	Entrained Air (%)		Notes
					LSL	USL	
S	20 (2900)	N/A	N/A	N/A	5.5	8.5	1, 5
A	30 (4350)	4,000	3,000	3,000	5.5	8.5	1,2,5,6
P	-----	-----	-----	-----	4	6	1,2,3,4,5
LP	35 (5075)	3,000	2,000	2,000	5.5	8.5	1,2,5,6
Fill	20 (2900)	N/A	N/A	N/A	N/A	N/A	6

LSL - lower specification limit
USL - upper specification limit

NOTE # 1 Target shall be the midpoint of the range of the LSL and USL

NOTE # 2 Permeability testing for all concrete mixes, excluding those containing fly ash (at 20 percent or greater pozzolan cement replacement), will be done at 56 days. Permeability testing for concrete mixes containing fly ash, at 20 percent or greater pozzolan cement replacement, will be done at 120 days. Concrete expected to be exposed to deicing salts prior to the test date shall be sealed with an alcohol based saline sealer listed on the Maine Department of Transportation Prequalified List of Protective Sealers for Structural Concrete in accordance with the manufacturer's recommendation, at no additional cost to the Department.

NOTE # 3 Calcium Nitrite shall be added at the rate of 14.85 L/m³ [3 gallons per cubic yard].

NOTE # 4 Strength and permeability requirements will be shown on the Plans.

NOTE # 5 Compressive strength testing for all concrete mixes, excluding those containing fly ash (at 20 percent or greater pozzolan cement replacement), will be done at 28 days. Compressive strength testing for concrete mixes containing fly ash, at 20 percent or greater pozzolan cement replacement, will be done at 56 days.

NOTE # 6 Coarse aggregate for concrete shall meet the requirements of Section

703.02 for Class “A” or “AA”.

At least 30 days prior to the first placement, a 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.

Once the design has been approved, the Contractor shall conduct a trial batch at the concrete plant utilizing transit mixers at the plant. The Contractor shall submit four clearly identified 100 mm diameter x 200 mm high [4 in diameter x 8 in high] cylinders to the Department at least 30 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 Contractor may submit the trial batch cylinders with the mix design. The cylinders shall be submitted between the ages of 2 and 7 days. Subsequent use of an approved design will not require this trial batch. For Method C concrete, trial batching is not required.

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.

B. Description of fine aggregate, original source, bulk specific gravity, absorption, colorimetric, gradation and Fineness Modulus (F.M.).

C. Description and amount of cement and pozzolanic material.

D. Target water cement ratio.

E. Target water content by volume.

F. Target strength.

G. Target air content, slump and concrete temperature.

H. Target concrete unit weight.

I. Type and dosages of air entraining and chemical admixtures.

J. Target Coulomb Value

Approval by the Department will be contingent upon the ability of the mix design proportions to produce concrete strength requirement and other factors that affect durability. Pozzolans are included as cementitious material.

Concrete mix designs shall contain not more than 30 percent fly ash or 50 percent slag pozzolan cement replacement, by weight.

Cast-in-place concrete shall contain not more than 377 kg/m^3 [635 lb/yd^3] of cement and not more than 392 kg/m^3 [660 lb/yd^3] 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.

No change in the source or character of the mix ingredients may be made without notice to the Resident and no new mix ingredients shall be used until the Resident has approved such ingredients and new mix proportions, if they change.

502.0501 Quality Control METHOD A, METHOD B and Method C The Contractor shall control the quality of the concrete through testing, inspection, and practices which shall be described in the Quality Control Plan, hereinafter referred to as the "QC Plan", sufficient to assure a product meeting the Contract requirements. The QC Plan shall meet the requirements of Section 106 - Quality and this specification. No QC Plan is required for Method C concrete.

No work under this item shall proceed until the QC Plan is submitted to and approved by the Resident.

Concrete sampling for QC shall be taken at the discharge point with pumped concrete sampling taken at the discharge end of the pump line.

The QC Plan 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
G. Initial and as Delivered Mix Properties, including Temperature, Air Content, Consistency and Water Cement Ratio
H. Process Quality Control Testing
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 QC Plan under METHOD A shall include the names and specific qualifications of the individuals meeting these requirements and qualifications:

A. Plan Administrator meeting one of the following qualifications:

1. Professional Engineer registered in the State of Maine with one year of concrete experience acceptable to the Department.

2. Engineer-in-Training certified by the State of Maine with two years of concrete experience acceptable to the Department.

3. An individual with three 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. Construction Materials Technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).

5. Highway Materials Technician certified at Level III by NICET.

6. Highway Construction Technician certified at Level III by NICET.

7. A NICET certified engineering technician in Civil Engineering Technology with five years of concrete experience acceptable to the Department.

8. A Maine Concrete Technician Certification Board [MCTCB] certified engineering technician with 5 years concrete experience acceptable to the Department.

9. A New England Transportation Technician Certification Program [NETTCP] certified concrete technician with 5 years concrete experience acceptable to the Department.

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 QC Plan 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 QC Plan shall detail how these duties and responsibilities are to be accomplished and documented and whether more than one PCT is required. The QC Plan 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 and utilize quality control tests at the job site to assure that delivered materials meet the requirements of the mix design(s), including temperature, water/cement ratio, air content, permeability and strength. The QCT shall inspect all equipment utilized in transporting, placing, consolidating, finishing, and curing to assure it is operating properly and that placement, consolidation, finishing, and curing conform to the Contract requirements. The QC Plan shall detail frequency of sampling and testing, corrective actions to be taken, and documentation. The QC Plan shall detail how these

duties and responsibilities are to be accomplished and documented, and whether more than one QCT is required. The QC Plan shall include the criteria utilized by the QCT to reject unsatisfactory materials. The QCT shall a MCTCB certified concrete field technician or a NETTCP certified concrete technician.

D. The Plan shall detail the coordination of the activities of the Plan Administrator, the PCT and the QCT.

The QC Plan under METHOD B shall include the name and specific qualifications of the technician meeting the following requirements:

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 mix design(s), including temperature, water/cement ratio, air content, permeability and strength. The QCT shall inspect all equipment utilized in transporting, placing, consolidating, finishing, and curing to assure it is operating properly and that placement, consolidation, finishing, and curing conform to the Contract requirements. The Contractor shall detail frequency of sampling and testing, corrective actions to be taken, and documentation. The Contractor shall include the criteria utilized by the QCT to reject unsatisfactory materials. The QCT shall meet one of the PCT qualifications above, or shall be a MCTCB certified concrete field technician.

Under METHOD A, METHOD B and METHOD C 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 & Number
Bridge Name
Manufacturing Plant (Batching Facility)
Name of Contractor (Prime Contractor)
Date
Time Batched/Time Discharged
Truck No.
Quantity (Quantity Batched this Load)
Type of Concrete by Class and Producer Design Mix No.
Cement Brand or Type, and Shipment Certification No.
Temperature of Concrete at Discharge
Target Weights per cubic meter [cubic yard] and Actual Batched Weights for:
1. Cement
2. Pozzolanic Additives, including Fly Ash, Slag Cement, and Microsilica
3. Coarse Concrete Aggregate
4. Fine Concrete Aggregate
5. Water (including free moisture in aggregates and water added at the project)
6. Admixtures Brand and Quantity (ml/cubic meter [fl. oz./cubic yard])

Air-Entraining Admixture
Water Reducing Admixture
Other Admixtures

Placement Location

The Contractor shall maintain records of all QC tests and calculations. The gradation test data and results shall be reported to the Department before the placement they represent. The compressive strength test results shall be reported to the Department by 10:00 A.M. of the first working day following the test. All QC test data shall be signed by the person who performed the test. The Contractor shall record all on site 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 first working day following the concrete placement. All Method A Quality Control testing shall meet the minimum requirements found in Table 2.

TABLE 2
METHOD A MINIMUM QUALITY CONTROL TESTING REQUIREMENTS

TEST	TEST METHOD	SAMPLING LOCATION	FREQUENCY
Gradation	AASHTO T-27 & T-11	Stockpile	One set per mix before production. One set every 120m^3 [155 yd^3] Min. 1 set per month
Organic Impurities	AASHTO T-21	Stockpile	One set per each FA gradation
% Absorption	AASHTO T-84 & T-85	Stockpile	Once per aggregate per 6 months
Specific Gravity	AASHTO T-84 & T-85	Stockpile	Once per aggregate per 6 months
Total Moisture in Agg.	AASHTO T-255	Stockpile	One set per day's production
Free Water and Agg. Wt.	N/A		One per day's production per design
% Entrained Air	AASHTO T-152	On Project	On first two loads and every third load thereafter
Compressive Strength	AASHTO T-22	On Project	One set per sublot
Compressive Strength	AASHTO T-22 @ 7days	On Project	One set per sublot

502.0502 Quality Assurance METHOD A The Department will determine the acceptability of the concrete through a quality assurance program.

The Department will take Quality Assurance samples a minimum of once per sublot on a statistically random basis. Quality Assurance tests will include compressive strength, air content and permeability.

Concrete sampling for quality assurance tests will be taken at the discharge point, with pumped concrete sampling taken at the discharge end of the pump line.

Lot Size A lot size shall consist of the total quantity represented by each class of concrete in the Contract, except in the case when the same class of concrete is paid for under both lump sum items and unit price items in the Contract; in this case, the lump sum item quantities shall comprise 1 lot and the unit price item quantities shall comprise a separate lot. 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 #3, 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 sublot size, then the lot shall be divided into 3 equal sublots.

Sublot Size, General The size of each sublot shall be determined in accordance with Table #3. The Resident may vary sublot 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 sublot quantity in the remaining quantity, then this quantity shall be combined with the previous sublot, and no further Acceptance testing will be performed; if there is more than one-half the estimated sublot quantity in the remaining quantity, then this quantity shall constitute the last sublot 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 3

Quantity m^3 [cy]	Recommended Sublot Size m^3 [cy]
0-400 [0-500]	40 [50]
401-800 [501-1000]	60 [75]
801-1600 [1001-2000]	80 [100]
1601 [2001]or greater	200 [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 Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice, Chapter 3 Section 2.5 Class 1, Section 2.6 Class 1A, or Section 4. 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.

Evaluation of materials will be made using the specification limits in Table 1.

Compressive strength tests will be completed by the Department in accordance with AASHTO-T22 at ≥ 28 days, except that no slump will be taken. The average of two concrete cylinders per sublot 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 sublot, shall be in accordance with AASHTO T152.

Rapid Chloride Permeability test specimens will be completed by the Resident in accordance with AASHTO T-277 at an age ≥ 56 days. Two 100 mm x 200 mm [4 in x 8 in] cylinders will be taken per sublot placed.

Surface Tolerance, Alignment and Trueness, Plumb and Batter, Finish The Resident will measure each of these properties as follows:

A. Surface Tolerance Exposed horizontal and sloping portions of the substructure, superstructure slabs, wearing surface, sidewalks, barriers and wingwalls will be measured at randomly generated locations with a 3 meter [10 ft] straightedge once per 10 m^2 [100 ft^2]. Measurements beyond tolerances given in Table 5, Section 502.14(E) will be cause for removal or pay adjustment and potential corrective action as determined by the Resident. The Contractor shall furnish the 3-meter [10 ft] straightedge. At the Resident's discretion, measurements may be taken with a lightweight profiler. When the Resident uses the lightweight profiler to measure tolerance, and the International Ride Index (IRI) is between 3.95 m/km and 4.74 m/km [250 and 300 in/mile] for any one placement, a pay adjustment will be made. When tolerances exceed 4.74 m/km [300 in/mile], there will be cause for removal or a pay adjustment and potential corrective action.

B. Alignment and Trueness Alignment and trueness may be measured by the Resident longitudinally along any vertical surface of any portion of the structure and shall not exceed a deviation of 5 mm per meter [¼ inch in 3 ft] for structures up to 10 meters [30 ft] in length. Structures in excess of 10 meters [30 ft] in length will be subject to a maximum tolerance of 50 mm [2 in]. Measurements exceeding these tolerances will be cause for removal or pay adjustment and potential corrective action as determined by the Resident.

C. Plumb and Batter The Resident will measure all columns and other vertical surfaces that will remain exposed to determine actual batter and plumbness. Measurements will be taken subsequent to 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 5 meters [15 ft] along the face of longitudinal wall. All measurements will be made on a per placement basis and will be subject to a tolerance of 6 mm per 3 meters [¼ inch in 10

ft]. Measurements between 6 mm and 12 mm per 3 meters [¼ inch and ½ inch in 10 ft] will result in pay adjustments. Measurements beyond 12 mm per 3 meters [½ inch in 10 ft] will be cause for removal or pay adjustment and potential corrective action as determined by the Resident.

D. Finish The Resident will measure and determine the areas to be repaired in accordance with Sections 502.10(d), 502.13, and 502.14(e) for each placement. Areas to be repaired will be measured as a percentage of the total surface area of the placement. Those areas to be repaired that are between 0 percent and 5 percent of the total surface area of the placement will result in no pay adjustment. Areas to be repaired that are between 5 percent and 10 percent will result in pay adjustments. Areas greater than 10 percent of the total surface area of the placement will be cause for removal or pay adjustment and corrective action as determined by the Resident.

Appropriate pay adjustments, as described in Section 502.194, will be made for any or all of the properties described above that do not meet specification requirements.

Rejection by Resident For an individual sublot with a calculated pay factor of less than 0.80, 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 Department. (See also Section 502.191)

For a lot in progress, the Contractor shall discontinue operations whenever one or more of the following occurs:

A. The pay factor for any property drops below 1.00 and the Contractor is taking no corrective action

B. The pay factor for any property is less than 0.90

C. The Contractor fails to follow the QC Plan

502.0503 Quality Assurance METHOD B The Department will determine the acceptability of the concrete through a quality assurance program.

The Department will take verification tests at times deemed appropriate by the Resident. Verification tests will include compressive strength, air content and permeability. Surface Tolerance, Alignment and Trueness, Plumb and Batter, and Finish will be measured as described in Section 502.0502.

Concrete sampling for verification tests will be taken at the discharge point, with pumped concrete sampling taken at the discharge end of the pump line.

Compressive strength test will be completed by the Department in accordance with AASHTO T22 at 28 days except that no slump will be taken. The average of two cylinders will be used to determine compressive strength.

Testing for entrained air in concrete, at the rate of one test per sublot, shall be in accordance with AASHTO T152.

Rapid chloride permeability test specimens will be completed by the Resident in accordance with AASHTO T277 at an age $\geq$ 56 days. Two 100 mm x 200 mm [4 in x 8 in] cylinders will be taken per sublot placed.

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 CRSI Chapter 3, Section 2.5 Class 1, Section 2.6 Class 1A or Section 4. All supports shall meet the requirements for type and spacing as stated in the Concrete Reinforcing Steel Institute (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.

Rejection by Resident For material represented by a verification test with a calculated pay factor of less than 0.80, 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 Department.

502.0504 Quality Assurance Method C Concrete The Department will determine the acceptability of the concrete through written verification from the Contractor that the concrete is in conformance with the Specifications. The Department reserves the right to perform verification tests at times deemed appropriate by the Resident, if the composition and proportioning of the concrete is in question. Verification tests will include compressive strength, air content and permeability. The results of verification tests may be cause for removal if it is determined that the concrete does not Substantially Conform to the Contract requirements, as determined by the Department.

502.0505 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. Circumstances may arise, however, where the Department's test results indicate that the material has a calculated pay factor of less than 0.80. In these cases, 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 Sections 502.0502 and

502.0503 - Quality Assurance METHOD A and METHOD B. This Subsection provides recourse for the Contractor to contest the Department's QA test results as follows, at no additional cost to the Department:

A. Compressive Strength In accordance with Section 502.191 - Pay Adjustments for Compressive Strength, the Contractor must take appropriate corrective measures when compressive strength test results are out of conformance. There may be situations where there is the possibility that an underlying structural element could be built-upon before test results for the underlying element have been reported, based upon the normal frequency of testing. In these instances, it is in the Contractor's best interest to perform additional testing that will provide indications that the concrete will meet the requirements of the applicable Specifications, prior to continuing to build upon this underlying element. In the extreme case where an underlying structural element has been built-upon before test results for the underlying element have been reported, the above mentioned safeguards of tracking and additional testing have failed and the final test results for the concrete of the underlying element indicate that removal is warranted and the Contractor's QC results do not confirm the Department's test results, the following procedure concerning compressive strength may be undertaken by the Contractor and witnessed by the Department, within 36 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/C42M, 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 sublot in question, from randomly selected locations to be representative to the entire volume of the sublot. The Resident and the Contractor's representative shall agree on the sample locations prior to drilling. The specimens shall have a minimum diameter of 100mm [4 in] and a minimum length of 200mm [8 in].

3. The concrete cores shall be taken directly from the Project to the nearest MDOT laboratory where they will be tested. The cores shall be protected from drying during transport. The Contractor shall make arrangements with the appropriate MDOT laboratory for testing prior to beginning the coring process.

4. Core test results will be evaluated by the Department with the understanding that the strength of drilled cores is, in general, 85% of that of corresponding standard-cured molded cylinders. Therefore, 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 sublot in question. If coring is not done with the 36-day time limit the Department will not allow dispute testing of the sublot.

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 will be paid for at a reduced rate, as determined by the Department. If the Department concludes that the strength of the structural element in question is unsatisfactory as a result of the above procedure, then the Department will direct the Contractor to take appropriate actions, as determined by the Department, and at no additional cost to the Department.

In the case where the Department's test results for compressive strength for a particular sublot indicate that the material has a pay factor of less than 1.00 and the Department determines that the indicated strength is adequate for the structural element in question, but the Contractor's QC results indicate a significantly higher strength than the Department's results, the Contractor may contest the Department's results, provided the laboratory performing the QC testing is certified by NETTCP. When the Contractor's QC results for a particular sublot are higher than the Department's results by more than 3.45 MPa [500 psi], the Contractor may elect to undertake the preceding five-step procedure.

B. Rapid Chloride Permeability The Department's verification testing may result in values that exceed the maximum permeability requirements outlined in Section 502.192 - Pay Adjustment for Chloride Permeability, for a particular sublot. In this situation, where the material is subject to rejection and replacement, the following procedure concerning permeability maybe undertaken by the Contractor, if initiated within four calendar days of the receipt of the results and witnessed by the Department:

1. Drilled core specimens shall be retrieved from the concrete in question in accordance with the requirements of ASTM C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. Specimens shall have a diameter of 200mm [8 in] and a minimum length of 400mm [16 in].

2. One drilled core specimen shall be taken from a location that would be from the same load as the original Department specimen for each sublot in question.

3. The concrete cores shall be taken directly from the Project to the nearest MDOT laboratory where they will be tested. The cores shall be protected from drying during transport. The Contractor shall make arrangements with the appropriate MDOT laboratory for testing prior to beginning the coring process.

4. The cored cylinder will be tested by the Department in accordance with AASHTO T-277. 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 sublot 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 will be paid for at a reduced rate, as determined by the Department. If the Department concludes that the permeability of the affected placement in question is unsatisfactory as a result of the above procedure, then the Department will direct the Contractor to take appropriate actions, as determined by the Department, and at no additional cost to the Department.

Because the Contractor does not perform permeability testing, the Contractor may not contest the Department's results in a situation where the Department's results are within acceptable limits

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 0.8 percent, then the material shall be retested by both parties. If the difference between the retests is equal to or greater than 0.8 percent, the concrete placement will be suspended immediately, and 1) both air meters shall be calibrated immediately, or 2) the Contractor shall immediately replace both air meters. Once it is demonstrated the QC and Acceptance air meters are in agreement with 0.8 percent, the concrete placement may resume.

502.06 Batching Measuring and batching of materials for Method A and Method B shall be performed at an approved batching plant, either commercial or otherwise in accordance with the QC Plan. Measuring and batching of materials for Method C concrete shall be performed at an approved batching plant. The plant shall meet the requirements of AASHTO M-157.

502.0701 Delivery

A. Delivery and discharge of the concrete from the mixer shall be completed within a maximum of 1½ hours from the time the cement is added to the aggregate, except that in hot weather when the concrete mix temperature exceeds 21°C [70°F] or under other conditions contributing to quick stiffening of the concrete, delivery and discharge from the mixer shall be completed within 1 hour. When approved by the Resident, the use of a retarding admixture (Type D) may be used for increasing the 1 hour discharge time to 1½ hours, provided concrete temperatures are kept below 27ºC [80ºF] and conditions contributing to quick stiffening of the concrete are not present.

B. Concrete, which has been condemned for any reason, shall be removed immediately from the job site and disposed of properly.

C. Concrete temperature before placement shall not exceed 30°C [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 5°C [40°F] in the shade and dropping and shall not be resumed until the atmospheric temperature is as high as 2°C [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 82°C [180°F]. When either the aggregate or water is heated to above 50°C [120°F], they are to be combined first in the mixer before the cement is added. If the atmospheric temperature is

below -4°C [25°F], the aggregate shall also be heated when directed by the Resident. Materials containing frost or lumps of frozen material shall not be used. Stockpiled aggregates may be heated by the use of 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 temperature of the mixed concrete shall be between the minimum values shown in Table 4 and 20°C [70°F] when it is placed in the forms. Salt or other chemicals shall not be added to the concrete for any reason whatsoever, except by written permission of the Resident.

Table 4
COLD WEATHER TEMPERATURE TABLE

MINIMUM FORM DIMENSION SIZE			
Less than 300mm(12in)	300 - 900 mm (12 -36 in)	900 - 1800 mm (36 - 72 in)	Greater than 1800mm (72in)
13°C (55°F)	10°C (50°F)	7°C (45°F)	5°C (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 QC Plan shall not relieve the Contractor of 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.

502.10 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 the slab structures, unless otherwise indicated on the Plans.

The placing of concrete in excavated pits and trenches without forms will be permitted only in exceptional cases and then at the discretion of the Resident.

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 600 mm [2 ft] below the final finished ground line.

Chamfer strips shall have a width across the diagonal face between 15 and 20 mm [½ and ¾ in]. 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 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 work can be removed to a depth of not less than 25 mm [1 in] from the face and back surfaces of the concrete without damaging such surfaces.

Elevations will be taken on the top flanges of structural steel beams and girders for the purpose of 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 steel beams or girders, including any required flooring beams and stringers, 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.

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 composed of members having ample structural sections to resist all loads imposed upon them, with deformations less than 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 centering or false work systems so that the failure of any member shall not cause a collapse. Design computations, layout drawings, and details of materials for the centering or false work systems shall be submitted to the Department for its records. The erection of centering or false work systems shall be accomplished in strict conformance with the design and details. No concrete shall be placed without prior approval of the Resident.

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.

All false work system computations, plans, and working drawings shall be designed and sealed by the Contractor's Professional Engineer, who must be registered in the State of Maine. This Professional Engineer may be directly employed, or otherwise retained, by the Contractor. Prior to concrete placement, the Professional Engineer responsible for the design of the false work system shall, after false work inspection, provide a sealed certification to the Resident that the system was erected in conformance with the Professional Engineer's plans and design details.

False work shall be so constructed that the forms will have a camber, the amount depending 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.

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. Forms shall not be removed until concrete cylinders cured with the structure establish that the concrete has developed 80 percent of design strength. The Contractor shall cast and break two cylinders per sublot and furnish the Resident with these test reports before removal of the forms.

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 7°C [45°F] and provided the following conditions are met:

Immediately after the forms are removed, defects in the concrete surface shall be repaired in accordance with Section 502.13 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 product listed on the Maine Department of Transportation Prequalified list of curing compounds. The curing compound shall be applied continuously by an approved pressure spraying or distributing equipment at a rate necessary to obtain an even, continuous membrane, meeting the manufacturer's recommendation but at a rate of not less than 0.2 L/m² [1 gal/200 ft²] of surface. Other methods of curing concrete may be used with the prior approval of the Resident.

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 responsibility for the safety of the work. In no case shall any portion of the wood forms be left in the concrete. As the forms are removed, all projecting metal devices that have been used for holding the forms in place shall be removed in accordance with Section 502.10. The holes shall be filled as required in Section 502.13.

502.11 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 has taken its initial set and, in any case, as specified in Section 502.0701. Concrete shall be placed in horizontal layers in such a manner as to avoid separation and segregation. A sufficient number of 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. 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 450 mm [18 in] 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 this Section 502.11(f).

Portland cement concrete with a high range, water reducing admixture shall not be placed when the concrete mix temperature is below 5°C [40°F] or above 29°C [85°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 under side of the slab and the bond between stem and slab shall be a mechanical one. The bond shall be produced by embedding 38 by 89 mm [2 by 4 in] wooden blocks having a length approximately 100 mm [4 in] 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 distance of 300 mm [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 450 mm [18 in] below the top of any face, unless the Plans provide for a coping having a thickness less than 450 mm [18 in], in which case at the option of the Resident, the construction joint may be made at the under side of the coping. Concrete in columns shall be placed in one continuous operation, unless otherwise directed.

Fresh concrete, threatened with rain damage shall be protected by approved means. Sufficient material for covering the work expected to be done in one 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 a distance of more than 2 m [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, with the exception of concrete placed under water. The vibrators shall be an approved type, with a frequency of 5,000 to 10,000 cycles per minute and shall be visibly capable of properly consolidating the designed mixture. 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. Special 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 250 mm [10 in] 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 easy deposit 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, except concrete cores for stone masonry, no horizontal construction joint will be permitted between extreme low tide and extreme high tide elevations.

At horizontal construction joints, temporary gage strips having a minimum thickness of 38 mm [1 ½ in] 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 6 mm [¼ in] 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 with approved equipment 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 3 mm [⅛ in] of the surface with a poured sealant conforming to the following requirements and in accordance with the manufacturer's recommendations. The joint sealant supplied shall be an approved two component, elastomeric sealant capable of 50 percent joint movement. Both components shall be in liquid form and the combining ratio of components by volume shall be as recommended by the manufacturer.

G. Concrete Wearing Surface and Structural Concrete Slabs on Precast Superstructures

When called for on the Plans, a separate concrete wearing surface or structural concrete slabs on precast superstructures shall be bonded to the supporting slab. No surface preparation of a new structural concrete slab shall begin before completion of the specified curing period.

When the supporting slab is composed of cast-in-place concrete the Contractor shall scabble the entire surface of the structural concrete slab and then sandblast the entire structural concrete slab surface. When the supporting slab is comprised of precast units, the Contractor shall sandblast the entire deck surface.

The entire area of the deck surface and the faces of curb and barrier walls or other median devices, up to a height of 25 mm [1 in] above the top elevation of the wearing surface or slab, shall be cleaned to a bright, clean appearance which is free from curing compound, laitance, dust, dirt, oil, grease, bituminous material, paint and all other foreign matter. Air lines shall be equipped with effective oil traps. The cleaning of an area of the deck shall be performed within the 24-hour period preceding placement of the wearing surface. The cleaning shall be performed by dry sand blasting or other methods approved by the Resident. All debris from the cleaning operation shall be thoroughly removed by compressed dry air from the cleaned surfaces and adjacent areas. The cleaned areas shall be protected against contamination before placement of the wearing surface. Contaminated areas shall be recleaned by dry sand

blasting. Prepared areas that have not received the wearing surface within 36 hours shall be recleaned.

All horizontal surfaces in contact with the wearing surface shall receive a coating of bonding grout or bonding agent listed on Maine Department of Transportation Prequalified List of Bonding Agents. 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 or an approved bonding agent.

Stiff bristled street brooms shall be used to brush the grout onto the surface. The coating shall not exceed 3 mm [⅛ in] 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 should be regrouted.

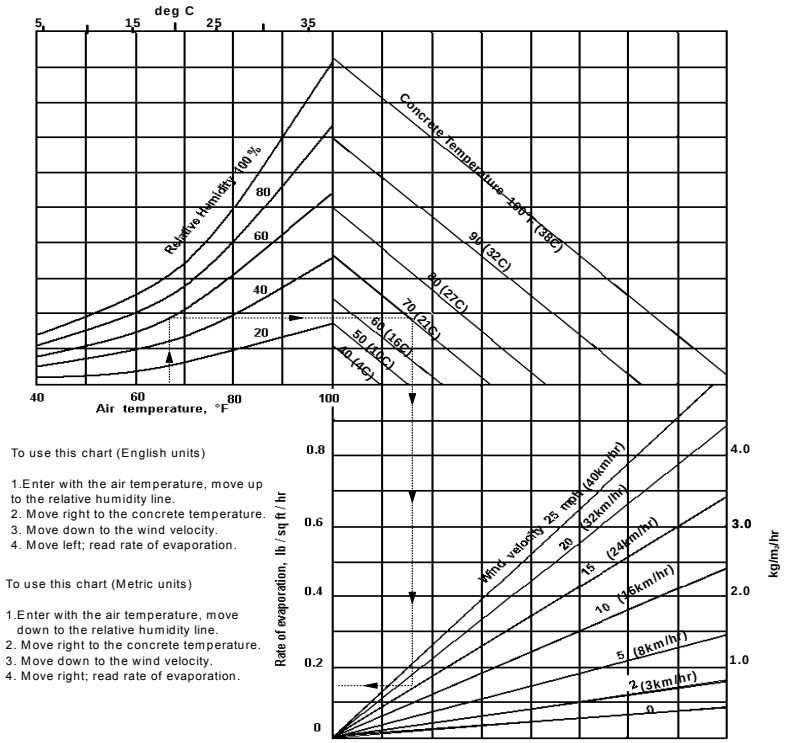
The bonding grout shall have Portland cement and fine aggregate proportioned 2 to 1 by volume. The fine aggregate from which the material larger than 3 mm [⅛ in] has been removed shall be the same source as used in the concrete. The cement and fine aggregate shall be measured separately in appropriately 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 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. The boding agent shall be one of the products listed on the Maine Department of Transportation's list of Prequalified Bonding Agents and shall be applied in accordance with the manufacturer's recommendations.

No structural concrete slab structure, 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 0.5 kg/m²/hr [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 0.75 kg/m²/hr [0.15 lb/ft²/hr] of exposed surface, the Contractor shall implement the remedial action described in the approved QC Plan. The temperature of the concrete shall not exceed 24°C [75°F] at the time of placement. The maximum temperature of the surface on which concrete will be placed shall be 32°C [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.

Rate of Evaporation from Concrete Surface Chart
METRIC UNITS & US CUSTOMARY UNITS



502.12 Expan hall be located and constructed a 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.

502.13 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 300 mm [12 in], 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 25 mm [1 in] 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 five days.

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 their 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.

502.14 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.

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 curbs and sidewalks.

B. Structural Concrete Slab Structures Include but 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. Where shear connector studs are available, welding to the studs will be permitted. No welding will be permitted directly on the stringer flanges to attach either screed rail supports or form supports of any type.

Screed rail supports set in the concrete shall be so designed that they may be removed to at least 50 mm [2 in] 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 or wearing surface. The mortar shall contain an approved additive in sufficient proportions to produce non-shrink or slightly expansive characteristics.

The rate of placing concrete shall be limited to that which can be finished without undue delay and shall not be placed more than 3 m [10 ft] ahead of strike-off.

The Contractor shall furnish a minimum of two work bridges behind the finishing operation, capable of spanning the entire width of the deck and supporting at least a 225 kg [500 lb] load without deflection to the concrete surface, to be supported on the screed rails. These working 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 18 m [60 ft] or less only one working 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 150 mm [6 in]. 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 150 mm [6 in] in depth, vibratory pan(s) having a minimum of 3000 vibrations/min shall be operated between the oscillating screed(s) or rotating cylinder screed(s) and the power auger(s). For concrete placed in excess of 90 mm [3 ½ in] but less than 150 mm [6 in] thickness, 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 no higher than the center of the rotating auger(s). The advance auger(s) shall strike off the concrete to approximately 6 mm [¼ in] above the final grade. The concrete shall then be consolidated with the vibrating pan(s) and then finished to final grade.

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 on slab structures which are more than 300 mm [12 in] below the roadway finish grade or have a length of 9 m [30 ft] or less, or where concrete placements are specified to be less than 5 m [16 ft] in width and shall have the following features:

1. It shall be portable and easily moved, relocated, or adjusted by no more than four persons.
2. The power unit shall be operable without disturbing the screeded concrete.
3. It shall be self-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. It shall have controlled, uniform, variable frequency vibration, end to end.
5. It shall 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 13 mm [½ in] above the finished grade in front of the front screed. The screed shall be operated such that at least 1 m [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.

The texturing of concrete wearing surfaces shall be applied as approved by the Resident. The surface tolerance and texture shall be acceptable to the Resident, or the placement may be suspended until remedial action has been taken. The Resident may order the removal and replacement of material damaged by rainfall.

On all concrete wearing surfaces, a 300 mm [1 ft] wide margin shall be finished adjacent to curbs and permanent barriers with a magnesium float.

Immediately after screeding, floating and texturing, the surface of the concrete shall be tested for trueness, by the Contractor, with a 3 m [10 ft] straightedge and all irregularities corrected at once in order to provide a final surface within the tolerance required in Table 5. The surface shall be checked both transversely and longitudinally. Any area that requires finishing to correct surface irregularities shall be retextured.

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 Curb and sidewalk finish is a float finish produced by using a short float, moved in small circles to produce a shell-like pattern on the surface of the concrete. Alternately, sidewalks may receive a light broom finish perpendicular to the sidewalk.

When a concrete curb is monolithic with a sidewalk, a 150 mm [6 in] 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, 50 mm [2 in] in width, with a 6 mm [¼ in] radius lip.

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, using first class form material, well-constructed forms and the exercise of special care, concrete surfaces are obtained that are satisfactory to the Resident, 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 and 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 300 mm [12 in] 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 3m [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. The lightweight profiler will be furnished by the Department.

Areas found to not comply with the tolerance of Table 5 shall be brought into conformity by methods proposed by the Contractor and approved by the Resident at no additional cost to the Department.

TABLE 5
SURFACE TOLERANCE LIMITS

Type of Surface	*Maximum deviation of surface in millimeters [in] below 3 m [10 ft] straightedge
Concrete Wearing Surface, Curbs, Sidewalks, and Barriers	3 mm [⅛ in]
Concrete Slab Surfaces to be Covered by Membrane Waterproofing or Concrete Wearing Surfaces	6 mm [¼ in]
Concrete Slab Surfaces with Integral Concrete Wearing Surface	6 mm [¼ in]
Concrete Slab Surfaces to be Covered By Earth or Gravel	10 mm [⅜ in]
Concrete Surface of Box Culvert Bottom Slab	10 mm [⅜ in]
Concrete Surface of Abutments, Piers, Pier Shafts, Footings, and Walls	10 mm [⅜ in]

*Allowance shall be made for crown, camber and vertical curve.

502.15 Curing Concrete All concrete surfaces shall be kept wet with clean fresh water for a curing period at least 7 days after placing of concrete. For concrete wearing surfaces and all concrete containing fly ash or slag, the temperature of the concrete shall be kept above 10°C [50°F] for the entire seven (7) day period. All other concrete and its surfaces shall be kept above 10°C [50°F] for the first four (4) days of the curing period and above 0°C [32°F] for the remainder of the period.

As an alternative to the above, the Contractor may shorten the seven (7) day curing period when it can be shown that the concrete has developed 80 percent of design strength. The Contractor shall make cylinders and furnish test results to the Resident before curing is stopped.

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 22°C [40°F] for moderate sections, such as abutments and pier bents, and 17°C [30°F] for mass sections, such as massive piers.

When the ambient temperature is expected to fall below 2°C [35°F] during the shortened curing period and 24 hours following, the Contractor shall make provisions to maintain the temperature of the concrete and its surface above 0°C [32°F].

All slabs and wearing surfaces shall be water cured only and kept continuously wet for the entire approved 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 30 minutes after the concrete is screeded and before the surface of the concrete has lost its surface "wetness" or "sheen" appearance. The first layer of either the burlap or the cotton mats shall be wet and shall be applied as soon as it is possible to do so without damaging the concrete surface. 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 by the use of a continuous wetting system and shall be located to insure 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 by the use of wet burlap, cotton mats or other suitable fabric until the end of the curing period. Polyethylene sheets shall not be placed directly on the concrete, but may be placed over the fabric cover to prevent drying.

Surfaces of all concrete placements containing silica fume additive shall be coated with an approved evaporation retardant immediately after finishing and texturing the concrete surface. The application of wet burlap or wet cotton mats shall be made within 15 minutes after the finishing of the concrete surface.

The application rate, the desired equipment, and the mixing and application procedures for an approved evaporation retardant shall be as designated by the manufacturer. Successive applications or heavier applications of this evaporation retardant shall be applied as necessary to retain the required surface "wetness" appearance.

502.16 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 of time 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 to 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 502.10 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.

502.17 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 the purpose of providing drainage for any moisture that may collect between the floor slab and the bituminous concrete roadway surface, approved 25 mm [1 in] 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 10 mm [⅜ in] below the surface of the slab and the outlets shall project 50 mm [2 in] 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.

502.18 Method of Measurement

A. Structural concrete satisfactorily placed and accepted will be measured by the cubic meter [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 meter [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 transition 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 meters [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 38 mm [1 ½ in] or less in depth, pipes, weep holes and authorized openings for utilities of 0.2 m^3 [¼ yd^3] or less in volume, when any of these items occur in structural concrete which is to be paid for on a cubic meter [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 meters [cubic yards] of concrete actually and satisfactorily placed above a plane at 300 mm [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 300 mm [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 Method A, quantities of lots and sublots shall be determined as outlined under Section 502.0502 - Quality Assurance Method A, and under Section 502.19 - Basis of Payment.

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 meter [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, 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, 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.

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 Quality Control Plan and costs associated with acceptance test sampling shall be incidental.

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 accepted under Method A. 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 formulas in Sections 502.191 through 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 meter (yd^3) for all pay adjustment purposes.

502.191 Pay Adjustment for Compressive Strength Compressive strength tests will be completed by the Department in accordance with AASHTO-T22 at 28 days. If three consecutive tests fail to meet the below listed strength requirements, the Contractor shall submit remedial actions acceptable to the Department, at no additional cost. These remedial actions shall be taken until the source of the problem can be identified and corrected or new trial batches can be performed. When the average of three consecutive tests falls to less than 1.0 MPa [150 psi] above the specified strength or any single test more than 1.4 MPa [200 psi] below the specified strength, the Resident will notify the Contractor to make corrective changes in the materials, mix proportions, or in the concrete manufacturing procedures before placing additional concrete of the same class. Such changes shall be subject to the approval of the Resident.

The lot pay adjustment for compressive strength will be as follows:

Pay factors (PF) for sublot pay adjustments for compressive strength per sublot will be determined as specified below.

TABLE 6

Class	Compressive Strength	Pay Factor (PF) {Metric}	Pay Factor (PF) [US Customary]
A	>30 MPa [4350 psi]	1	1
	27 - 30 MPa [3900 - 4350 psi]	(0.10/3) x (strength)	(0.10/450) x (strength) + 0.0333
	<27MPa[3900 psi]	(0.10/3) x (strength)	(0.10/450) x (strength) + 0.0333
LP	>35 MPa [5075 psi]	1	1

	32 - 35 MPa [4575 - 5075 psi]	(0.10/3) x (strength)-0.1667	(0.10/500) x (strength) - 0.0150
	<32MPa [4575 psi]	(0.10/3) x (strength) -0.1667	(0.10/500) x (strength) - 0.0150
S	> 20 MPa [2900 psi]	1	1
	17 - 20 MPa [2600 - 2900 psi]	(0.10/3) x (strength) +0.3333	(0.10/300) x (strength) + 0.0333
	<17MPa [2600 psi]	(0.10/3) x (strength) +0.3333	(0.10/300) x (strength)+ 0.0333

The pay adjustment per sublot for compressive strength will be as follows:

Sublot Pay Adjustment = P x (PF - 1) x Sublot Size

No positive pay adjustments for compressive strength will be made.

502.192 Pay Adjustment for Chloride Permeability Pay factors (PF) for sublot pay adjustments for rapid chloride permeability per sublot for Class A concrete will be determined as specified below, except for those decks provided for in Table 8. Decks that will be covered with one of the approved products on the Department's Prequalified List of Approved Materials for High Performance Waterproofing Membrane or gravel will be computed using the pay factors shown in Table 7.

TABLE 7

Rapid Chloride Permeability Coulomb Value	Pay Factor (PF)
< 800	1. 05
800 - 2000	1.100 - [(0.050/1200) x Permeability)]
2001 - 3000	1
3001 - 4000	1.75 - [(0.25/1000) x (Permeability)]

Values greater than 4000 coulombs shall be subject to rejection and replacement at no additional cost to the Department.

Pay factors (PF) for sublot pay adjustments for rapid chloride permeability per sublot for Class A concrete placed in decks which will receive a concrete wearing surface, will have an integral wearing surface, or will have a sheet type membrane, will be determined as specified in Table 8.

TABLE 8

Rapid Chloride Permeability Coulomb Value	Pay Factor (PF)
< 800	1. 075
800 - 2000	1.125 - [(0.075/1200) x (Permeability)]
2001 - 3000	1
3001 - 4000	1.75- [(0.25/1000) x (Permeability)]

Values greater than 4000 coulombs shall be subject to rejection and replacement at no additional cost to the Department.

Pay factors (PF) for sublot pay adjustments for rapid chloride permeability per sublot for Class LP concrete will be determined as specified below.

TABLE 9

Rapid Chloride Permeability Coulomb Value	Pay Factor (PF)
< 800	1. 075
800 - 1500	1.16 - [(0.075/700) x (Permeability)]
1501 -2000	1
2001 - 3000	1.50 - [(0.25/1000) x (Permeability)]

Values greater than 3000 coulombs shall be subject to rejection and replacement at no additional cost to the Department.

The pay adjustment per sublot for rapid chloride permeability will be as follows:

Sublot Pay Adjustment = P x (PF - 1) x Sublot Size

502.193 Pay Adjustment for Air Content Pay factors (PF) for pay adjustments for air content will be determined using the Quality Level Analysis as specified in Section 106. The pay adjustment for air content will be as follows: Lot Pay Adjustment = P x (PF-1) x Lot Size

The maximum allowable bonus for air content shall be 2.5 percent.

502.194 Pay Adjustments for Surface Tolerance, Alignment and Trueness, Plumb and Batter, and for Finish No positive pay adjustments will be made under this section. Negative pay adjustments will be made on a per placement basis as follows:

A. Surface Tolerance When the Resident uses a 3 meter [10 ft] straightedge to measure surface tolerance and more than 15 percent of the measurements taken for any one placement exceed the maximum deviations shown in Table 5 of Section 502.14(b), a pay adjustment of 10 percent as required, will be computed according to the formula given below.

When the Resident uses a lightweight profiler to measure tolerance and the International Ride Index (IRI) is in excess of 6.5 m 3.95 m/km [250 in/mile] for any one placement, a pay adjustment of 10 percent as required, will be computed as follows:

Pay Adjustment = P x Placement Size x .10

B. Alignment and Trueness When alignment and trueness exceed the tolerances described in Section 502.0502, the Resident will make a pay adjustment of 10 percent as required, according to the formula given below: Pay adjustment = P x Placement Size x .10

C. Plumb and Batter The Resident will take measurements in accordance with Section 502.0502. When any one measurement is beyond the allowable limits, a pay adjustment of 10 percent as required, will be computed as follows: Pay adjustment = P x Placement Size x .10

D. Finish The Resident will take measurements to determine the areas to be repaired in accordance with Section 502.0502. When more than 5 percent and less than 10 percent of the surface of any placement requires repairs of defects or there are defects that expose reinforcing steel, a pay adjustment of 10 percent as required, will be computed as follows:

Pay adjustment = P x Placement Size x .10

Payment will be made under:

Pay Item		Pay Unit
502.21	Structural Concrete, Abutments and Retaining Walls	Cubic Meter [Cubic Yard]
502.219	Structural Concrete, Abutments and Retaining Walls	Lump Sum
502.22	Structural Concrete, Abutments and Retaining Walls (placed under water)	Cubic Meter [Cubic Yard]
502.229	Structural Concrete, Abutments and Retaining Walls (placed under water)	Lump Sum
502.23	Structural Concrete Piers	Cubic Meter [Cubic Yard]
502.239	Structural Concrete Piers	Lump Sum
502.24	Structural Concrete Piers (placed under water)	Cubic Meter [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 Meter [Cubic Yard]
502.289	Structural Concrete Rigid Frame Structures	Lump Sum
502.29	Structural Concrete Wearing Surface on Bridges	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 Meter [Cubic Yard]
502.33	Structural Concrete Culvert End wall	Lump Sum
502.40	Structural Concrete Box Culvert	Cubic Meter [Cubic Yard]
502.41	Structural Concrete Superstructure Slab	Cubic Meter [Cubic Yard]
502.42	Structural Concrete Roadway and Sidewalk Slab on Steel Bridges	Cubic Meter [Cubic Yard]
502.43	Structural Concrete Superstructure T-beam Type	Cubic Meter [Cubic Yard]
502.44	Structural Concrete Wearing Surface on Bridges	Cubic Meter [Cubic Yard]
502.45	Structural Concrete Approach Slab	Cubic Meter [Cubic Yard]
502.46	Structural Concrete Culvert Connection	Cubic Meter [Cubic Yard]
502.48	Low Permeability Concrete	Cubic Meter [Cubic Yard]
502.49	Structural Concrete Curbs and Sidewalks	Lump Sum
502.56	Concrete Fill	Cubic Meter [Cubic Yard]

SECTION 503 - REINFORCING STEEL

503.01 Description This work shall consist of furnishing and placing reinforcement, either plain or epoxy-coated, in accordance with these specifications and in conformance with the Plans, Supplemental Specifications and Special Provisions.

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 effect 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 or epoxy-coated, shall be stored on skids or other supports a minimum of 300 mm [12 in] 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.

If it is expected that epoxy-coated bars will be required to be stored outdoors for a period in excess of three 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, shall meet the requirements of AASHTO M284/M284M (ASTM A775/A775M), Epoxy-Coated Reinforcing Steel Bars, 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 bar 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 M284/M284M (ASTM A775/A775M), and Section 503.053 of these specifications.

b. Patching material as specified in Section 5.4 of AASHTO M284/M284M (ASTM A775/A775M), shall be supplied for both shop and field patching of the coated reinforcing steel. The patching material shall be supplied as required, but at not less than the following rates:

#10 to #16 [#3 to #5] bars: 1 L/4800 m [1 qt/15000 ft] of bar, or fraction thereof
#19 to #29 [#6 to #9] bars: 1 L/2550 m [1 qt/8000 ft] of bar, or fraction thereof
#32 [#10] and up: 1 L/1900 m [1 qt/6000 ft] of bar, or fraction thereof

c. All testing shall be as specified in AASHTO M284/M284M (ASTM A775/A775M), 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 eight 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 M284/M284M (ASTM A775/A775M), at the expense of the fabrication shop. 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 the coating application, so that the Resident or their designated representative may be present at the beginning of the application of the epoxy 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 M284/M284M (ASTM A775/A775M).

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 Packaging and Handling of Epoxy-Coated Bars All handling of epoxy-coated 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 epoxy-coated bars shall be spaced at a maximum of 4.5 m [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 complied with the above.

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 300 mm [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 tightly twisted wire or by tack welding when permitted by the Resident. All tack welding shall be done in accordance with Section 504, Structural Steel. No tack welding for fastening or supporting reinforcing steel in areas of high tensile stresses will be permitted. Welding on epoxy-coated reinforcing steel will not be permitted under any condition.

In general, no welding will be permitted on the main reinforcing steel of superstructure slabs.

Proper distances from the forms shall be maintained by means of stays, blocks, ties, hangers or other approved means. Blocks used for this purpose shall be precast portland cement mortar blocks of approved shape and dimensions. Chairs may be used for this purpose and, when used, must be plastic, plastic coated, epoxy coated or plastic tipped. 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 bar mats.

Epoxy-coated 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 50 mm [2 in] from the point of contact with the reinforcing bars. Reinforcing bars used as support bars shall be epoxy-coated. In walls, spreader bars shall be epoxy-coated.

Tie wire for epoxy-coated reinforcing steel shall be soft annealed wire that has been nylon, epoxy or plastic coated.

Field bending or cutting of epoxy-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.

Bars in bridge seats shall be placed so as to clear anchor bolts.

When specified on the contract 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 list of Prequalified Type 3 Anchoring Materials. Installation shall be in accordance with the manufacturer's published recommendations.

At each anchor location, existing reinforcing will 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:

METRIC UNITS

Minimum Lap Splice Length (millimeters) [1]									
Bar Type	Bar Size								
	#10	#13	#16	#19	#22	#25	#29	#32	#36
Plain	350	450	550	650	825	1075	1350	1725	2100
Epoxy Coated	530	675	825	975	1250	1625	2025	2600	3150

US CUSTOMARY UNITS

Minimum Lap Splice Length (inches) [1]									
Bar Type	Bar Size								
	#3	#4	#5	#6	#7	#8	#9	#10	#11
Plain	14	18	22	26	33	43	54	68	83
Epoxy Coated	21	27	33	39	50	64	80	103	124

[1] Lap Splice lengths are based on the following parameters: Minimum center-to-center spacing between bars of 150 mm [6 in]; nominal yield strength of the reinforcing steel of 420 MPa [60 ksi]; minimum 28-day compressive strength of concrete of 30 MPa [4350 psi]. When any of the preceding parameters is altered, appropriate minimum lap splice lengths will be determined by the Resident. When lap splices are placed horizontally in an element where the concrete depth below the splice will be 300 mm [12 in], or more, the indicated lap splice lengths shall be multiplied by a factor of 1.4.

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 300 mm [12 in] 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.

503.08 Lapping Sections of welded steel wire fabric shall securely fasten to adjoining sections and overlap. All laps shall be in accordance with Wire Reinforcement Institute Manual of Standard Practice.

Bar mats shall be spliced as required for the individual bars.

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, both plain and epoxy-coated, shall be measured by the computed number of kilograms [pounds] of steel reinforcement authorized. Welded steel wire fabric shall be measured by the computed number of kilograms [pounds] of fabric authorized. 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 bars, both plain and epoxy-coated, weights will be computed in accordance with the following table:

METRIC UNITS

Kilograms per Meter									
Bar Size	#10	#13	#16	#19	#22	#25	#29	#32	#36
Weight	0.560	0.994	1.552	2.235	3.042	3.973	5.060	6.404	7.907

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:

METRIC UNITS

Size in mm	152 by 152	76 by 152	102 by 102	152 by 152
Gauge	W1.4 by W1.4	W1.4 by W1.4	W1.4 by W1.4	W2.9 by W2.9
Weight (Kg/m^2)	1.02	1.46	1.51	2.05

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 ($lbs/100\ ft^2$)	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 meter [foot] of the uncoated bars will be made because of additional requirements for blast cleaning and epoxy 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 will be paid for at the contract unit price per kilogram [pound] for each item involved, completed, and accepted.

The accepted quantity of epoxy-coated reinforcing steel will be paid for at the contract unit price per kilogram [pound] for each item involved, completed 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 kilogram [pound].

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 effect 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 kilogram [pound], in place, completed and accepted.

The accepted quantity of mechanical and/or welded splices will be paid for at the contract unit price each, completed 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:

Pay Item		Pay Unit
503.12	Reinforcing Steel, Fabricated and Delivered	Kilogram [Pound]
503.13	Reinforcing Steel, Placing	Kilogram [Pound]
503.14	Epoxy-Coated Reinforcing Steel, Fabricated and Delivered	Kilogram [Pound]
503.15	Epoxy-Coated Reinforcing Steel, Placing	Kilogram [Pound]
503.16	Welded Steel Wire Fabric, Complete in place	Kilogram [Pound]
503.17	Mechanical/Welded Splice	Each

SECTION 504 - STRUCTURAL STEEL

504.01 Description This work shall consist of detailing, fabricating and erecting structural steel bridges, ancillary bridge products and other steel structures.

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 may be used without furnishing Certificates of Conformance from the electrode/consumable manufacturer.

504.03 Drawings The Contractor shall prepare shop detail, erection and other necessary working drawings in accordance with Section 105.7 - Working Drawings. Weld and nondestructive examination symbols shall be shown on the shop drawings. Welding Procedure Specifications (WPSs) shall be considered part of the shop drawing submittal. The drawings will be reviewed and approved in accordance with the applicable requirements of Section 105.7 and the AASHTO/NSBA Shop Detail Drawing Review/Approval Guidelines, G1.1.

504.04 Facility Requirements Steel shall be fabricated in a facility holding a current AISC or MDOT shop certification as follows:

Type of Product	Type of Certification Required[1,2,3,4,]
Continuous and Complex Bridge Structures, HPS 485W (HPS 70W), HPS 345W (HPS 50W)	AISC Cbr
Unspliced Rolled Beam Bridges, Steel for Bridge Repair and Rehabilitation	AISC Cbr or Sbr
Ancillary Products, Non-vehicular Bridges, Structural Supports, High Mast Poles, Light Poles and Other Steel Products	AISC Cbr or Sbr or Cbd or Sbd or MDOT

[1] Application of protective coatings requires a "P" endorsement or SSPC QP3 Certification.

[2] Fracture Critical fabrication requires an "F" endorsement.

[3] All materials fabricated in a non-certified shop will be rejected.

[4] Work shall not be subcontracted to a non-certified facility without the approval of the Fabrication Engineer.

504.05 Notice of Beginning Work The Contractor shall give the Fabrication Engineer a minimum of two weeks notice before the beginning of work. No work shall be performed before the Fabrication Engineer has been notified. Before beginning work, a pre-fabrication meeting may be held at the discretion of the Fabrication Engineer or, if requested, by the Contractor.

The Contractor shall advise the Fabrication Engineer of the production schedule and any changes to it. If the Contractor suspends work on a project, the Fabrication Engineer will require 48 hours notice prior to the resumption of work.

504.06 Inspection Quality Control (Q.C.) is the responsibility of the Contractor. The Quality Control Inspector (Q.C.I.) shall inspect all aspects of the work and shall supervise all nondestructive examination (NDE). The Q.C.I. shall record measurements and test results in a clear and legible manner. The Q.C.I. shall reject materials and workmanship that do not meet contract requirements. The Contractor may perform NDE in addition to the minimum required. The results of all measurements and testing shall be made available to the Quality Assurance Inspector (Q.A.I.).

Quality Assurance (Q.A.) is the prerogative of the Fabrication Engineer. The Q.A.I. will ensure that the Q.C. Department is performing properly, verify documentation, periodically inspect workmanship and witness NDE. Q.A. testing deemed necessary by the Fabrication Engineer in addition to the minimum testing requirements shall be scheduled to minimize interference with the production schedule.

504.07 Inspector's Authority The Q.A.I. will have the authority to reject material or workmanship that does not meet the contract requirements. The acceptance of material or workmanship by the Q.A.I. will not prevent subsequent rejection, if found unacceptable.

504.08 Rejections Rejected material and workmanship shall be corrected or replaced by the Contractor.

504.09 Facilities for Inspection The Contractor shall provide a private office at the fabrication plant for inspection personnel authorized by the Department. The office shall have an area not less than 9.3 m² [100 ft^2] and shall be in close proximity to the work. The office shall be climate controlled to maintain the temperature between 18° C [65° F] and 30° C [85° F], lighted 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 office shall be equipped with a desk or table having a minimum size of 1200 by 760 mm [48 in by 30 in], 2 chairs, a telephone, telephone answering machine, line data port, plan rack and 2-drawer letter size file cabinet with a lock and 2 keys which shall be furnished to the Inspector(s).

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, basic monthly telephone charges and all furnishings shall be incidental to the contract.

504.10 Mill Orders and Mill Test Reports The Contractor shall provide a copy of the material mill orders. The Contractor shall provide Certified Mill Test Reports (CMTRs) for all material. The CMTRs shall include chemical and mechanical properties as well as the results of CVN testing, when required. CMTRs shall originate from the producer of the steel. The CMTRs shall be provided prior to the beginning of fabrication.

504.11 Material Identification and Control Structural steel plates and shapes shall be marked as specified in AASHTO M 160M/M 160(ASTM A 6/A 6M). Material from stock shall

only be used if it can be positively identified, properly documented and the direction of rolling can be determined, when necessary.

Material shall be stored above the ground and shall be kept free from dirt, grease and other foreign material. Steel shall be protected from significant corrosion.

Fasteners shall be organized and stored by size and production lot to facilitate sampling. Fasteners shall be stored in a protected environment that preserves the fastener lubricant.

504.12 Protective Coatings Paint, metallizing and fusion-bonded coatings shall be applied in accordance with Section 506 and/or the plans as applicable.

Galvanizing shall be done in accordance with AASHTO M 111 (ASTM A 123). Steel shall be abrasive blast cleaned to SSPC SP-6/NACE No. 3 before galvanizing. Fasteners shall be galvanized in accordance with AASHTO M 232 (ASTM A 153) or AASHTO M 298 Class 50 (ASTM B 695 Class 50). 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 Products fabricated from weathering steel shall remain in the bare, unpainted condition, unless otherwise noted on the plans. All surfaces shall be cleaned to a minimum SSPC SP-6/NACE No. 3, Commercial Blast Cleaning.

HIGHWAY BRIDGE FABRICATION

504.14 Materials for Bridges Bridge steel shall meet the requirements of AASHTO M 270M/M 270 (ASTM A 709/A 709M). The grade of steel shall be designated on the plans.

504.15 Design Bridge design, detail and load requirements shall conform to Division 1, Design, of the AASHTO LRFD Bridge Design Specifications, applicable Interim Specifications, and these Specifications.

504.16 Fabrication Fabrication shall be in accordance with the *ANSI/AASHTO/AWS D1.5 Bridge Welding Code* (the D1.5 Code), as modified herein, and these Specifications.

Material shall be handled in a manner that prevents nicks, gouges or other damage from chains, wire ropes or other handling devices during all phases of fabrication.

504.17 Nondestructive Examination Nondestructive examination shall be performed in accordance with the D1.5 Code. The Q.A.I will witness all nondestructive examination. The Contractor shall give the Q.A.I. twenty-four hours notice to facilitate the Q.A.I.'s presence. Nondestructive examination shall be documented on the appropriate forms from Annex III of the D1.5 Code or an equivalent form prepared by the user.

504.18 Plates for Fabricated Members Plates subject to calculated stress, including splice plates, shall be cut so that the direction of rolling is parallel to the primary stresses. The direction of primary stresses for web material is parallel to the flanges unless otherwise shown.

Heat numbers shall be transferred to all primary bridge material and maintained until it is incorporated in a piece-marked member.

Ends of flange plates that are to be butt-welded shall be scanned for laminations by ultrasonic straight beam testing (UT) in accordance with ASTM A 898/A 898M as modified herein. The plate shall be scanned a distance of 300 mm [12 in] from the ends prior to welding.

The acceptance standard shall be Level I. Repairs to laminations within 300 mm [12 in] of butt welds shall have the prior approval of the Fabrication Engineer.

504.19 Correcting Materials Steel may be corrected by any method that does not damage the material. If heating of the steel is required, it shall be done in accordance with a written procedure approved by the Fabrication Engineer.

Following corrective work, the steel shall be carefully inspected using nondestructive examination (NDE) methods acceptable to the Fabrication Engineer. The presence of cracks or fractures shall be cause for rejection of the material.

For general use, a Contractor may submit a procedure for correcting camber or sweep by heating for pre-qualification by the Fabrication Engineer.

504.20 Base Metal Repairs Base metal repairs that require welding shall not be made without the approval of the Fabrication Engineer.

504.21 Thermal Cutting Steel shall be thermal cut with automatic equipment or with a mechanical guide. The rate of travel of the cutting equipment shall be adjusted to prevent hardening the steel. Freehand cutting is not allowed.

504.22 Edge Hardness Thermal cut edges of cover plates, flange plates and splice material other than ASTM A 36/A 36M shall have an average hardness not exceeding Rockwell C30 and no individual reading shall exceed Rockwell C35. Hardness shall be measured at approximately mid-thickness of the plate and the spacing of the measurements shall be at both ends, quarter points and midpoint unless additional testing is required by the Q.A.I. One measurement shall consist of the average of three readings taken at each location. Hardness readings and locations shall be documented by the Q.C.I.

Excessive hardness shall be removed by the application of heat, by grinding or machining. Heating shall be done only with the approval of the Fabrication Engineer.

504.23 Edge Planing Sheared edges of plates greater than 16 mm [⅝ in] thick for use as flanges, cover plates, bearing stiffeners and splice material shall be planed to a depth of 5 mm [3/16 in].

504.24 Bent Plates Cold-bent, rolled steel plates shall conform to 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. Minimum radii, measured to the concave face of the metal, are shown in the following table:

AASHTO (ASTM)	Metric Units [U.S. Customary] Plate Thickness in Millimeters [Inches]		
	t≤25 [1 in]	25[1 in]<t≤50[2 in]	50 [2 in]<t
M 270M (A 709M) Grade 250 (Gr. 36) M 270M (A 709M) Grade 345 (Gr. 50) M 270M (A 709M) Grade 345W (Gr. 50W) M 270M (A 709M) Grade HPS70W M 183M (A 36M) M 223M (A 572M) M 222M (A 588M)	2.5 t	3.5 t	4 t

(c) If a smaller radius is required, the plates shall be bent hot at a temperature not greater than 595° C [1100° F]. Before bending, the edges of the plates shall be rounded to a radius of 2 mm [$^{1}/_{16}$ in] through that portion of the plate where the bending occurs.

504.25 Die Stamping Die stamping of primary members (including splice material, diaphragms and cross frames on curved bridges) shall be done only with the approval of the Fabrication Engineer. Secondary members may be die stamped with the piece mark. Die stamping shall be limited to no-stress locations. Die stamping shall be done with blunt nose, low-stress dies.

504.26 Camber and Curvature If camber or curvature is required for stringers or girders, the camber or curvature will be specified on the plans. The allowable tolerances for the camber and curvature of stringers and girders shall be as specified in the D1.5 Code. Specified camber or curvature shall be measured and documented using the same ordinates shown on the plans.

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 160M/M 160(ASTM A 6/A 6M).

504.27 Heat Cambering and Curving Structural members may be brought to the required camber and/or curvature by the application of heat. Steel with a specified minimum yield greater than 345 MPa [50,000 psi] and High Performance Steel shall not be heat-curved or heat-cambered without the approval of the Fabrication Engineer..

A heat cambering/curving procedure shall be submitted to the Fabrication Engineer for approval before beginning the work. The procedure shall include:

1.The proposed heating pattern, showing location and distribution of heated areas, the size and shape of heated areas and sequencing of heating.
2. Method of support of the member.
3. Minimum and maximum temperature.
4. Method of heating (gas, gas flow, nozzle size, etc.)

5. Method and rate of cooling.

Steel shall be blast cleaned to SSPC SP-6/NACE No. 3 prior to heating. Both flanges and webs shall be heated with a minimum of two torches (one torch on either side of the member). Restraining or jacking the member before or during heating shall be done only with the approval of the Fabrication Engineer. The Contractor shall 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 shall be 595º C [1100º F]. Steel heated in excess of 675°C [1250° F] will be subject to rejection. The temperature of the steel shall be measured using temperature indicating crayons applied to the heated area approximately 10-15 seconds after the torch is removed. Alternate methods of measuring the temperature may be used with the approval of the Fabrication Engineer.

For camber, the heated area of the web shall be a "V" with a 10-15 degree included angle extending full web depth less 50 mm [2 in]. The heated area of the flange shall be rectangular and centered over the base of the triangle. Web heating shall begin at the apex of the triangle and proceed toward the base using the ½ lap technique. Flange heating shall begin immediately after completion of the web. Backtracking is not allowed.

Curving may be performed by a combination of line heats applied to the edge of both flanges simultaneously using an automatic track torch(es) and "V" heats, or by "V" heats alone. If the Contractor elects to use line heating, the steel shall be allowed to cool to ambient temperature before the beginning of "V" heats. When using "V" heats, the heated area shall have an included angle of 15-30 degrees and a height 65% the flange width. The Contractor shall apply heat to adjacent areas on both flanges and both sides of the flanges simultaneously.

Following the application of heat, the steel shall be allowed to cool in still air to below 315ºC [600ºF] after which compressed air may be used. Quenching will not be allowed.

All cambering and curving, including corrections, shall be carried out in the presence of the Q.A.I. Heating a structural member without the Q.A.I. present shall be cause for rejection. Camber and sweep shall be measured for acceptance after the steel has reached ambient temperature.

Areas of suspected cracking shall be tested by an NDE method satisfactory to the Fabrication Engineer. The cost of NDE examination required by the Fabrication Engineer after heat curving or cambering shall be incidental to the contract.

504.28 Welding AASHTO M 270M/M 270 (ASTM A 709/A 709M),Gr. 250, Gr. 345, Gr. 345W Weld Procedure Specifications (WPSs) for groove welds and multiple-pass fillet welds shall be qualified by Procedure Qualification Testing in accordance with the D1.5 Code. The electrical parameters shall be within the consumable manufacturer's published recommendations.

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. When backgouging is required, the groove and 75 mm [3 in] on either side of the groove shall be preheated to 51° C [125° F] 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. The "T" test shall be performed 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". The test specimens shall be macroetch tested in accordance with the requirements of Section 5 of the D1.5 Code. Acceptance and re-testing, if required, shall be in accordance with Section 5 of the D1.5 Code.

The minimum heat input for single-pass fillet welds during testing and production shall be 1.4 kilojoules/mm [35 kilojoules/in].

504.29 Welding AASHTO M 270M/M 270 (ASTM A 709/A 709M) HPS 345W (HPS 50W) and HPS 485W (HPS 70W) Steel Consumables shall be handled and stored in accordance with Subsections 12.6.5, and 12.6.6 of the D1.5 Code.

Filler metals for joining HPS 345W (HPS 50W) to HPS 345W (HPS 50W) or Grade 345W (Grade 50W) base metal shall meet the requirements of Table 4.1 or Table 4.2 of the D1.5 Code for Grade 345W (Grade 50W) steel.

Filler metals for welding HPS 485W (HPS 70W) base metal shall meet the following requirements:

Unless otherwise specified on the Plans, filler metals for fillet welds joining HPS 485W (HPS 70W) to HPS 485W (HPS 70W), HPS 345W (HPS 50W) or Grade 345W (Grade 50W) shall meet the matching filler metal requirements of Table 4.1 of the D1.5 Code for Grade 345W (Grade 50W) steel (H8 maximum).

Single-pass fillet welds joining HPS 485W (HPS 70W) to HPS 345W (HPS 50W) or Grade 345W (Grade 50W) steel shall meet the requirements of Section 4.1.5 of the D1.5 Code.

Single-pass fillet welds need not meet the requirements for exposed bare application.

Filler metals for multiple-pass fillet welds joining HPS 485W (HPS 70W) to either HPS 485W (HPS 70W), HPS 345W (HPS 50W) or Grade 345W shall meet the requirements of Table 4.3 of the D1.5 Code for Grade 345W (Grade 50W) steel (H8 maximum).

Filler metals for groove welds joining HPS 485W (HPS 70W) to HPS 345W (HPS 50W) or Grade 345W (Grade 50W) shall meet the matching filler metal requirements for Grade 345W (Grade 50W) steel (H8 maximum) as listed in Table 4.1 of the D1.5 Code.

Matching filler metal for HPS 485W (HPS 70W) shall meet the following requirements:

(a) AWS Classification F9A4-EXXX-X with the optional supplemental diffusible hydrogen designator of H2 or H4 and a minimum of 1% Nickel. In addition to the Procedure Qualification Test, diffusible hydrogen (H_d) tests shall be performed on the weld metal. The deposited weld metal shall have a diffusible hydrogen level of 4mL/100g [0.0048 gal/lb] or less. H_d shall be prepared at the fabrication facility and tested in accordance with AWS A4.3.

(b) Matching SMAW electrodes shall meet the requirements of E9018RHZ and have an optional diffusible hydrogen designator of H2, H4, or H8. Undermatching SMAW electrodes shall meet the requirements of undermatching filler metals form Tables 4.1 or 4.3 of the D1.5 Code as applicable.

(c) As an alternative, HPS 485W (HPS 70W) base metal may be welded by the SAW process using the consumables and reduced preheat temperatures specified in Appendix A of the *AASHTO Guide Specification for Highway Bridge Fabrication with HPS70W Steel*, September, 2000.

Procedure Qualification Tests for HPS 345W (HPS 50W) shall be performed in accordance with Section 5 of the D1.5 Code except that the backing bar may be Grade 345W (0.025 S max.) or HPS 345W (HPS 50W).

Weld Procedure Specifications for butt welds and multiple-pass fillet welds joining HPS 345W (HPS 50W) to HPS 345W (HPS 50W) shall be written based on the results of approved Procedure Qualification Tests performed on HPS 345W (HPS 50W) base metal.

Weld Procedure Specifications for single-pass fillet welds joining HPS 345W (HPS 50W) to HPS 345W (HPS 50W) or Grade 345W (grade 50) may be written based upon an approved Procedure Qualification Test performed on Grade 345W (Grade 50W) base metal.

Procedure Qualification Tests for HPS 485W (HPS 70W) shall be performed in accordance with Section 5 of the D1.5 Code except that the backing bar may be Grade 345W (0.025 S max.) or HPS 485W (HPS 70W). The heat input range developed by testing shall be between 1.6 kJ/mm and 3.5 kJ/mm [40 kJ/in and 90 kJ/in].

SAW and SMAW processes are approved for welding HPS 485W (HPS 70W). FCAW and GMAW processes shall be subject to approval by the Fabrication Engineer.

The results of a Procedure Qualification Test performed with HPS 485W (HPS 70W) and matching filler metal shall meet or exceed the Base Metal Requirements of AASHTO M 270M/M 270 (ASTM A 709/A 709M) for HPS 485W (HPS 70W) Steel.

Weld Procedure Specifications for fillet welds on HPS 485W (HPS 70W) using under-matched filler metals shall be written based upon an approved Procedure Qualification Test performed on HPS 345W (HPS 50W) or Grade 345W (Grade 50W) test plates.

Weld tabs for butt joints joining HPS 485W (HPS 70W) shall meet the requirements of Section 3.12 of the D1.5 Code except that the minimum length shall be 150 mm [6 in].

When welding HPS 485W (HPS 70W) steel to HPS 485W (HPS 70W) steel, preheat and interpass temperatures shall meet the requirements of Table 4.4 of the D1.5 Code for Grade 485W (Grade 70W) base metal. When welding HPS 485W (HPS 70W) steel to HPS 345W (HPS 50W) or Gr. 345W steel, the minimum preheat temperature shall meet the requirements of Table 4.4 of the D1.5 Code for the applicable grade and thickness of the base metals.

Nondestructive Examination of HPS 485W (HPS 70W) steel shall be performed in accordance with Section 6 as modified herein. Inspectors and NDT Technicians shall be qualified in accordance with Section 12 of the D1.5 Code. Fillet weld repairs shall be inspected in accordance with Subsection 12.16.2.3 of the D1.5 Code. Cooling time prior the inspection shall be in accordance with Subsection 12.16.4 of the D1.5 Code.

504.30 Welded Fabrication A copy of an approved Welding Procedure Specification (WPS) for the joint being welded shall be displayed at each welding station. Only WPSs bearing the approval stamp of the Maine Department of Transportation shall be used.

Flange plate and web plate butt joints, web to flange welds, stiffener and connection plate to web welds, and cover plate to flange welds shall be made using an automatic or semi-automatic weld process.

Repairs to welds shall be made with the same process used for the original welds, except that repairs less than 300 mm [12 in] in length may be made with a different process using an approved WPS.

Runoff tabs shall be removed and butt welds shall be ground smooth prior to nondestructive examination. Butt welds joining plates of equal thickness shall be ground flush with the base metal. Butt welds joining plates of unequal thickness shall be ground at a slope of 1:2.5. Butt joints joining plates of unequal width shall have a smooth transition with a minimum 600 mm [24 in] radius. Grinding marks shall be parallel to the direction of the primary stresses.

Weld metal deposited without an approved WPS or outside the parameters of an approved WPS shall be removed and rewelded as directed by the Fabrication Engineer.

504.31 Shop Assembly Abutting members shall be placed in their exact relative field position for erection and shall be assembled with the associated filler and splice material. The Q.C.I. shall record all measurements necessary to demonstrate that the shop assembly meets the requirements of the plans and Specifications. The Q.A.I. shall be given the opportunity to verify the measurements prior to disassembly.

504.32 Tolerances Dimensional tolerances for welded plate girders shall be as described in the D1.5 Code. Dimensional tolerances for rolled shapes shall be as described in AASHTO M 160 M/M 160 (ASTM A6/A 6M).

Layout and fit-up tolerances for plate girders and rolled stringers shall be as described in the D1.5 Code. The tolerance for the length of any primary bridge member shall be ±6 mm [¼ in].

The bearing- to-bearing tolerance shall be ±3 mm [⅛ in]. Abutting joints at field splices shall have an opening of 6 mm [¼ in] ± 3 mm [⅛ in].

504.33 Match marking Drill assembled or ream assembled parts shall be match marked prior to disassembly. The match marks shall be preserved through field erection.

504.34 Holes for High Strength Bolts Holes for connections may be sub-punched and reamed, sub-drilled and reamed, or drilled full-size with all the splice material assembled in final position. Holes that are reamed shall be sub-punched or sub-drilled 5 mm [3/16 in] smaller than the nominal diameter of the bolts. After assembly, the splices shall be reamed 2 mm [$^1/_{16}$ in] larger than the nominal bolt diameter. The Contractor may drill holes full size in each piece separately, provided that after drilling, all connections are fully assembled, duplicating the final position of the stringers or girders, to demonstrate the accuracy of the holes. Splice plates that have been drilled full size may be used as one-time templates to drill webs and flanges. The plates shall remain with the splice. Plates damaged while being used as a template shall be replaced.

Holes for cross frames, diaphragms and associated connection plates may be punched when the thickness of the plate is not greater than 20 mm [9/16 in] for AASHTO M 270M/M 270 (ASTM A 709/A 709M, Grade 250) steel and 16 mm [⅝ in] for AASHTO M 270M/M 270 (ASTM A 709/A 709M, Grade 345 and Grade 345W). The diameter of the die shall not exceed the diameter of the punch by more than 2 mm [$^1/_{16}$ in]. Holes shall be clean cut, without torn or ragged edges. When the material is thicker than the above limits, punching is not allowed.

Holes shall be cylindrical and perpendicular to the member. Burrs caused by drilling or reaming shall be removed from all parts.

Oversize or short-slotted holes may be used in connections other than splices of primary members and end connections of floor beams. Hardened washers shall be used over oversize and slotted holes.

Thermal cut holes in bearing plate material shall be produced using an automatic or mechanically guided process. The surface roughness shall not exceed ANSI 25µm [1000 µin].

504.35 Accuracy of Holes After assembling all parts of a connection containing sub-punched or sub-drilled holes, it shall be possible to enter a pin 3 mm [⅛ in], smaller in diameter than the nominal size of the hole in at least 75 percent of the contiguous holes in the array. When assembled, all holes in a connection shall be able to pass a pin 5 mm [3/16 in] smaller in diameter than the nominal size of the sub-punched or sub-drilled holes. Pins shall be entered perpendicular to the face of the member and no drifting will be allowed. Failure to comply with either of the above criteria shall be cause for rejection of the splice material.

Following the completion of the drilling or reaming of all holes in a contiguous group, with all plies of a connection in their proper position for assembly, all holes shall accept a pin 0.8 mm [1/32 in] smaller in diameter than the nominal hole size.

No finished hole shall be located more than 3 mm [⅛ in] from its theoretical location. The repair of mislocated holes shall be subject to the approval of the Fabrication Engineer.

The minimum edge distances for holes shall be as shown below:

Fastener Size-mm[in]	Sheared/Flame Cut Edges-mm[in]	Rolled or Gas Cut Edges-mm[in]
16 [⅝]	30 [1 ⅛]	22 [7/8]
20 [¾]	32 [1 ¼]	25 [1]
22 [7/8]	40 [1 ½]	30 [1 ⅛]
24 [1]	45 [1 ¾]	32 [1 ¼]

After the splices have been disassembled, all faying surfaces shall be solvent cleaned in accordance with SSPC-SP 1.

Bolted connections shall be considered slip-critical unless otherwise specified. Contact surfaces within slip-critical joints shall be blast cleaned to SSPC SP-6/NACE No. 3, Commercial Blast unless otherwise specified.

504.36 Shop Bolts Shop bolts shall be installed and tensioned in accordance with this Specification. As an alternative, Tension Control (TC) bolts meeting the requirements of ASTM F 1852 may be used with the approval of the Fabrication Engineer.

504.37 Bearings Bearings, base plates and other contact surfaces shall be finished to the following tolerances:

Surface Roughness Requirements-Metric [U.S. Customary]

Steel slabs	50 µm [ANSI 2000 micro-inches]
Bearing sole plates	25 µm [ANSI 1000 micro-inches]
Milled ends to compression members, milled or ground ends of stiffeners or rockers	10 µm [ANSI 500 micro inches]
Bridge rockers and rollers	5 µm [ANSI 250 micro-inches]
Sliding bearings	3 µm [ANSI 125 micro-inches]
Pins and pin holes	3 µm [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 1 mm [1/32 in].

504.38 Marking and Delivery Each member shall be marked for identification. Erection marks, match marks and piece marks shall be placed where they will not be exposed in the finished structure.

The Contractor shall furnish the Fabrication Engineer copies of shipping documents and erection diagrams.

Bolts of one length and diameter, along with the required number of nuts and washers shall be packed together in heavy-duty waterproof containers. Each container shall have a list and

description of the contained material, including the identifying shipping lot number and Rotational-Capacity lot number, in a waterproof envelope, firmly attached to the outside of the container.

504.39 Handling and Storing Materials Material shall be placed and supported above the ground. They shall be kept clean and properly drained. Fabricated members shall be supported in a manner that will prevent injury due to excessive deflection or torsion. Care shall be exercised to prevent gouges, scratches and other damage. Chains and wire rope slings shall not be used in direct contact with fabricated members when being lifted or transported. Steel members shall be loaded, transported and unloaded at their destination without damage.

BRIDGE STEEL ERECTION

504.40 Plans 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 The Contractor shall submit to the Fabrication Engineer plans for any false work and/or for modifications to an existing structure necessitated by construction loading. 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 Professional Fabrication Engineer. The approval of 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. No work shall be done without the Fabrication Engineer's approval.

504.42 Bearings, Expansion Devices, and Anchorages Bearings shall be installed in accordance with Section 523 - Bearings.

504.43 Assembling Steel The steel shall be assembled as shown on the plans. Surfaces in permanent contact shall be cleaned before assembly. Drift pins shall be used in both the webs and flanges of connections to assure alignment of all holes. A minimum of eight drift pins shall be used in each flange and web connection. No less than 50% of the bolts in each contiguous group shall be installed and snugged before the member is released from the crane. Drift pins shall not be removed until bolts have been installed and snugged in the remaining holes.

504.44 Connections Using High Strength Bolts The Contractor shall 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. 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, shall be provided by the Contractor. Both the tension measuring device and the torque wrench shall remain at the job site during steel erection.

Each torque wrench shall have a maximum capacity 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 two percent of the maximum capacity of the wrench and shall be readable to one percent of the maximum capacity.

If Direct Tension Indicators (DTI's) are used, a Technical Representative from the DTI manufacturer or supplier shall be present during initial testing of the DTI's.

504.45 Bolts, Nuts, Washers and Direct Tension Indicators Bolts, nuts and washers shall be furnished by one supplier and, when practicable, shall be from one manufacturer. DTI's shall be supplied from one manufacturer and, when practicable, from one production lot.

The manufacturer or supplier shall perform a Rotational Capacity Test (RCT) in accordance with AASHTO M 164M/M 164 (ASTM A 325/ A 325M) for each combination of bolts, nuts and washers supplied. Each combination shall be assigned a unique Rotational Capacity (R-C) lot number. The Contractor shall provide the results of the RCT to the Fabrication Engineer before installation of the fasteners.

Fasteners shall be protected from dirt and moisture. Only as many fasteners as anticipated to be installed during a work shift shall be taken from protected storage. Fasteners not used shall be returned to protected storage at the end of the workday. Fasteners that have become rusted or dirty shall be cleaned and lubricated 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. When assembled, all joint surfaces shall be free of mill scale, dirt, burrs, or other material that would prevent solid seating of the parts.

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Bolts shall be installed with a hardened washer under the element turned in tightening. Hardened washers are required over slotted and oversize holes. Washers must completely cover holes.

Fasteners shall be tightened within 48 hours of installation. All fasteners in a connection shall be tightened to at least 105% of the Minimum Bolt Tension values in Table 1.

When DTI's are used, the installation of DTI's under the turned element of the fastener assembly shall be done only with the approval of the Fabrication Engineer.

504.46 Test Specimens The Fabrication Engineer will select four specimens of each lot, length and diameter bolt along with the associated nuts, washers and DTI's for testing by the Department. The cost of the specimens shall be incidental to the appropriate contract items. Test specimens shall be available to the Department a minimum of three weeks prior to beginning steel erection. Fasteners that have been installed and later found unacceptable shall be replaced at the Contractor's expense.

504.47 Verification The Contractor shall perform a Rotational Capacity Test (RCT) for each lot, length, and diameter bolt assembly at the job site immediately prior to installation. If DTI's are used, the Contractor shall perform a DTI Verification Test for each production lot immediately prior to installation. The Fabrication Engineer will witness and document both the RCT and DTI Verification Test.

504.48 Rotational Capacity Test The test shall be conducted using a tension measuring device (Skidmore-Wilhelm or equivalent) and a torque wrench. Two randomly selected fastener assemblies of each length and diameter from each R-C lot shall be tested.

The fastener assemblies shall be tested in the following manner:

1. Bring the fastener to a snug-tight condition in the tension-measuring device (approximately ten percent of the Installation Tension from Table 1 below). Mark the socket with reference to a point on the tensioning device in such a way that nut rotation can be measured.

Table 1
Minimum Installation Tension Requirements and Turn Test Tension-Metric [U.S. Customary]

Bolt Diameter, mm	16 [⅝]	20 [¾]	22 [7/8]	24 [1]	27 [1 ⅛]	30 [1 ¼]	36 [1 ⅜]
Installation Tension-kN [kips]	85 [19]	125 [28]	175 [39]	227 [51]	249 [56]	316 [71]	378 [85]
Turn Test Tension-kN [kips]	98 [22]	142 [32]	200 [45]	262 [59]	285 [64]	365 [82]	436 [98]

2. From snug tight, bring the fastener assembly to the Minimum Required Installation Tension specified in Table 1 using the torque wrench.

3. At a point after the required Minimum Installation Tension has been achieved, one reading of tension and torque shall be recorded. The readings should be taken with the nut in rotation and as close as possible to the Minimum Installation Tension.

4. Further tighten the fastener assembly to the total rotation (from snug-tight) specified in Table 1A below:

Table 1A

Bolt length up to and including 4 diameters	2/3 turn (240 degrees)
Bolt length over 4 diameters up to and including 8 diameters	1 turn (360 degrees)
Bolt length over 8 diameters	1 1/3 turns (480 degrees)

5. The tension at the specified rotation above shall be equal to or greater than the Turn Test Tension (see Table 1). Record the tension.

6. Upon completion of steps 1 through 5:

(a.) The torque measured in step 3. to produce the measured tension shall not exceed the value obtained by the following equation:

METRIC

Torque ≤340 PD Where:
Torque = Measured Torque (N.mm)
P = Measured Bolt Tension (N)
D = Nominal Bolt Diameter (mm)

U.S. CUSTOMARY

Torque ≤ 0.25*PD* Where:
Torque = Measured Torque (ft.-lbs.)
P = Measured Bolt Tension (lbs.)
D = Nominal Bolt Diameter (feet)

(b) If the torque measured in step 3 exceeds the torque calculated in step 6, all fasteners from the lot represented shall be re-lubricated and retested.

7. Bolts that are too short to be assembled in the tension-measuring device shall be tested in a steel joint. Mark the turned element relative to the steel joint in such a manner that fastener rotation can be measured. Use the torque wrench to bring the fastener assembly from a snug-tight condition to 1/3 turn. Record the torque required to reach that rotation while the turned element is in motion. The torque thus determined shall not exceed the maximum torque requirement using the formula in step 6., assuming *P* to be equal to the appropriate Turn Test Tension from Table 1. Further tighten the fastener assembly to 2/3 turn from the initial mark. Assemblies that fail before 2/3 rotation either by stripping or fracture fail the test.

8. Disassemble each fastener assembly and run the nut down the full length of the threads excluding the grip length. If evidence is found of torsional failure, shear failure or stripping of the threads, the assembly shall be deemed to have failed the test. Slight necking in the grip length is not considered a failure.

9. Bolts used for the Rotational Capacity Test shall be discarded.

504.49 DTI Verification Test When Direct Tension Indicators are used, a DTI Verification Test shall be performed at the job site. The Verification Test shall be performed for each production lot of DTIs in combination with each R-C lot of fasteners. The test shall be performed in two steps:

1. a) Use three randomly selected fastener assemblies from each R-C lot and for each position of the DTI with respect to the turned element.

b) Install the bolt, nut, hardened washer, and DTI in a tension-measuring device in such a manner that the DTI is available for inspection by feeler gauge after tensioning. Use flat inserts instead of the normal bolt head restraints so that both nut and bolt are capable of rotating.

c) Using two wrenches, one to restrain the unturned element of the bolt assembly, tighten the assembly to the Bolt Tension listed in Table 2. If an impact wrench is used, tighten to approximately 2/3 the required tension and use a manual wrench to attain the required tension.

TABLE 2-Metric [U.S. Customary]

AASHTO M 164M/m 164 (ASTM A 325/ A 325M)							
Bolt Dia.-mm [in.]	16[⅝]	20[¾]	22[7/8]	24 [1]	27[1 ⅛]	30[1 ¼]	36[1 ½]
Bolt Tension-kN [kips]	89 [20]	129 [29]	182 [41]	240 [54]	262 [59]	334 [75]	480 [108]

d) Determine and record the number of spaces between the protrusions on the DTI that a 0.13 mm [0.005 in] thickness gage is refused.

e) The number of spaces in which the 0.13 mm [0.005 in] gage is refused shall not exceed the number given in Table 4. If the number of refusals exceeds the number in Table 4, the DTI fails the Verification Test.

TABLE 3-Metric [U.S. Customary]

AASHTO M 164M/m 164 (ASTM A 325/ A 325M)							
Bolt Dia.-mm [in.]	16 [⅝]	20 [¾]	22 7/8]	24[1]	27[1 ⅛]	30[1 ¼]	36[1 ½]
Number of Gaps	4	5	5	6	6	7	8

TABLE 4

Verification Criteria*						
Number of spaces in DTI	4	5	6	7	8	9
Max. Number of gaps in which gage is refused	1	2	2	3	3	3

*If the test is a coated DTI, the maximum number of spaces the gage is refused is the number of spaces on the DTI minus one.

2. a]The bolt shall be further tightened to the smallest gap to be allowed in the work. Normally, this is defined as all gaps refusing a 0.13 mm [0.005in] gage and at least one visible gap remaining. Record the tension. The tension shall not exceed the applicable tension from Table 5.

TABLE 5 -Metric [U.S. Customary]

AASHTO M 164M/m 164 (ASTM A 325/ A 325M)							
Bolt Dia.-mm [in.]	16 [⅝]	20[¾]	22[7/8]	24[1]	27[1 ⅛]	30[1 ¼]	36[1 ½]
Bolt Tension -kN [kips]	120 [27]	178 [40]	245 [55]	325 [73]	356 [80]	454 [102]	658 [148]

TABLE 6-Metric and U.S. Customary

Inspection Criteria*					
Number of gaps in DTI	4	5	6	7	8
Minimum number of gaps gage is refused	2	3	3	4	4

*The gage shall be refused in all gaps when a coated DTI is used under the turned element.

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 runout and the tension does not exceed the allowable tension from Table 5, 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 minimum acceptance gap.

c) If the number of gage refusals is less than the minimum number from Table 6 when the tension is equal to or greater than the applicable bolt tension from Table 5, the DTI lot shall be rejected.

Bolts too short to fit in the tension-measuring device shall be tested by tightening to the minimum gap in step 2. a) and checked in accordance with step 2. b). The DTI used with the short bolt should be verified using a longer bolt in the tension-measuring device.

504.50 Calibration, Installation and Tensioning of High Strength bolts The Contractor shall select one of the methods listed herein for installing and tensioning high strength bolts. Standard torque determined by the use of tables or formulas that attempt to relate torque to tension are not acceptable.

The Fabrication Engineer will observe the calibration and testing procedures to confirm that the selected installation procedure is properly used and that the specified tensions are attained as a minimum. The installation of fasteners in the work will be monitored by the Fabrication Engineer to verify that the selected procedure is routinely being used in an acceptable manner.

Regardless of the procedure used, care shall be taken to assure that all fasteners are brought to a snug tight condition before final tensioning. Snug tight is defined as all plies in a connection being in contact with approximately 10% of the final bolt tension applied to all fasteners.

High Strength bolts shall be installed and tensioned by: (1) the Calibrated Wrench method, (2) the Turn of Nut method, (3) with Direct Tension Indicators or (4) Alternative Design Fasteners.

504.51 Installation A Hardened washer shall be installed under the turned element. Fastener assemblies shall be installed in all holes in a contiguous group, except for holes containing drift pins, and shall be brought to a snug tight condition, progressing systematically from the most severely restrained location in a connection to the free edges. Drift pins shall not be removed until enough bolts have been tightened to prevent slippage in the joint. Tightening shall progress systematically from the most rigid part of the joint to the free edges.

504.52 Tightening Tightening of fasteners shall be done by one of the following:

1. The Calibrated Wrench Method Adjustable pneumatic wrenches, adjustable hydraulic wrenches or calibrated torque wrenches may be used. Each wrench used shall be calibrated.

The Calibrated Wrench method for tensioning bolts shall be calibrated at least once each shift for fastener assemblies of each diameter, length, and R-C lot being installed.

Three fastener assemblies (bolt, nut and washer) for each diameter and length shall be randomly selected for wrench calibration.

Install each of the three fastener assemblies in the tension-measuring device and install enough washers so at least three but no more than five threads are showing. A hardened washer shall be under the turned element. Snug the bolt using the same procedure to be used during installation.

When the calibrated wrench is an adjustable pneumatic wrench or an adjustable hydraulic wrench, the wrench shall be set so that each of the three assemblies shall be tightened from snug to less than 105% of the Minimum Bolt Tension specified in Table 1.

When a manual torque wrench is used, the torque required to tension each of the three bolts to 105% of the Minimum Bolt Tension specified in Table 1 shall be recorded. The job installation torque shall be the average of the three recorded torque values. The torque shall be measured with turned element in rotation.

When bolts are too short to fit in the tension measuring device, the wrenches shall be calibrated using DTI's. The DTI's must first be calibrated as described in Section 504.49.

Following the snug tightening operation, calibrated wrenches shall be operated until the wrench cuts out at the setting established by calibration or manual torque wrenches shall be used to bring the bolt assembly to the job installation torque as a minimum. Torque shall be measured with the turned element in rotation. The wrench shall be returned to "touch up" previously tightened fasteners that may have relaxed because of subsequent tightening.

2. The "Turn of Nut" Method The Turn of Nut method shall be calibrated once, prior to fastener installation, for each diameter and length bolt of each R-C lot.

Select a random sample of three fastener assemblies of each diameter, length and R-C lot. Install each assembly in a tension-measuring device, using the snugging procedure to be used in the work. Mark the nut or socket to a reference point on the tension-measuring device and further tighten the bolt to the required rotation in Table 6. The bolt tension shall be a minimum of 105% of the Minimum Bolt Tension from Table 1.

All bolts shall be installed in a connection (except for holes with drift pins) and brought to a snug tight condition. This may be attained by a few impacts of an impact gun or the full effort of a man using an ordinary spud wrench.

Following the snugging operation, all bolts shall be tightened by the applicable amount of rotation. 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 1:20 (bevel washer not used) 3	Both Faces Sloped Not More Than 1:20 from Normal to Axis (bevel washer not used) 3
Up to and including 4 diameters	1/3 turn	½ turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	½ 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. For bolts installed by ½ turn and less, the tolerance shall be plus or minus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance shall be plus or minus 45 degrees.

2 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 The tolerances in footnote 1 may be exceeded if calibration in an approved tension measuring device shows that the specified minimum tension cannot be obtained or is exceeded when using the specified turns.

3. Tensioning Fastener Assemblies with DTI's Fasteners using DTI's shall be tightened so that a 0.13 mm (0.005 in) feeler gage is refused in at least the number of gaps shown in Table 7 and the minimum acceptance 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
Min. number of gap refusals	2	3	3	4	4	5

4. Alternate Design Fasteners Alternate design fasteners designed to indicate bolt tension indirectly or tension bolts automatically may be used only with the prior approval of the Fabrication Engineer. Alternate design fasteners shall meet the chemical and

mechanical requirements of AASHTO M 164M / M 164 (ASTM A 325/ A 325M) and shall have the same body diameter and not less than the same bearing area under the head and nut as a heavy hex fastener.

The Contractor shall provide a detailed written installation procedure from the fastener manufacturer to the Fabrication Engineer for approval before beginning bolt installation. The Fabrication Engineer may modify or place restrictions on the installation procedure before approval.

Before installation, three fastener assemblies of each diameter, length, and lot shall be calibrated in a tension measuring device. Each fastener shall achieve a minimum of 105% of the Minimum Bolt Tension from Table 1 when installed and tensioned in accordance with the approved installation procedure. If any of the three fasteners fails to achieve 105% 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 105% of the Minimum Bolt Tension, the lot shall be rejected. The Fabrication Engineer may require re-calibration of the fasteners if the condition of the fasteners has significantly changed.

Alternate design fasteners shall be tensioned immediately after installation. Alternate design fasteners shall be installed and snugged in accordance with the approved installation procedure. After all fasteners in a connection have been properly snugged, the fasteners shall be brought to final tension starting at the most rigid part of the joint and working systematically toward the free edges. After all other bolts in a connection have been properly tensioned, the drift pins shall be removed and fasteners shall be installed in the remaining holes.

Alternate design fasteners are extremely dependent on proper lubrication and thread condition. Fasteners shall be handled and stored in accordance with the manufacturer's recommendations. Fasteners that have been improperly handled or stored shall be rejected.

504.53 Inspection For joints not using DTI's or alternate design fasteners that indicate proper tensioning, inspection of all completed joints shall be done within 24 hours following completion of each joint.

The following inspection procedure shall be used:

1. The contractor, in the presence of the Fabrication Engineer shall use a calibrated torque wrench as an inspection tool.

2. At least once each day, a representative sample of five bolts from each diameter, length and R-C lot used in the work shall be tightened in the tension measuring device to the Minimum Bolt Tension specified in Table 1. There shall be a washer under the turned element of each bolt. 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 five degrees (approximately one inch at a twelve inch 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 7 and the minimum gap allowed in the work (from the DTI Verification Test) remains in at least one space.

5. At the Fabrication Engineer's option, if the Fabrication Engineer witnesses the snugging 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 Only black AASHTO M164M/M164 (ASTM A325/A325M) bolts may be reused. There shall be no excessive elongation of the bolt in the threaded area. If the nut can be installed by hand for the full thread length, no excessive elongation is evident. Fastener assemblies that are found to be deformed due to improper installation or tightening shall be rejected and replaced at the Contractor's expense.

504.55 Field Welding Welders shall have in their possession a valid certification, for the process and position required, from the American Welding Society or other organization acceptable to the Fabrication Engineer.

A written Weld Procedure Specification (WPS) for each joint shall be submitted to the Fabrication Engineer for approval. The WPS shall be provided to the welder and Inspector before beginning welding.

Field welding and nondestructive examination of field welds shall conform to the requirements of the D 1.5 Code.

504.56 Misfits The correction of misfits involving reaming will be considered a legitimate part of steel erection. Errors in shop fabrication or deformation from handling and transportation which 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 Fabrication Engineer. The contractor shall provide a written proposal for correction to the Fabrication Engineer.

ANCILLARY BRIDGE PRODUCTS and SUPPORT STRUCTURES

504.57 Ancillary Bridge Products Ancillary bridge products are defined in Section 713.01. The fabrication of ancillary bridge products shall be in accordance with the D1.5 Code as applicable to ancillary bridge products and this Specification.

504.58 Support Structures Support structures shall be welded in accordance with the *AWS D1.1 Structural Welding Code* (the D1.1 Code). Support structures shall include, but not be

limited to, pedestrian bridges, high mast poles, sign supports, light and signal poles, dual purpose poles, strain poles, cantilever 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 A 709/A 709M) steel is specified for ancillary bridge products, equivalent ASTM grades of steel may be substituted. Materials for support structures shall be as specified in the Contract documents. CMTRs shall be provided for all steel products.

504.60 Holes for Base Plates Holes in base plates may be drilled or thermal cut at the Contractor's option. If thermal cut, the roughness shall not exceed the allowable tolerances in the D 1.1 Code. Deviation from specified dimension for thermal cut holes shall not exceed 2 mm [$^{1}/_{16}$ in] in any direction.

504.61 Bolted Connections Holes for bolted connections shall meet the requirements of Sections 504.34 and 504.35. High strength bolts shall be installed, tensioned and inspected in accordance with Sections 504.50 through 504.54.

504.62 Anchor Bolts Anchor bolts shall be as shown on the Plans, Standard Details or Specifications.

504.63 Support Structures Weld Procedure Specifications, welders and welding operators shall be qualified in accordance with the D1.1 Code.

Circumferential shop splices for poles shall be full penetration, butt welds. Welded longitudinal seams shall have 100 percent penetration for 150 mm [6 in] on either side of a shop splice, and for the splice length plus 150 mm [6 in] 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 percent of the wall thickness. Pole to base welds may be complete joint penetration welds or socket-type joints with two fillet welds. When complete joint penetration welds are used, the backing bar shall be removed after welding.

Before erection, the assembled shaft or structure shall not exhibit a sweep in excess of 0.2 percent of the nominal pole height or length, as measured with the pole or structure in a horizontal position.

Shafts or structures that do not conform to the sweep requirements shall be corrected with a method approved by the Fabrication Engineer.

504.64 Non Destructive Testing-Ancillary Bridge Products and Support Structures Unless otherwise specified, nondestructive testing shall be as follows:

1. Twenty five percent of each production lot shall be examined using Magnetic Particle (MT) inspection. The operator shall be qualified in accordance with the AWS D 1.1 Structural Welding Code. If any welds examined require a welded repair, an additional twenty five percent of the original lot number will be examined using MT. If any welds in the second twenty five percent require a welded repair, all welds in that production lot shall be tested 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 one week's production.

3. One hundred percent of all circumferential welds and the full penetration sections of the longitudinal seam welds shall be inspected by radiographic examination (RT). Ten percent of the partial penetration sections of the longitudinal seam welds shall be inspected by the magnetic particle method (MT). Ultrasonic testing may be used on material over 8 mm [5/16 in] thick with the approval of the Fabrication Engineer. Fillet and partial penetration welds connecting the upright to the horizontal members of cantilever or butterfly type sign support structures shall be one hundred percent tested by the magnetic particle method (MT).

4. Nondestructive testing shall be performed in the presence of the Fabrication Engineer.

504.65 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, rolled	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 threaded fasteners in accordance with the ANSI/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 Welded 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 120°C [250°F] for two hours prior to use.

The longitudinal spacing of shear connectors shall vary no more than +/- 25 mm [1 in] from that shown on the plans. The minimum edge distance shall be 50 mm [2 in].

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 -20°C [-4°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 Resident.

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. The studs shall be bent a minimum of 30° from their original axis with a hammer, pipe or other hollow device. If either stud fails the visual or bend test, the Contractor shall correct the procedure and weld two more studs to separate material representative of the grade and thickness of the material being welded in production. This procedure shall continue on separate plates until the Contractor has successfully welded two consecutive studs.

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, the weld area shall be ground flush. If base metal has been pulled out in the course of stud removal, the pocket shall be filled by welding in accordance with the field welding requirements of Section 504 - Structural Steel. The weld shall be ground flush. Base metal repairs in compression areas shall be the same as the repairs for tension areas except that if the depth of the pocket is less than 3 mm [⅛ in] it shall be faired out by grinding. Replacement studs shall be welded no closer than 25 mm [1 in] 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 30° from its original position in a direction away from the missing weld flash. Studs not developing a crack or tear will be considered acceptable. 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 - PAINTING STRUCTURAL STEEL

Reserved

SECTION 507 - RAILINGS

507.01 Description This work shall consist of the furnishing of all materials for, and the construction of, bridge rail, handrail, and barrier mounted bridge 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 Hand 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 5 mm [$^{3}/_{16}$ in] of 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 5 mm [$^{3}/_{16}$

in] of 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% in excess of the theoretical minimum number required. After erection of the railing, the Contractor shall clean the whole assembly, to present a neat and uniform appearance.

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 to the requirements of AASHTO M111 (ASTM A123) and/or coated in accordance with Special Provision 506 - Painting Structural Steel.

Rail bars to be used on a radius of 300 m [1 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 3 mm per meter [⅛ in/yd], not to exceed 12 mm [½ in], total.

507.06 Steel Pipe Hand Railing When called for on the plans, railings shall be galvanized to the requirements of AASHTO M111 (ASTM A123) and/or coated in accordance with Special Provision 506.

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 subpunched 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 Code-Aluminum D1.2. No welding shall be performed before the approval of the appropriate weld procedures. No field welding is permitted.

To facilitate bending, aluminum extrusions of Alloy 6061-T6 or 6351-T5 may be heated to a maximum temperature of 205°C [400°F] for a period of not more than thirty minutes.

Threaded fasteners shall conform to the requirements of ANSI Standard B1.13M, Class 6g for external and Class 6h for internal threads (ANSI Standard B 1.1, Class 2A for external and Class 2B for internal threads).

507.08 Method of Measurement Railing will be measured as one lump sum unit, fabricated, delivered, erected, and accepted.

507.09 Basis of Payment 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.

Payment will be made under:

Pay Item	Pay Unit

507.0811	Steel Bridge Railing, 2 Bar	Lump Sum
507.0821	Steel Bridge Railing, 3 Bar	Lump Sum
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 - MEMBRANE WATERPROOFING

508.01 Description This work shall consist of furnishing and applying an approved membrane waterproofing to concrete deck surfaces, or other concrete surfaces, with a barrier type membrane in accordance with this specification and in conformance with the plans. When high performance waterproofing membrane is specified, the Contractor shall furnish and install an approved high performance waterproofing membrane to the concrete deck with a pourable or heat welded membrane system applied in accordance with the plans, specifications, and the manufacturer's published recommendations.

508.02 Materials When high performance membrane is specified, the materials shall meet the requirements of the manufacturer and shall be one of the approved products on the Department's Prequalified List of Approved Materials for High Performance Waterproofing Membrane. All other membrane shall consist of an adhesive primer, preformed sheet waterproofing membrane, and a mastic with all components being as recommended by the manufacturer and approved by the Department as shown on the Prequalified List of Approved Barrier Membranes maintained by the Department.

508.04 General The Contractor shall store and install the membrane and all associated components in accordance with the manufacturer's published recommendations. Priming and membraning shall only be done when the air and concrete temperatures are above 6°C [40°F] and the surfaces that are to receive the primer and membrane have a moisture content at, or below, 6%. The moisture content will be checked with a "Sovereign Portable Electronic Moisture Master" meter, or an approved equal. Primer or membrane shall not be applied or installed until the concrete has been in place for a minimum of 10 days. Membrane waterproofing remaining on existing structures to be rehabilitated shall be completely removed to the primed surfaces. The entire deck shall be shot blasted to achieve an anchor profile which is clean of all foreign materials, such as oil or grease, and any sharp protrusions removed, and free of laitance. 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. Areas where rapid setting patching materials have been placed shall be cured for a minimum of 72 hours, or longer when recommended by the product manufacturer, prior to applying primer or installing membrane. All surfaces shall then be swept and cleaned by brooms and compressed air, as directed by the Resident.

The 25 mm [1 in] diameter drains in the deck shall be completely opened prior to paving over them. Any drainage slots in the metal roadway drains shall be opened both before and after placing the bituminous pavement.

Paving operations shall be done in a manner to permit water to drain to the low area of the deck without entrapment.

When a heat welded membrane system is used, it shall be machine applied when the surface area of the deck is greater than 750 m^2 [8,073 ft^2].

A manufacturer's representative shall be present during the placement of the high performance membrane and the paving of the binder course over it.

508.05 Installation This subsection only applies when High Performance Membrane is not specified.

A membrane sheet with a minimum width of 225 mm [9 in] shall be applied with termination ends at concrete faces, the top edge being within 13 mm [½ in] of the top of the bituminous pavement overlay. The first full sheet of membrane at the termination ends shall be applied as close as possible to the face lines.

Termination edges at the ends of slabs shall be double covered with membrane by first applying a sheet with a minimum width of 225 mm [9 in], centered along the axis of the edge, applied to the primed surface. All edges shall be chamfered and all inside corners filled with a mortar fillet.

All slab construction joints shall be double covered with membrane by first applying a sheet with a minimum width of 300 mm [12 in], centered along the joint centerline, applied to the primed surface.

Membrane shall be installed in a shingled pattern so that water is permitted to drain to the low areas of the deck without accumulating against seams, and pressed or rolled into place to assure bond with the primed surface and to eliminate air bubbles.

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.

No vehicles, other than the bituminous overlay equipment, will be permitted on the membrane prior to the bituminous overlay. Overlay equipment wheels and tires shall be clean and free from stones or other material that could penetrate the membrane. The bituminous overlay may be applied immediately after the membrane is installed.

Immediately prior to paving over the membrane, the entire surface of the membrane shall be rolled with a rubber tired roller and any air bubbles shall be eliminated by slitting the membrane

and forcing out the air. These slits, and any other ruptures found, shall be repaired by applying a membrane sheet that is at least 150 mm [6 in] wider than the slit or rupture, in all directions.

Overlap of side seams and end laps, application procedures not addressed by this specification, and the laydown temperature of the bituminous overlay shall be in accordance with the membrane manufacturer's published recommendations.

When primer is required for the membrane system it shall be allowed to cure in accordance with the manufacturer's published recommendations.

508.06 Method of Measurement Membrane waterproofing will be measured for payment as one lump sum.

508.07 Basis of Payment Membrane waterproofing will be paid for at the contract lump sum price, which shall be payment in full for furnishing all materials, labor and equipment, including moisture meter, and all incidentals necessary to satisfactorily complete the work. Payment for repair of surfaces to which membrane is to be applied shall be paid for separately, except that 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	Membrane Waterproofing	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 meter [bolts/ft] 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, 50 mm [2 in] apart for steel structural plates and shall be in 2 rows, 44 mm [1¾ in] 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 that 300 mm [12 in] 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 3 mm [⅛ in] greater that the diameter of the bolts.

509.06 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 275 N-m [200 ft/lb] plus or minus 125 N-m [100 ft/lb] of torque. Aluminum nuts, used with aluminum structural plate structures, shall be tightened to 170 N-m [125 ft/lb] plus or minus 13.5 N-m [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 six 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 13 mm [½ in] 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 0.013 mm [0.005 in] over the damaged sections and surrounding cleaned areas.

The Contractor shall maintain a minimum cover of 1 m [3 ft] over the top of the structure where construction equipment is used or traffic is maintained.

509.07 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 no frozen material, vegetable matter nor anything that will not pass through a 75 mm [3 in] square opening screen. The 75 mm [3 in] size limitation shall not apply to areas 1.5 m [5 ft] or more from the structure.

Fill material shall be deposited evenly on both sides of the structure in layers not exceeding 150 mm [6 in] 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 200 mm [8 in], loose measure. Backfilling and compacting shall be done in the presence of the Resident.

509.08 Structural Plate Arches Structural plate arches shall be anchored to 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 1 m [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.

509.10 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. 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.

509.11 Method of Measurement Structural plate pipe, pipe arches, arches and plate box culverts will be measured as one lump sum.

509.12 Basis of Payment The accepted structure will be paid for at the respective Contract lump sum price, which price shall include full compensation for preparation of the bed for pipes and pipe arches; the asphalt filler and unbalanced channel for arches; the horizontal end reinforcing ribs for aluminum alloy structural plate pipe and pipe arches; the headwalls, wingwalls, toewalls, full metal invert and/or footing pads for metal box culverts; anchor bolts imbedded in concrete; the receiving channels for metal box culverts on concrete substructures; and all incidental items required to complete the work, including 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	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	Structural Plate Pipe	Lump Sum
509.19	Aluminum Alloy Structural Plate Pipe Arch	Lump Sum
509.20	Aluminum Alloy Structural Plate Arch	Lump Sum
509.21	Structural Plate Pipe (Steel or Aluminum Alloy Option)	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. The Contractor may obtain additional easements at no cost to the Department.

510.02 Materials Materials used for the Special Detour structure and approaches shall be approved by the Resident before they are incorporated in the structure and approaches.

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.

Design and details for the Special Detour shall be furnished to the Resident by the Contractor. The Special Detour including the temporary structure shall be designed and sealed by a Professional Engineer, registered in accordance with the laws of the State of Maine.

The Contractor shall submit detailed plans of the temporary structure and approaches and obtain approval of the Resident before construction. These plans shall be provided in accordance with, and subject to, the conditions of Section 105.7 - Working Drawings. In addition, the design computations relating to the temporary structure shall be submitted for review by the Resident.

Temporary structures shall be designed in accordance with current AASHTO Standard Specifications for Highway Bridges, except as noted herein, to meet live load requirements of MS18 [HS20]. References to Main Load Carrying Members shall mean those members in which the major stresses result from dead load or live load, or both. Secondary Members are those members whose primary purpose is to brace the structure against lateral or longitudinal force, or to brace or reduce the unbraced length of main members, or secondary members.

a. Structural Steel Allowable working stresses for tension, compression, and shear in Main Load Carrying Members and Secondary Members and in Steel Grid Floor or Deck as given in the AASHTO Standard Specifications may be increased 35% except where age or condition of the steel to be incorporated in the temporary structure may be cause for reduced allowable working stresses. Fatigue stresses need not be considered.

b. Deflections Primary structural members shall be designed so that deflection due to live load plus impact shall not exceed 1/300 of the span.

c. Reinforced Concrete Allowable working stresses for concrete in compression (f_c) and reinforcing steel in tension (f_s) may be increased 50% for main load carrying members and floor slabs. Allowable stress in compression for concrete (f_c) shall be limited to the lesser value of 0.6 f_c or 12 MPa [1800 psi].

d. Timber Allowable working stresses for extreme fiber in bending ("F_b") and horizontal shear ("F_v") may be increased by 50% for use as main load carrying members, secondary members, floor or curb provided that material incorporated in the structure is sound and not subject to excessive checks, splits, knots or other deterioration.

e. Bridge Railing Loads Bridge railing shall be designed in accordance with AASHTO Specifications, except that the static design load "P" specified as 44.5 kN [10 kips] may be decreased to 22.3 kN [5 kips]. However, allowable design stresses for material used in bridge rails and posts shall not be increased above those allowed by AASHTO Specifications.

f. Waterway Opening The minimum waterway opening of the temporary structure shall be designed to pass the discharge indicated in the Contract Specifications, without any overtopping of the roadway.

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 60 m [200 feet] at the centerline of roadway, except as approved by the Resident.

Roadway width as indicated in the proposal shall be the minimum clear traveled width between faces of bridge curbs. Bridge curb shall be between 150 mm and 225 mm [6 in and 9 in] high. The roadway face of bridge rail shall be located 75 mm to 150 mm [3 in to 6 in] behind the face of curb. The approach roadway shall have minimum 600 mm [2 ft] shoulders to the roadway berms or to the face of approach road guardrail in addition to the roadway width indicated in the proposal.

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 Table III - 20, Case I or Case III of the AASHTO Specification.

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 where side slopes are steeper than three horizontal to one vertical. Approach guardrail shall be attached to the bridge guardrail in a manner that develops the approach guardrail in tension. Approach guardrail shall consist of Type 3 guardrail or an approved equal unless other rail or barriers are specified.

The termination of approach guardrail and the end treatment of the rail shall be in accordance with the current AASHTO Roadside Design Guide.

d. Approach Road Base Drainage The approach road base structure shall consist of a minimum of 300 mm [1 ft] thick layer of aggregate subbase course gravel, Type D or E and the layer shall be designed to support legal loads during the use of the detour. Drainage shall be designed to drain the approach area.

e. Approach Road Surface The approach surface shall be approved gravel, except when specified to be paved, and shall be maintained in a compacted and smooth condition.

f. 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 specification.

510.041 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 4 kN/m² [85 lb/ft²].
b. The detour shall have a minimum clear width of 1.50 m [5 ft] or as specified on the contract plans or specifications.
c. Ramps shall be provided to allow access to wheelchair or handicapped persons.
d. Deflections due to live load shall not exceed 1/300 of the span.

510.042 Vehicular and Pedestrian Traffic Separated The provisions of both Section 510.03 - Vehicular and Pedestrian Traffic Not Separated, and Section 510.041 - 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 225 mm [9 in] above the roadway surface or suitably protected by means of an adequate curb at least 225 mm [9 in] in height above the roadway surface. No bridge rail will be required between vehicle traffic and pedestrian traffic, but shall be located at the exterior side of the sidewalk.

510.051 Vehicular and Pedestrian Traffic Not Separated The Special Detour, including temporary structures shall be constructed in accordance with the plans submitted by the Contractor and approved by the Resident. Barricades, warning signs, lights and other traffic control devices shall be provided in accordance with the project traffic control plan requirements.

Deck and floor members shall be fastened or anchored so that all contact surfaces with adjacent supporting members bear continuously. Immediate corrective action shall be taken by the Contractor to remedy any condition in the structure that results in objectionable or distractive noise levels when subject to traffic loads.

If a wood plank deck is used, it shall be secured into wood nailer strips, or secured by an alternate method acceptable to the Resident.

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 approved design plans and these specifications.

Prior to opening the temporary structure to traffic, the Professional Engineer responsible for the design shall certify in writing to the Department that the structure was constructed in conformance with the approved plans and design details.

510.052 Pedestrian Traffic Only The provisions of Section 510.051 - Vehicular and Pedestrian Traffic Not Separated, shall apply, however, screw type nails will not be required to anchor wood plank for pedestrian traffic use.

510.053 Vehicular and Pedestrian Traffic Separated The provisions of both Section 510.051 - Vehicular and Pedestrian Traffic Not Separated, and Section 510.052 - Pedestrian Traffic Only, shall apply.

510.06 Contractor's Responsibility The provisions of Section 104 - General Rights and Responsibilities, Section 105 - General Scope of Work, Section 107 - Time, and Section 652 - Maintenance of Traffic, shall apply to work under this section. The Contractor shall be responsible for removal of snow from areas provided for pedestrian traffic as well as vehicular traffic in accordance with Section 104 - General Rights and Responsibilities. In addition to normal maintenance, should any part or all of the detour be damaged or destroyed by high water or any other cause prior to opening the highway to traffic, it shall be repaired or replaced by the Contractor without additional compensation.

Erosion control shall be accomplished in accordance with Section 656 - Temporary Soil Erosion and Water Pollution Control. An Erosion Control Plan shall be submitted for approval by the Resident with the plans and details of the detour.

510.07 Removal of Detour When the highway has been opened to traffic, the temporary structure and approaches shall be removed to or below the streambed or finish ground line and the approaches shall be obliterated and stabilized to original or better than original conditions. The provisions of Section 104 - General Rights and Responsibilities, shall apply.

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, designed, constructed, maintained, completely removed and the affected areas rehabilitated and stabilized, including loaming, seeding and mulching.

When erosion control is required due to runoff from the detour roadway surface, erosion control will be paid under applicable contract items. Other erosion control work required for the special detour will not be paid for directly and all costs for such erosion control will be considered included in the lump sum payment for special detour. Traffic control devices, pavement, and dust control will be paid for under the applicable contract items.

Payment will be made under:

Pay Item	Pay Unit

510.10	Special Detour, ___ meter [foot] Roadway Width Vehicular and Pedestrian Traffic Not Separated	Lump Sum
510.11	Special Detour, Pedestrian Traffic Only	Lump Sum
510.12	Special Detour, ___ meter [foot] Roadway Width Vehicular and Pedestrian Traffic Separated	Lump Sum

SECTION 511 - COFFERDAMS

511.01 Description This work shall consist of the complete construction, maintenance and removal of all cofferdams, caissons, cribs and sheeting, and other related work, including dewatering, required to allow for the excavation of foundation pits and to permit and protect the construction of structural units, in accordance with these specifications.

511.02 Materials If requested, the Contractor shall submit for approval, plans showing the materials to be used and the proposed method of protecting the foundation construction. Construction shall not be started on cofferdams until such plans are approved. Approval of the plans shall not relieve the Contractor of the responsibility for the satisfactory functioning of the cofferdam.

511.03 Cofferdam Construction Cofferdams shall, in general, be carried well below the elevation of the bottom of footings, and shall be well braced and as watertight as necessary for the proper construction of the foundation. Unless it is contemplated that a concrete foundation seal will be placed under water, the interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction and inspection of forms and to permit pumping outside of forms. Cofferdams shall be so constructed that sea water will not come in contact with concrete, as required in Section 502 - Structural Concrete.

During the placing of seal concrete, the elevation of the water inside the cofferdam shall be controlled to prevent any flow through the concrete.

No timber or bracing shall be used in cofferdams or cribs in such a way as to remain in the substructure masonry.

Cofferdams shall be constructed to protect fresh concrete against damage from the sudden rising of the waterbody and to prevent damage by erosion.

Unless otherwise provided, cofferdams or cribs, including all sheeting and bracing involved, shall be removed after the completion of the substructure, care being taken not to disturb or otherwise injure the finished masonry.

511.04 Pumping Pumping from the interior of any foundation enclosure 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, but in no case will pumping be permitted until a minimum of 5 days has elapsed since the completion of the installation of the seal concrete, when the temperature of the waterbody outside the cofferdam is greater than 4°C [40°F], or a minimum of 7 days has elapsed since the completion of the installation of the seal concrete, when the temperature of the waterbody outside the cofferdam is less than 4°C [40°F].

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 accompanied Special Provision.

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.

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 1 m [3 ft] below the elevation shown on the plans, and if requested by the Contractor, then the entire cost of the cofferdam will be paid for in accordance with Section 109.7 - Equitable Adjustments to Compensation, instead of at the contract lump sum price.

All costs of constructing, maintaining, and removing a sedimentation basin, and pumping or transporting water and other materials to the sedimentation basin will not be paid for directly, but will be considered incidental to the cofferdam pay item(s).

All costs of 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).

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 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 Stones shall be placed behind and against the structures with the bottom of the stones at the elevation of the flow line of the weeper drains. The stones shall form a box section, 600 mm [2 ft] wide and 600 mm [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 stones, to the limits of 600 mm [2 ft] above the stones, 600 mm [2 ft] behind the stones and 600 mm [2 ft] below the stones, 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 brooming lightly and uniformly with 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, except that the curing period will be 5 days.

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 meters [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 meter [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 meter [Square Yard]
513.22	Crushed Stone Slope Protection	square meter [Square Yard]

SECTION 514 - CURING BOX FOR CONCRETE CYLINDERS

514.01 Description This item shall consist of furnishing, installing, operating, and maintaining an approved thermostatically controlled curing box for concrete test cylinders, with the equipment as herein specified.

514.02 General The curing box shall be for the sole use of the Resident for the duration of the contract. The Contractor shall relocate the curing box to a new location, as directed, whenever considered necessary during the progress of the work. The Contractor shall furnish and maintain the electrical power and all utility connections necessary for the operation of the curing box. The Contractor shall monitor and maintain the internal temperature and water level of the box. The Resident shall be provided 2 locks, each with 2 keys, to be used with the 2 securing latches. A lock for the switch box, with 2 keys shall be furnished.

514.03 Construction Details The curing box for 150 mm [6 in] diameter by 300 mm [12 in] long concrete cylinders shall have dimensions sufficient to allow storage of a minimum of 18 cylinders. The top of the curing box shall be a lid hinged at the back with at least 2 securing latches on the front suitable for sealing and locking the curing box. The free movement of the lid shall be restricted to an angle of approximately 100º from the closed position to an open position. For metal boxes subject to corrosion, all interior surfaces shall have rustproof protection and the exterior surfaces shall be substantially painted with an approved paint. A moisture-proof seal, constructed of an approved cellular strip of 2BE520F26 synthetic rubber complying with the requirements of ASTM D2000, shall be provided between the lid and body of the curing box.

The curing box shall be constructed so that the required temperature and humidity within the box can be maintained using an immersible 1000 watt (minimum) heating element, when the heating element is immersed in water, approximately 100 mm [4 in] 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. A drain shall be provided for the water, located at the lower front edge of the box. Access shall be provided to all parts of the box for cleaning. 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.

All electrical connections from the curing box to the utility connection shall conform to the latest requirements of the NEC. The curing box shall be effectively grounded. Grounding shall be accomplished in one of the following ways:

a. By means of a grounding conductor run with the circuit conductors in cable assemblies or flexible cords, provided an approved plug is used, 1 fixed contacting member for the purpose of connecting such grounding conductor to the grounded metal raceway or to a grounding conductor installed only for equipment grounding purposes; the grounding conductor in a cable assembly may be uninsulated but, where an individual covering is provided for such conductors, it shall be finished to show a green color.

b. A direct connection from the grounding wire (green color) on the Curing Box wiring to a 2.4 m [8 ft] non-ferrous metal driven ground rod and ground rod clamp.

For installation, where the Curing Box is outside and exposed to the weather, all wiring and fittings shall be of the weatherproof type.

An approved bimetallic thermometer shall be installed that will measure the internal temperature of the curing box. The thermometer shall have minimum gradations of 1°C [2°F] and a minimum face diameter of 75 mm [3 in], open to the outside. The thermometer shall be easily read from a distance and shall be protected from physical damage by suitable shielding. Substantial folding handles shall be provided on the end of the box for use in moving.

The curing box shall be suitable for maintaining an internal temperature of 21°C [70°F] plus or minus 3°C [5°F] when the ambient temperature is as low as -23°C [-10°F].

514.04 Method of Measurement Curing box for concrete cylinders will be measured by each unit, furnished and satisfactorily maintained.

514.05 Basis of Payment The accepted quantity of curing box for concrete cylinders will be paid for at the contract unit price each, which payment shall be full compensation for furnishing and maintaining, for all materials, labor, tools, equipment, electrical power, temporary utility changes and adjustments, and all necessary incidentals. At the completion of the contract, the Curing Box shall remain the property of the Contractor and shall be removed from the site of the work.

Payment will be made under:

Pay Item		Pay Unit
514.06	Curing Box for Concrete Cylinders	Each

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.

515.02 Materials Materials shall meet the requirements of Section 711.05, Protective Coating for Concrete Surfaces.

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 and dust. All traces of dust shall be removed immediately before applying the linseed oil mixture.

The treatment shall not be done until at least 14 days after casting the concrete and completed at least 24 hours before the treated portion is opened to traffic.

515.04 Application Enough material shall be used to coat the surfaces thoroughly. Two coatings shall be applied 24 hours or more apart. The minimum rates of application shall be 0.10 L/m² [.025 gal/yd²] for the first coat and 0.07 L/m² [.015 gal/yd²] for the second coat.

The method of application may be dependent on available equipment and the area involved. Hand spray methods or pressure distributors may be used and application by rollers or brushes may be desirable under some conditions. Care shall be taken to prevent discoloration of areas and parts not requiring treatment.

Twenty-four hours after application, excess coating materials, if any, must be removed.

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 4°C [40°F] at the time of application.

515.05 Method of Measurement Protective coating for concrete surfaces will be measured for payment by the square meter [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 meter [square yard] or lump sum as specified.

Payment will be made under:

Pay Item		Pay Unit
515.20	Protective Coating for Concrete Surface	square meter [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 substructure and superstructure 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 by sandblasting and/or wire brushing, and placing 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%. Vertical surfaces are defined as any concrete surfaces where the slope is between 15% and zero % (plumb), and where the surface is between a slope of zero % (plumb) and is overhanging up to a maximum of 15% from plumb. All other concrete surfaces will be considered overhead surfaces.

518.03 Repair Materials A patching material from the Maine Department of Transportation's list of Prequalified Patching Materials may be used instead of concrete for any depth of placement at the Contractor's option, provided 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 less than 25 mm [1 in], the repair material used shall be one of the products listed on the Maine Department of Transportation's list of Prequalified Patching Materials.

Where the depth of placement is equal to or greater than 25 mm [1 in], 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	25 - 75 mm [1 - 3 in]	75 - 150 mm [3 - 6 in]	> 150 mm [> 6 in]
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

Coarse Aggregate Gradation Designation	Sieve Designation Percent By Weight Passing a Square Mesh Sieve							
	19 mm [¾ in]	12.5 mm [½ in]	9.5 mm [⅜ in]	4.75 mm [No. 4]	2.36 mm [No. 8]	1.18 mm [No. 16]	300 µm [No. 50]	75 µm [No.200]
SP-1-7	100	90-100	40-70	0-15	0-5	-	-	0-1.5
SP-1-78	100	90-100	40-75	5-25	0-10	0-5	-	0-1.5
SP-2-8		100	85-100	10-30	0-10	0-5	-	0-1.5
SP-2-89		100	90-100	20-55	5-30	0-10	0-5	0-1.5

1. 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 Prequalified Patching Materials 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 Concrete Slabs or Repair of Upward Facing Surfaces the bonding grout shall have portland cement and fine aggregate proportioned 1 to 1 by volume. The fine aggregate shall be from the same source as that used in the repair concrete. All material greater than 3 mm [⅛ in] 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. The Contractor may opt to apply a bonding agent from the Maine Department of Transportation's List of Prequalified Bonding Agents in accordance with the published manufacturer's recommendations.

   b) For Repair of Vertical and Overhead Surfaces the Contractor shall apply a bonding agent selected from the Maine Department of Transportation's List of Prequalified Bonding Agents in accordance with the published manufacturer's 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 15 mm [⅝ in], 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 16 kilograms [35 lbs] 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.

For Repair of Upward Facing Surfaces, 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 Prequalified Patching Material is used.

c) To the minimum depths indicated in the Thickness of Placement Table, when concrete is used, depending on the coarse aggregate gradation.

d) Minimum depth of 25 mm [1 in] behind reinforcing steel when reinforcing is exposed or encountered.

For Repair of Vertical and Overhead Surfaces, deteriorated concrete shall be removed to one of the following depths, whichever is greatest:

a) Sound substrate

b) Minimum depth of 40 mm [1 ⅝ in] behind reinforcing steel

518.04 Reinforcing Steel All existing reinforcing steel exposed by concrete removal, which is to remain in the bridge, shall be cleaned of all loose rust by sand blasting, wire brushing or by machine wire brushing. Where reinforcing steel is to remain in the bridge, 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 percent or more of the original cross sectional area shall be supplemented with reinforcing steel of the same diameter. Supplementary reinforcing steel shall be lapped 30 bar diameters and 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. 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

1. When bonding grout is used on repair of upward facing surfaces the following shall apply, except that, in the case where Prequalified 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 3mm [⅛ in] 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.

2. When a bonding agent from the Maine Department of Transportation's List of Prequalified Bonding Agents is used, the bonding agent shall be applied in accordance with the published manufacturer's recommendations.

518.07 Placing Repair Materials When concrete is used as the repair material the provisions of Section 502 of the shall apply. Additionally, concrete shall not be placed when either the ambient air temperature or the existing concrete temperature is below 7 °C [45 °F]. All repair concrete, regardless of quantity, shall be considered Method B unless designated otherwise in the Special Provisions. When a patching material is used, the Contractor shall follow the published manufacturer's 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. Curing compounds will not be allowed. Patching materials shall be cured in accordance with the published manufacturer's 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 200 mm [7.9 in] in depth and repair areas 200 mm [7.9 in] 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 200 mm [7.9 in], or 200 mm [7.9 in] or greater.

Concrete repair will be measured for payment by the square meter [square yard] of all surfaces repaired where the average depth of repair is less than 200 mm [7.9 in], complete and accepted.

Concrete repair will be measured for payment by the cubic meter [cubic yard] for all repairs where the average depth of repair is 200 mm [7.9 in] or greater, complete and accepted. The quantity will be determined by the yield or truck count, in accordance with Section 502.18.

Supplementary reinforcing steel will be measured for payment by the kilograms of steel installed and paid for under item 503.12, Reinforcing Steel, Fabricated and Delivered, and Item 503.13 Reinforcing, Placing, except that Reinforcing Steel, Placing, will be measured for payment as 1.5 times the actual number of kilograms [pounds] placed.

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.

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.

Payment for the removal of concrete and the furnishing and placing of new concrete, or other designated repair material, in areas where concrete is removed, will be included in the unit price for the respective concrete repair items.

The cleaning of existing reinforcing steel to remain in the structure shall be incidental to related contract items.

The satisfactory disposal of all removed materials shall be considered as incidental to related contract items.

Payment for furnishing and installing bonding material shall be considered incidental to related contract items.

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 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, for all formwork, and for 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, < 200 mm [7.9 in]	M^2 [Square Foot]
518.51 Repair of Upward Facing Surfaces - below Reinforcing Steel, < 200 mm [7.9 in]	M^2 [Square Foot]
518.52 Repair of Upward Facing Surfaces-≥ 200 mm [7.9 in]	M^3 [Cubic Yard]
518.60 Repair of Vertical Surfaces < 200 mm [7.9 in]	M^2 [Square Foot]
518.61 Repair of Vertical Surfaces ≥ 200 mm [7.9 in]	M^3 [Cubic Yard]
518.70 Repair of Overhead Surfaces < 200 mm [7.9 in]	M^2 [Square Foot]
518.71 Repair of Overhead Surfaces ≥ 200 mm [7.9 in]	M^3 [Cubic Yard]

SECTION 519 - VACANT

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 and in accordance with these specifications.

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	
Anchor Studs	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	
Anchor Studs	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 Maine Department of Transportation Prequalified List of Approved Products. (See www.state.me.us/mdot/planning/product).

Acceptance of the materials for Expansion Devices will be based on a Materials Certification Letter as specified in Division 700 - Materials.

520.03 Fabrication All work shall conform to the applicable provisions of Section 504- Structural Steel.

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 15 m [50 ft] or greater. Sections under 15 m [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 Coating 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 shop, to the opening required at 7°C [45°F].

520.06 Installation Expansion Devices shall be erected following placement of the structural deck slab. The devices shall be lowered in the blocked-out area of the deck slab, adjusted for the temperature as directed by the Resident, set to the proper height and fastened in place, in accordance with the Standard Details. Immediately following this, all shipping and temperature adjustment devices shall be removed and the blocked-out concrete for the slab and abutment backwall may be placed.

Seal elements shall be installed in accordance with the manufacturer's recommendations, using equipment manufactured specifically for the installation of said element. 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.

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. 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/A786M, ASTM A36/A36M. Other plates shall conform to the requirements of ASTM A36/A36M or ASTM A572/A572M. Shapes shall conform to the requirements of ASTM A500, Grades A and B, or ASTM A992/A992M. 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 M169/M169M (ASTM A325/A325M).

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 M111 (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 3 mm to 5 mm [⅛ in to $^{3}/_{16}$ in] in thickness and shall consist of a single layer of 415 g [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	13.8 MPa [2,000 psi]
ASTM D412	
Elongation at Break, Minimum Accelerated	300%
Test to Determine Long Term Aging Characteristics	
Oven Aged - 70 Hours/100ºC [70 Hours/212ºF]	
ASTM D573	
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
38 +/- 1ºC [100 +/- 2ºF] - ASTM D1149*	100 hours
(*Samples shall be solvent wiped before test to remove any traces of surface impurities.)	
Compression Set - 22 Hours/100ºC [22 Hours/212ºF]	
ASTM D395 - Method B, 0/0 Maximum	35%

ASTM D746 - Procedure B	-40ºC [-40ºF]
Brittleness at No Failure	
Fluid Resistance - ASTM D471	
70 Hours/100ºC [70 Hours/212ºF] in ASTM Oil No. 3	
Change in volume, Maximum	+120%
Change in tensile strength, Maximum	-70%
Change in ultimate elongation, Maximum	-55%

The finished fabric shall have a minimum breaking strength of 120 N/mm [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. The Contractor shall furnish a Materials Certification Letter for each lot in accordance with Division 700 - Materials.

Not less than thirty days prior to the installation of the trough, a sample length of each lot of fabric, not less than 1 m [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 free of cost. Approval of the material must be obtained before the material is incorporated in the work.

521.05 Fabrication The Contractor shall submit working drawings to the Fabrication Engineer for approval 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 stage 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 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 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 and labor incidentals thereto.

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

522.011 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.

522.012 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 Adhesives	714.03
Gland Type Seals	714.06

All steel divider bars, end channels and support bars shall conform to the requirements of ASTM A572/A572M Grade 345 [Grade 50] Steel. Other steel plates shall conform to the requirements of ASTM A36/A36M or ASTM A572/A572M. Shapes shall conform to the requirements of ASTM A500, Grades A and B, or ASTM A992/A992M. 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 M111 (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.

522.013 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 on the design drawings.

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 scissors 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 12 mm [½ in], and the maximum joint opening shall be 89 mm [3½ in].

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.

522.014 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 ultrasonic tested. Twenty-five percent of fillet welds and partial penetration welds shall be inspected by magnetic particle. 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 75 μm to 120 μm [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 to the published manufacturer's 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 7°C [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 at the direction of the Resident, in the field, prior to the final concrete placement.

522.015 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 design drawings or approved by the Fabrication Engineer before shop fabrication.

522.016 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 design drawings.

522.017 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.

522.018 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
PTFE	711.13
Structural Steel	713.01
Preformed Pads	713.03

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. The drawings will be reviewed and approved in accordance with the applicable requirements of Section 105.7. Changes and revisions to the approved working drawings shall require further approval by the Fabrication Engineer.

523.04 General Requirements Requirements for the type of bearing furnished are as follows:

Steel Bearings	Sections 523.10 thru 523.19
Elastomeric Bearings	Sections 523.20 thru 523.29
Pot or Disc Bearings	Sections 523.30 thru 523.39
Spherical Bearings	Sections 523.40 thru 523.49

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.

523.05 Fabrication Steel fabrication work, for all types of bearings, shall comply with Section 504 - Structural Steel.

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 (Q.C.) is the responsibility of the Contractor. The Quality Control Inspector (Q.C.I.) shall inspect all aspects of the work and shall supervise all testing. The Q.C.I. shall record measurements and test results in a Job Control Record (JCR). The Q.C.I. 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 (Q.A.I.).

Quality Assurance (Q.A.) is the prerogative of the Fabrication Engineer. The Q.A.I. will ensure that the Contractor's Q.C. is performing properly, verify documentation, periodically inspect workmanship and witness testing. Q.A. 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 Bearings Bearings shall be placed upon bridge seats that are properly finished. Bridge seat elevations shall be within ± 6 mm [¼ in] of the elevation shown on the plans and the differential elevation between any tow adjacent bearing areas shall not exceed ± 10 mm [⅜ in] than that shown on the plans.

When the bearings are to be set directly on the concrete bridge seats, as indicated on the plans, the bridge seats shall be dressed 25 mm [1 in] 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 50 mm [2 in] wide and with a minimum slope of 4 percent, 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.

523.09.1 Anchor Rods The contractor shall drill the holes and set the anchor rods with an Anchoring Material from the Department's Pre-qualified List. The anchor rods shall be accurately set with an approved two part high-strength epoxy mortar. The epoxy mortar shall completely fill the holes. Anchor bolts shall be capable of developing unconfined pullout strength of 120 kN and 280 kN (30 kips and 70 kips) for M24 and M36 (1 in and 1 ½ in) anchor bolts respectively.

The Department reserves the right to perform in-place pullout tests. Bolts failing to meet the pullout strength requirements shall be replaced at the Contractor's expense.

523.09.2 Grout Pads When the bearings are to be set on a grout pad, the grout shall be composed of one part of Portland cement, Type I or II, to two parts fine aggregate by weight with non-shrink admixture, approved by the resident, well mixed with sufficient water to produce proper consistency.

The grout shall have a minimum compressive strength of 27.5 MPa [4000 psi] at 28 days. A sufficient quantity of the grout materials, including admixtures, and the design composition shall be submitted to the Resident for testing 60 days prior to placement.

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.

523.09.3 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.

523.09.4 Final Adjustment Bearings shall not be welded in place until the deck is in place and dead load deflection(s) of the superstructure has occurred. Final adjustment of the bearings for temperature shall be made after dead load deflection of the superstructure has taken place. Welding of the sole plate to the 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 7ºC [45º F]. When determining temperature adjustments for bearings, the difference between the steel temperature (not the ambient temperature) and 7ºC [45º 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 place, the lower of double nuts shall be left loose, bring to contact and loosen approximately ¼ turn, to allow movement of the sole plate.

STEEL BEARINGS

523.10 Steel Bearings Structural steel bearings, pedestal type, rocker type, 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.

523.11 Materials Materials shall conform to Section 523.02 - Materials.

ELASTOMERIC BEARINGS

523.20 Description Two types of bearings are applicable for the following Sections; 1) Laminated Elastomeric Bearings consist of layers of elastomer laminated to steel plates and 2) Plain Elastomeric Bearings 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 contract drawings, 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.

Shear modulus tests shall be carried out using the apparatus and procedure described in Annex A of the ASTM D4014 specifications.

Flash tolerance, finish, and appearance shall meet the requirements of the latest edition of the Rubber Handbook as published by the Rubber Manufacturers Association, Inc., RMA F3 and T.063 for molded bearings and RMA F2 for extruded bearings.

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 5 μm [250 mils] finish. Steel laminates shall be abrasive blast cleaned to an SSPC SP-6 and protected from contamination.

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 6.9 N/mm [39.4 lb/in]. Peel strength tests shall be performed by ASTM D429, Method B. The shear modulus of the material shall be tested at 23^{o}C [74^{o}F] using the apparatus and procedure described in Annex A of the ASTM Specifications. In lieu of performing a shear modulus test for each batch of material, the manufacturer may elect to provide certificates from tests performed, on identical formulations, within the preceding year.

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 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 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 2 mm [0.079 in] wide and 2 mm [0.079 in] deep exists.

5. Long-Duration Compression Tests on Bearings (This test is required on 10% of each type and size of bearing furnished.)

The long-term compression test shall be performed as specified in section 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 occurs, 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 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 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.

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 other than those given on the plans 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 shop drawings.

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 bolts.

The bearings shall be designed to accommodate a rotation of not less than 0.015 radians.

The static coefficient of friction between the polytetrafluoroethylene (PTFE) and the stainless steel surface, for each size and type of bearing, shall not exceed 0.04 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 elastomeric discs shall be designed to meet the following:

1. The minimum thickness shall be $^{1}/_{15}$ of the diameter.

2. The average unit pressure shall be 24.1 MPa [3500 psi], -0%, +10%, for the maximum vertical load indicated on the plans.

3. The average unit pressure shall not be less than 4.8 MPa [700 psi] for the minimum vertical load indicated on the plans.

4. When utilizing flat brass sealing rings, the upper edge of the discs shall be recessed to receive the brass rings.

5. A PTFE sheet, filled or unfilled, 1.6 mm [$^{1}/_{16}$ in] 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 2.5 mm [0.1 in] 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 3 mm [⅛ in] minimum depth recess in the steel masonry plate or distribution plate and shall be capable of being removed for inspection and repairs.

The piston shall be designed to meet the following:

1. The outside diameter shall be 0.76 mm [0.03 in] 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, 1.6 mm [$^{1}/_{16}$ in] minimum thickness and the same diameter as the bottom surface of the piston, shall be bonded to the bottom surface of the piston.

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 10 mm [⅜ in] minimum with bearings up to a 4450 kN [1000 kip] capacity and a 13 mm [½ in] width with bearings over a 4450 kN [1000 kip] capacity.

b. Have a minimum thickness of 1.3 mm [.050 in].

c. Have two rings with a bearing capacity up to 4450 kN [1000 kip], three rings with a bearing capacity over 4450 kN [1000 kip], but less than 13,500 kN [3000 kip], and four rings with a bearing capacity of over 13,500 kN [3000 kip].

d. Have the ends cut at 45° with a minimum gap in the installed position of 1.27 mm [.050 in] 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.

The PTFE sliding surface shall be designed to meet the following:

1. The average unit pressure shall be 24.1 MPa [3500 psi], -5%, +0%, for the maximum vertical load indicated on the plans.

2. Unfilled PTFE shall have a minimum thickness of 3.2 mm [⅛ in] with half of its thickness recessed into the piston.

3. Filled PTFE shall be a minimum of 1.6 mm [$^{1}/_{16}$ in] 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 2.4 mm [$^{3}/_{32}$ in], except, if recessed it shall be 4.8 mm [$^{3}/_{16}$ in].

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 25 mm [1 in] edge clearance beyond the PTFE.

2. The thickness shall be not less than 1.02 mm [.040 in] nor greater than 2.29 mm [.090 in].

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 3.2 mm [⅛ in] less than the clear width of the keyway in the guided member.

4. A PTFE sheet, 1.6 mm [$^{1}/_{16}$ in] minimum thickness shall be bonded to the sliding contact surfaces of the guide bars. The sheets shall be filled PTFE.

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.

Elastomer shall have a Shore A hardness of 50 or 60 DURO.

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 shall remain in 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 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 6 mm [¼ in] bead of a flexible silicone rubber sealing compound approved by the Fabrication Engineer.

Each bearing shall have permanent match marks to indicate the neutral 7°C [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 523.04 - General Requirements, and as noted below.

Brass sealing rings shall have finished surfaces of less than 1.6 μm [63 mils] (ANSI B 46.1).

523.34 Protective Coating All structural steel, except surfaces bonded to PTFE and stainless steel surfaces, shall be zinc metalized in accordance with Section 506 - Protective Coating. Thickness shall be 0.20 mm [8 mils] on exterior surfaces and 0.05 mm [2 mils] on interior surfaces.

523.35 Testing and Certification The manufacturer of the pot bearings shall furnish test facilities for testing and inspection of the completed bearings in their plant or at an independent test facility approved by the Fabrication Engineer. The Fabrication Engineer or their 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 24 MPa [3500 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 one 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 reviewed by the Fabrication Engineer.

523.40 thru 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 support(s) shall be designed by a registered Professional Engineer and all plans, computations, and working drawings shall be signed by that Engineer, and shall be submitted to the Resident for approval.

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.

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) without the prior approval of the Resident.

No loads shall be placed on temporary supports which are adjacent to traveled ways or which support structures carrying traffic unless the Engineer responsible for the design has certified to the Resident that the system was erected in conformance with the approved plans and design details.

The approval by the Resident of all or part of temporary support(s) shall not be construed as in any way relieving the Contractor of their responsibility and the work shall be entirely at the Contractor's risk.

Upon completing the work requiring the use of the temporary structural supports, they shall be removed and the area under and around the temporary structural supports shall be restored to its original condition.

524.28 Method of Measurement Temporary structural supports will be measured as the number of individual units called for on the plans, satisfactorily designed, erected, and dismantled. Temporary supports used by the Contractor for their convenience will not be measured for payment. The removal and reinstallation of existing highway appurtenances (e.g. guardrails, sign supports, etc.) to facilitate the erection of temporary supports will not be measured for payment, but will be considered incidental to the work under this specification.

524.29 Basis of Payment Temporary structural supports will be paid for at the contract unit price each 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 these specifications.

Pay Item		Pay Unit
524.30	Temporary Structural Support	Each

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 an approved quarry 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/A36M steel, galvanized in accordance with AASHTO M111 (ASTM A123), or ASTM A276 Type 304 stainless steel, 19 mm [¾ in] 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 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 12.5 mm +/- 3 mm [½ in +/- ⅛ in] in thickness.

A complete setting plan shall be submitted for approval before ordering any stone.

The arrangement and the length of the stones shall be as approved by the Resident.

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 75 mm [3 in] for any one stone measured from the pitch line. Irregular depressions shall be limited to a maximum of 25 mm [1 in] 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 102 mm [4 in], with the balance not to fall away more than 102 mm [4 in].

The top layer of granite shall have a 38 mm [1½ in] 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 203 mm [8 in] and not more than 305 mm [12 in] 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 380 mm [15 in].

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 1219 mm [48 in] 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 1219 mm [48 in] 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 1219 mm [48 in] between anchors.

Anchors in the top and bottom beds of each stone shall be located such that an anchor will be not greater than 457 mm [18 in] 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 457 mm [18 in] 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 5°C [40°F] in the shade and dropping and shall not be resumed until the atmospheric temperature is as high as 2°C [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 it shall be well cleaned. The thickness of all joints and beds shall be uniform throughout. Spalls shall not be used as pinners 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 as directed. 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 152 mm [6 in] 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 38 mm [1½ in] 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 25 mm +/- 12.5 mm [1 in +/- ½ in] in thickness.

525.09 Method of Measurement Granite masonry will be measured for payment by the number of square meters [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 meter [square foot] complete in place and accepted. This price shall include all materials, 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 meter [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 and the lines and grades shown on the plans or established by the Resident.

The types of concrete barrier are designated as follows:

Temporary Concrete Barrier Type I Double faced removable concrete barrier of the shape shown on the plans.

Permanent Concrete Barrier Type II Double face barrier of a shape shown on the plans.

Permanent Concrete Barrier Type IIIa Single face barrier 825 mm [32 in] high of a shape shown on the plans.

Permanent Concrete Barrier Type IIIb Single face barrier 1075 mm [42 in] high of a shape shown on the plans.

Permanent Concrete Transition Barrier Barrier of various heights joining steel bridge rail to steel guardrail.

Permanent Texas Classic Rail Barrier, either traffic rail or sidewalk rail, as shown on the plans.

526.02 Materials

a. Concrete Portland Cement Concrete shall meet the provisions of Section 502 - Structural Concrete, and portland cement shall conform to the requirements of AASHTO M85, Type I, II, or III.

Concrete for permanent barriers shall be Class LP, in accordance with Section 502.05 - Composition and Proportioning.

Concrete for temporary barriers shall be portland cement concrete. The state reserves the right to take test core samples from the barriers in accordance with ASTM C42. Average compressive test strengths below 17 MPa will result in rejection of the barriers.

b. Reinforcing Steel Reinforcing steel shall meet the requirements of Section 503 - Reinforcing Steel.

c. Structural Steel The bearing plate shall meet the requirements specified in Section 713.01 - Structural Steel.

d. Tests Materials shall meet the following ASTM Standards where applicable:

A 82	Specification for cold drawn steel wire for concrete reinforcement
A 185	Specification for welded steel wire for concrete reinforcement
A 416	Specification for uncoated seven wire low-relaxation strand for prestressed concrete
A 496	Specification for deformed steel wire for concrete reinforcement
C 31	Making and curing concrete test specimens in the field
C 33	Specification for concrete aggregates
C 39	Test for compressive strength of cylindrical concrete specimens
C 42	Obtaining and testing drilled cores and sawed beams of concrete

526.03 Construction Requirements Permanent Concrete barrier shall be constructed in accordance with the provisions of Standard Specification Section 502.05 - Composition and Proportioning, through Section 502.15 - Curing Concrete, inclusive, with the following additions:

a. The following is added to Section 502.10 A. - Construction of Forms, after Construction of Forms: "Permanent concrete barrier may be formed by cast-in-place or slip forming methods. Temporary concrete barrier may be formed by precasting and/or prestressing methods. Precasting and/or prestressing methods may be used for other barriers with the approval of the Resident."

b. The following is added to Section 502.14: D. - Form Surface Finish "Concrete finish shall be equal to a steel form finish.''

c. The following paragraphs are added to the end of Section 502.15 - Curing Concrete "Liquid membrane-forming compounds may be used for curing concrete barriers, if approved by the Resident. If allowed, the membrane-forming compound shall not contain fugitive dye or other agents, which will discolor the concrete."

When the slip forming method is used, a dissipating curing compound shall be applied to the concrete during placement, and then wet curing shall proceed in accordance with this Section.

In addition to the foregoing methods of curing concrete, barrier may be cured by an accelerated curing method using low-pressure steam or radiant heat in a moist atmosphere. Other methods of curing may be used if approved by the Resident.

If called for, protective coating shall be applied in accordance with Standard Specification Section 515 - Protective Coating for Concrete Surfaces."

Temporary concrete barrier shall be generally free from fins and porous areas and shall present a neat and uniform appearance.

Permissible dimensional tolerances for all concrete barriers shall be as follows:

a. Cross-sectional dimensions shall not vary from design dimensions by more than 6 mm [¼ in]. The vertical centerline shall not be out of plumb by more than 6 mm [¼ in].

b. Longitudinal dimensions shall not vary from the design dimensions by more than 6 mm per 3 m [¼ in per 10 ft] of barrier section and shall not exceed 20 mm [¾ in] per section.

c. Location of anchoring holes shall not vary by more than 13 mm [½ in] from the dimensions shown in the concrete barrier details on the plans.

d. Surface straightness shall not vary more than 6 mm under a 3 m [¼ in 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 300 mm [12 in] or more, regardless of position in the section.

526.04 Method of Measurement Concrete Barrier Type II, IIIa, IIIb, and Texas Classic Rail will be measured for payment by lump sum complete in place.

Temporary concrete barrier will be measured for payment by the meter from end to end of each run of barrier measured along the centerline of the barrier complete in place or by the lump sum unit as specified. No deduction in pay length will be made for joints between abutting barrier sections.

When temporary concrete barrier is measured by the lump sum unit, measurement will consist of verification of the installation and removal of all concrete barrier required by the plans for the Contractor's operations.

The Contractor shall replace sections of temporary concrete barrier damaged by the traveling public when directed by the Resident. Replacement sections will be measured for payment.

Transition barrier will be measured by each barrier connecting bridge rail to guardrail complete in place.

The bid price for concrete barrier shall include payment for barrier reinforcing steel, cable and fixtures; no separate payment shall be made for these items.

526.05 Basis of Payment The accepted quantities of Texas Classic Rail, Type II, IIIa, and IIIb concrete barrier will be paid for at the contract lump sum price for the type specified, complete in place. Such payment shall be full compensation for furnishing all material to assemble and all incidentals necessary to complete the work.

The accepted quantities of Temporary Concrete Barrier Type I will be paid for at the contract unit price per meter or lump sum, as specified, complete in place. Such payment shall be full compensation for furnishing all material, assembling and all incidentals necessary to complete the work.

When temporary concrete barrier is paid for at the lump sum price, such price shall be full compensation for furnishing all materials, assembling, moving and resetting, transporting, temporary storing, removing, furnishing new parts as necessary, and all incidentals necessary to complete the work.

Payment for resetting temporary concrete barrier shall be full compensation for removing, transporting, temporary storing, resetting and furnishing new parts as necessary. No additional payment shall be made for temporary concrete barrier removed and not reset.

Temporary 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, and will be full compensation for furnishing all material and incidentals necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
526.30	Temporary Concrete Barrier, Type I	Meter [Linear Foot]
526.301	Temporary Concrete Barrier, 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
526.40	Resetting Temporary Concrete Barrier Type I	Meter [Linear Foot]

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 Work Zone Crash Cushions must comply with NCHRP Report 350. Work Zone Crash Cushions meeting NCHRP 350 include, but are not limited to, the following: The N-E-A-T from Energy Absorption Systems of Chicago, Illinois, Adiem-II from Syro Inc. of Dallas, Texas, Clusters of the Energite III sand barrels from Energy Absorption Systems of Chicago, Illinois, or an 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 functionability 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

SECTIONS 531 to 533 - VACANT

SECTION 534 - PRECAST STRUCTURAL CONCRETE

Reserved

SECTION 535 - PRECAST, PRESTRESSED CONCRETE SUPERSTRUCTURE

535.01 Description This work shall consist of casting and erecting precast and prestressed concrete products and related material. Materials, work, inspection and documentation not specifically addressed by this Specification shall done be in accordance with the applicable sections of the PRECAST/PRESTRESSED CONCRETE INSTITURE (PCI), *Manual for QUALITY CONTROL for Plants and Production of PRECAST AND PRESTRESSED CONCRETE PRODUCTS* (MNL 116), including Commentary.

535.02 Materials. Materials for precast and prestressed concrete products shall meet the requirements of the following Sections:

Water	701.02
Air Entraining Admixture	701.03
Water Reducing Admixture	701.04
High Range Water Reducing Admixture (HRWR)	701.0401
Set-Retarding Admixtures	701.05
Fly Ash	701.10
Calcium Nitrite Solution	701.11
Silica Fume	701.12
Ground Granulated Blast Furnace Slag	701.13
Fine Aggregate for Concrete	703.01
Coarse Aggregate for Concrete	703.02
Reinforcing Steel	709.01
Welded Steel Wire Fabric	709.02
Steel Strand for Concrete Reinforcement	709.03

Portland cement shall conform to the requirements of AASHTO M85 (ASTM C150), Type I, Type II, or Type III. The Contractor shall supply the Department with copies of certified mill tests of the cement. The mill tests shall show the name of the manufacturer, location where produced, silo number and the person or agency conducting the test.

Coarse aggregate shall conform to the requirements of Section 703.02 - Coarse Aggregate for Concrete, Class A, Class AA or Latex.

A Materials Certification from the manufacturer of the steel pre-stressing strand shall be provided to the Fabrication Engineer. The certification shall include a representative load elongation curve for each coil. Each coil of strand shall be clearly identified by the manufacturer and the identification shall not be removed from the coil until it is entirely used. Partial coils may be used only with the approval of the Fabrication Engineer. Failure to maintain trace-ability of a coil will be cause for rejection.

535.03. Drawings 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 and approved in accordance with the applicable requirements of Section 105.7. Changes and revisions to the approved working drawings shall require further approval by the Fabrication Engineer.

Concrete mix designs shall be part of the shop drawing submittal. Mix designs shall include aggregate specific gravity, absorption, percent fracture, fineness modulus and gradation.

A copy of the Contractor's Quality System Manual (Q.S.M.) shall be submitted when requested by the Fabrication Engineer.

535.04 Plant Precast, prestressed concrete products shall be manufactured in a Precast/Pre-stressed Concrete Institute (PCI) Certified facility.

535.05 Inspection Facilities The Contractor shall provide a private office at the fabrication plant for inspection personnel authorized by the Department. The office shall have an area not less than 9.3 m² [100 ft²] and shall be in close proximity to the work. The office shall be climate controlled to maintain the temperature between 18°C [65°F] and 30°C [85°F], lighted 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 office shall be equipped with a desk or table having a minimum size of 1200 mm by 760 mm [48 in by 30 in], 2 chairs, a telephone, telephone answering machine, line data port, plan rack and 2-drawer letter size file cabinet with a lock and 2 keys which shall be furnished to the Inspector(s).

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, basic monthly telephone charges and all furnishings shall be incidental to the contract.

535.06 Notice of Beginning Work The Contractor shall give the Fabrication Engineer a minimum of two weeks notice prior to beginning work. The Contractor shall advise the Fabrication Engineer of the production schedule and any changes to it. If the Contractor suspends work on a project, the Fabrication Engineer will require 48 hours notice prior to the resumption of work.

535.07 Inspection Quality Control (Q.C.) is the responsibility of the Contractor. Quality Control Inspectors (QCIs) 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, or work under the direct supervision of an ACI certified technician.

The QCI shall inspect all aspects of the work in accordance with the Contractor's QSM. The QCI shall record measurements and test results on the appropriate forms from APPENDIX E of MNL 116 or an equivalent form prepared by the user. Copies of measurements and test results shall be provided to the Quality Assurance Inspector (QAI) as follows:

Type of Report	When Provided to Q.A.I*
Material certifications/stressing calculations/ calibration certifications	Prior to beginning work (anticipate adequate time for review by QAI)
Tensioning report	The same work day
Pre-pour 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 testing (for release)	The same work day
Concrete temperature records	Provide with compressive testing (for release)
Non-conformance reports/repair procedures	Within 24 hours of discovery
Results of compressive testing (for design strength)	Prior to stopping curing/Prior to final acceptance
Post-pour inspection report	Prior to final acceptance

*The Contractor and QAI, by mutual agreement, may modify any part of the schedule, however, failure to provide the documentation when required will result in the product being deemed unacceptable.

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 testing shall be made available to the (QAI).

Quality Assurance (Q.A.) is the prerogative of the Fabrication Engineer. The QAI will verify documentation, periodically inspect workmanship, and witness testing. Testing deemed necessary by the Fabrication Engineer in addition to the minimum testing requirements shall be scheduled to minimize interference with the production schedule.

535.08 Inspector's Authority The QAI will have 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 found unacceptable.

535.09 Rejections Rejected material and workmanship shall be corrected or replaced by the Contractor. In the event that an item fabricated under this Specification does not meet the contract requirements but is deemed suitable for use by the Fabrication Engineer, said item will be paid for in accordance with Section 108.8.1 - Substantially Conforming Work.

535.10 Forms and Casting Beds Form dimensions shall conform to the approved shop drawings. Forms shall be well constructed, carefully aligned and sufficiently tight to prevent

leakage of mortar. Forms that do not maintain the plan dimensions within allowable tolerances during concrete placement shall be rejected.

Bulkheads shall be fabricated and secured in a manner that prevents leakage of mortar. Bulkheads between units shall be separated by a minimum of 450 mm [18 in]. Bulkheads shall be inspected by the Contractor after each cast and repaired or replaced if worn or damaged except that bulkheads for deck panels that may be placed to provide the minimum strand projection.

Wood forms shall be sealed with a material to prevent absorption. The sealer shall be applied and cured in accordance with the manufacturer's recommendations.

Forms shall be cleaned of adherent material before each use. Forms shall be cleaned of all foreign matter and debris immediately prior to placing concrete. New forms shall be free from paint or other protective coatings.

Forms shall be treated with a non-staining bond breaking compound applied in accordance with the manufacturer's recommendations.

If the reinforcing steel or strand has been contaminated with the bond-breaking compound, it shall be cleaned with solvent. No concrete shall be placed until the reinforcing steel and strand has been inspected and accepted by the QCI.

535.11 Reinforcing Steel Reinforcing steel shall be fabricated, packaged, handled, stored, placed, spliced, and repaired in accordance with Section 503 - Reinforcing Steel.

Reinforcing steel shall be accurately located and securely anchored to prevent displacement during concrete placement. All reinforcing steel shall be installed and secured before beginning the concrete placement.

The concrete cover shown on the approved shop drawings shall be the minimum allowable cover. The contractor shall use 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. Damaged voids shall be repaired in manner acceptable to the QAI. Voids shall be stored, handled and placed in a manner that prevents damage. Residue from void placement shall be entirely removed from the forms before beginning or continuing the concrete placement.

Voids shall be located accurately, anchored securely, capped and vented. Any portion of a void that is displaced beyond the allowable dimensional tolerances shall be cause for rejection of the slab or beam.

Cast in place threaded inserts shown on the plans shall be accurately located and securely fastened. Inserts installed to erect forms in the field shall be recessed a minimum of 25 mm [1 in]. Holes that penetrate through the thickness of a member will not be permitted.

535.13 Concrete Concrete mix designs shall be submitted to the Fabrication Engineer for approval a minimum of 30 days prior to beginning work. Mix designs previously approved for use shall not require qualification by trial batch if the mix design meets all the requirements of this Section.

New concrete mix designs shall be qualified by trial batches prepared in accordance with AASHTO T126 (ASTM C192). The test results shall demonstrate that the concrete meets the requirements of the Plans and this Section. If accelerated curing is to be used in production, the test specimens shall be similarly cured.

No concrete shall be placed until the mix design has been approved. Approval of the mix design does not relieve the Contractor of the responsibility of meeting the requirements of this Section during production.

The concrete mix design shall meet the following requirements:

Table 1

Minimum cement content	400 kg/m^3 [658 lb/yd^3]
Water-cement ratio	0.40 maximum
Air entrainment	5½ % - 7½ %
Allowable slump	125 mm to 255 mm [5 in to 10 in]
Calcium Nitrite*	14.85 L/m^3 [3 gal/yd^3]
Silica Fume (when required)	5% - 10% of cement content by weight
Fly Ash	40% of cementitious material maximum
Slag	50% of cementitious material maximum

*The water in the Calcium Nitrite solution shall be included when calculating the water/cement ratio

The concrete mix design shall be proportioned such that the concrete achieves transfer strength within twenty-four hours of the completion of the placement. If two consecutive placements fail to meet the above requirement, no further placements shall take place until corrective action is taken by the Contractor.

The batching equipment, mixers and delivery equipment shall meet the requirements of MNL 116. Concrete shall be batched, mixed and handled in accordance with MNL 116.

535.14 Concrete Placement The first two loads of concrete from each placement shall be tested by the QCI for temperature, air entrainment, and slump. If the first load is unacceptable, the second load shall be tested as the first. This process shall continue until two consecutive loads are found acceptable. After two consecutive loads are found acceptable, the frequency of testing shall be at the discretion of the QAI.

Concrete shall be tested if there is a change in the dosage rate of any admixture, a change of 50 mm [2 in] or more in slump or a change of more than 3°C [5°F] in mix temperature.

Any load of ¾ m³ [1 yd^3] or less from a stationary mixer or 1½ m³ [2 yd^3] or less from a transit mixer shall be tested for air entrainment, slump, and temperature prior to being placed in the form.

Concrete shall be placed as nearly as possible to its final location. The depth of a lift shall be controlled in order to minimize entrapped air voids. The maximum depth of an unconsolidated lift shall be 450 mm [18 in]. Concrete shall be vibrated with internal or internal and external vibrators. External vibrators shall not be used alone. Internal vibrators shall be inserted vertically and penetrate the lower layer of concrete by at least 100 mm [4 in]. The vibrators shall be inserted to assure that the radii of action of the vibrators overlap. The vibrators shall be held in position from 5 to 15 seconds. Vibrators shall not be used to move concrete horizontally.

When concrete placements are interrupted (e.g. placing voids in box beams), no more than 60 minutes shall elapse from the time of the beginning of the placement and the resumption of the concrete placement when the concrete temperature is below 24°C [75°F]. When the concrete temperature is above 24°C [75°F], the elapsed time shall be reduced to 30 minutes. Cold joints may make the unit subject to rejection.

No water shall be added to the concrete after batching. HRWR may be added to the concrete after batching if that practice conforms to the manufacturer's published recommendations. Concrete that becomes unworkable shall be discarded.

535.15 Process Control Test Cylinders All process control test cylinders shall be made and tested in accordance with the following Standards:

AASHTO T23 (ASTM C31/C31M) Practice for Making and Curing Concrete Test Specimens in Field
AASHTO T22 (ASTM C39) Test Method for Compressive Strength of Cylindrical Concrete Specimens
AASHTO T119 (ASTM C143) Test Method for Slump of Hydraulic Cement Concrete
AASHTO T141 (ASTM C172) Practice for Sampling Freshly Mixed Concrete
AASHTO T152 (ASTM C231) Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C1064 - Test Method for Temperature of Freshly mixed Portland Cement Concrete

A minimum of 8 concrete test cylinders shall be cast to represent each continuous concrete placement except that, 8 concrete test cylinders shall be made for each bulb "T" girder cast in a continuous placement. Six of the cylinders from each test shall be cured under the same conditions as the units. Unit identification, entrained air content, water-cement ratio, slump and temperature of the sampled concrete shall be recorded by the Contractor at the time of cylinder casting. Testing shall be done in the presence of the QAI. The QAI will designate the loads to

be tested. Cylinders made to determine transfer strength shall be made during the last 1/3 of the placement.

At least once a week, the Contractor shall make four cylinders for use by the Department. They shall be cured in accordance with AASHTO T23 (ASTM C31/C31M).

If the Contractor fails to make enough cylinders to demonstrate that the product meets the contract requirements, the product will be considered unacceptable.

The standard size test cylinder for acceptance shall be 150 mm by 300 mm [6 in by 12 in]. If 100 mm by 200 mm [4 in by 8 in] cylinders are used for acceptance, the compressive strength values shall be reduced by 5%. The compressive strength of the concrete shall be determined by averaging the compressive strength of two test cylinders made from the same load.

For the purpose of detensioning prestressed products, neither of the test cylinders shall have a compressive strength less than the minimum required transfer strength after the 5% reduction 100 mm by 200 mm [4 in by 8 in] cylinders is taken.

For the purpose of acceptance, the average of two cylinders shall meet or exceed the design strength, and, neither cylinder shall be more than 3.5 MPa [500 psi.] below the required strength.

Compressive testing to determine transfer and design strength shall be done in the presence of the QAI. Cylinder tests not witnessed by the QAI will not be acceptable.

535.16 Curing Immediately after the concrete has been finished, the product shall be covered with an impermeable barrier to prevent moisture loss. The barrier shall be tight to the form and securely fastened. The exposed surface of the concrete shall be kept moist. The Contractor shall monitor and record the concrete temperature during the initial curing cycle.

After the product has been removed from the form, moist curing shall continue until it has reached design strength. All surfaces of the product shall be kept moist and the product shall be placed in a moisture retention enclosure with a relative humidity not less than 80%. The product shall not be exposed to temperatures below 10°C [50°F] until design strength is achieved.

Membrane curing compounds shall not be used without the approval of the Fabrication Engineer. If approved, the compound shall be applied in strict accordance with the manufacturer's published instructions. The Contractor shall provide the QAI with the product data sheet for the compound prior to application. The compound shall be applied immediately after stripping.

535.17 Accelerated Curing (Optional) Accelerated curing shall begin after the concrete has attained its initial set. 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 3.5 MPa [500 psi.] indicates initial set. The Contractor shall provide documentation that

the mix design being used has been tested in accordance with ASTM C403. Accelerated curing shall begin after the concrete has attained initial set. Application of heat more than 8 hours after initial set will not be considered accelerated curing.

The enclosure temperature may be increased by a maximum of 5.6°C/hr. [10°F/hour] prior to initial set. The total temperature gain prior to initial set shall not exceed 22°C [40°F].

After initial set, the temperature gain of the concrete shall not exceed 22°C/hr. [40°F/hour]. The concrete temperature shall attain a minimum temperature of 50°C [120°F] and that temperature shall be maintained for a minimum of 8 hours. The maximum allowable concrete temperature shall be 82°C [180°F]. Concrete temperature shall be measured near each end of the casting bed and at intervals not to exceed 30 m [100 ft].

The cooling rate from maximum accelerated curing temperature shall not exceed 22°C/hour [40°F/hour]. The cooling rate shall continue until the concrete temperature is within 22°C [40°F] of the ambient air temperature.

Steam curing shall take place in an enclosure that allows the free circulation of steam. Steam jets shall provide a uniform distribution of steam without discharging directly on the product or the test cylinders.

When radiant heat is used, the Contractor shall take measures to assure that there is no moisture loss from the product. Free water shall be present on all exposed surfaces at all times.

Recording thermometers that indicate the time/temperature relationship shall be used by the Contractor until transfer/stripping strength has been achieved. Copies of the time/temperature records shall be made available to the QAI.

If the units have achieved 80% of design strength during the curing cycle, no further curing will be required.

535.18 Prestressing The Contractor shall provide stressing calculations to the QAI before tensioning strands. Application of initial force and final tensioning shall be performed in the presence of the QAI. The QCI shall be present to witness and document the application of initial force, final tensioning and elongation of the strand.

Measurement of tensioning force shall be accomplished by one of the following:

a. Pressure gauges measuring hydraulic pressure
b. Dynamometer
c. Load cell-digital readout
d. Digital readout connected to a transducer measuring hydraulic pressure

Equipment used to measure tensioning force shall be calibrated within 6 months of the beginning of the project. Calibration shall be performed by an approved testing laboratory, calibration service or under the direct supervision of a Professional Engineer registered in the

State of Maine. Calibration shall be done in accordance with the manufacturer's recommendations.

The Contractor shall provide a Calibration Report for the tensioning device being used. The Calibration Report shall include a Calibration Conversion Chart that correlates gauge readings with actual force applied. The gauge reading used in production shall be interpolated using the gauge-force reading closest to the required force derived from the stressing calculations.

Equipment used to measure tensioning force shall be graduated to read within +/- 2% of the anticipated force. Rams, gauges, pumps and hoses shall be calibrated together as a system. Replacement of any of the previously listed components shall require re-calibration of the jacking system. If the same device is used for initial and final tensioning, separate gauges shall be installed in the system. Both initial force and final tensioning hydraulic gauges shall be at least 150 mm [6 inches] in diameter and shall be graduated such that the anticipated force falls within the middle third of the gauge range. Gauges shall be at or near eye level and the needles shall remain steady until the load is released.

Strands shall be pulled in an orderly sequence to avoid snags and entanglements. When strands from two or more coils or reel-less packs are used, the strands shall be identified by lot number. Elongation and adjusted gauge pressure readings shall be calculated for each modulus of elasticity and cross sectional area of the strands.

Prior to tensioning, hydraulic jacking devices shall be run until the hydraulic fluid is brought up to normal operating temperature. The jack shall be cycled several times to assure that the fluid in the lines is also at operating temperature.

Initial tensioning shall be done in the reverse order from that which the strand was pulled to avoid friction and dead load losses due to overlying strand. After all strands have been initially tensioned, final tensioning shall begin. As an alternative, if the Contractor demonstrates that each strand is free of potential friction and dead load losses prior to reaching initial tension, the final tensioning force may be applied to the strand at that time. The Contractor shall visually inspect each strand during initial tensioning to assure that the strand is free of overlying strands or reinforcing steel.

After initial tensioning, the Contractor shall establish a permanent and clearly visible reference mark on the strand to determine strand elongation after final tensioning. Strand elongation shall be measured to the nearest 2 mm [$^{1}/_{16}$ in]. The gauge pressure reading and strand elongation shall be within 5% of theoretical. The algebraic difference between the error in gauge reading and elongation shall not exceed 5%. If the elongation, gauge reading or the algebraic difference exceeds 5%, the tensioning operation shall be suspended until the Contractor determines the cause and makes corrections.

535.19 Detensioning Detensioning shall be carried out in the presence of the QAI and QCI.

At the beginning of every job, the strands of each unit shall be marked and strand slippage shall be measured and recorded by the QCI. The QAI may require that the strand slippage be measured on any unit if the QAI has reason to question the concrete consolidation around the strand.

Forms or any devices that restrict horizontal or vertical movement of the units shall be loosened or removed before detensioning. The Contractor shall take measures to prevent damage, spalling or cracking, to the members that may be caused by detensioning.

Detensioning shall be performed in the sequence shown on the approved drawings. Failure to follow this sequence shall be cause for rejection of the product.

Detensioning shall be done as soon as it is practical after the units have achieved transfer strength. If accelerated curing was used, detensioning shall be performed immediately following the curing period while the concrete is still warm and moist.

If detensioning is accomplished by single strand release, each strand shall be cut by heating gradually with a low oxygen flame at both ends of the pre-stressing bed and at all intermediate points, in multiple unit casts, simultaneously. A minimum length of 150 mm [6 in] of strand shall be heated to prevent any shock or snap when the strand is finally severed. When possible, the strand should be cut a minimum of 450 mm [18 in] from the bulkhead of the form.

If detensioning is accomplished by multiple strand release, the equipment shall be capable of releasing the load gradually, without shock, and with a minimum of movement of the units.

535.20 Finishing Concrete and Repairing Defects Products fabricated under this Section shall meet Standard Grade finish requirements as defined in MNL 116. The recommendations of Standard Grade finish requirements shall be mandatory. Fascia beams shall meet the requirements of finish Grade A.

Honeycombing, ragged or irregular edges and other cosmetic defects shall be repaired using a product from the MDOT Prequalified List for Patching Materials. The repair, including preparation of the repair area, mixing, application and curing of the patching material shall be in accordance with the manufacturer's published instructions. Edges not exposed in the final product may be ground smooth with no further repair necessary if the depth of the defect does not exceed 12 mm [½ in]. Form ties shall be removed to a depth of not less than 25 mm [1 in] from the face of the concrete and patched by a method approved by the Fabrication Engineer.

Structural defects shall be repaired by a method approved by the Fabrication Engineer. Structural defects shall include, but not be limited to exposed reinforcing steel or strand, cracks in bearing areas, through cracks and cracks 0.3 mm [0.013 in] in width that extend more than 300 mm [12 in]. The Contractor shall submit a proposed repair procedure for structural repairs to the Fabrication Engineer. No structural repairs shall be made without the QAI being present. The QAI shall be given adequate notice before beginning repairs.

Chamfers and drip notches shall be made smooth and uniform. Keyways shall be sandblasted to remove mortar paste. Ends of strands shall be recessed 25 mm [1 in] and shall be patched and coated with a bituminous protective coating or, if exposed, sacked to a uniform finish.

535.21 Precast Deck Panels Precast deck panels shall be produced in accordance with the plans and Standard Details, PRECAST CONCRETE DECK PANELS. Temporary supports for

precast deck panels shall consist of continuous high-density expanded polystyrene strips. As an alternative, non-corrosive embedded inserts, threaded leveling jacks and compressible foam seals or other sealing devices may be used to support the precast deck panels.

535.22 Tolerances Tolerances for precast units shall be in conformance with the latest edition of MNL 116, as applicable. Voided slabs shall be manufactured to the following tolerances:

Precast, Prestressed Voided Slabs	
Depth of Slab	+/- 6 mm [+/- ¼ in]
Width of Slab	+/- 6 mm [+/- ¼ in]
Length of Slab	+/- 3 mm /3 m [+/- ⅛ in/10 ft] of length or 13 mm [½ in], whichever is greater
Skewed Ends	+/- 6 mm [+/- ¼ in](deviation from required skew)
Beam Seat Bearing Area	+/- 2 mm [+/- $^{1}/_{16}$ in]
Horizontal Alignment	+/- 6 mm [+/- ¼ in] (deviation from straight line parallel to centerline of member)
Dowel Tubes	+/- 6 mm {+/- ¼ in] (center of tubes to sides of member)
Void Tubes	+/- 6 mm [+/- ¼ in] (vertically and horizontally) or +/- 13 mm [+/- ½ inch] (location of ends)
Post Tension Ducts	+/- 6 mm [+/- ¼ in]
Differential camber between Adjacent Units	+/- 3 mm /3 m [+/- ⅛ in/10 ft] of length or 13 mm [½ inch] maximum
Center of Gravity of Strand Group	+/- 6 mm [+/- ¼ in]
Stirrup Bars	+/- 13 mm [+/- ½ in] projection above top of beam or +/- 25 mm [+/- 1 in] longitudinal spacing

535.23 Transportation and Storage After the prestressed products are detensioned, they may be handled and moved, but shall not be transported until the 28 day design strength has been attained.

Prestressed products shall be transported so that the reactions with respect to the unit shall be approximately the same during transportation and storage as the product in its final position. The product shall be handled so that only a vertical force is applied to the lifting devices.

Stored products shall be supported above the ground on dunnage in a manner to prevent twisting or distortion. Products shall be protected from discoloration and aesthetic damage.

Units damaged by improper storing, hoisting or handling shall be replaced by the Contractor.

535.24 Bearings When longitudinal keys are to be grouted, the post-tensioning strand shall be tensioned to 22 kN [5 kips]. Prestressed units shall not be placed upon bearing areas that are improperly finished. Bearing shall be installed in conformance with Section 523 - Bearings. Elastomer sheets (non-laminated bearing pads) shall be installed as shown on the plans.

535.25 Keyway Grout Longitudinal keyways between beams shall be filled with a non-shrink, flowable, cementitious grout with a design compressive strength of 42 MPa [6000 psi.]. The grout shall be one of the products listed on the Maine Department of Transportation's list of Pre-qualified Grout Materials for Keyways. The grout shall be mixed, placed and cured in accordance with the manufacturer's published recommendations. Gaskets of compressible material are required around duct openings within keyways to prevent blocking of the duct with grout.

Immediately before filling the keyway, it shall be cleared of debris. The keyway surfaces shall be soaked with water prior to placement of grout. The keyways shall be sealed to prevent material loss.

535.26 Lateral Post-Tensioning A final tension of 129,000 N [29,000 lb] per strand shall be applied to lateral post-tensioning strands.

After tensioning, the ends of the strands shall be sawn or abrasion cut not less than 32 mm [1¼ in] from the end of the wedge. The tendon tail and the gripping part of the anchorage shall be coated with a corrosion inhibiting grease and then capped with a watertight covering. The entire anchorage shall be watertight.

Recesses at ends of lateral post-tensioning ducts shall be filled with grout using the same type cement as that in the prestressed slabs. Prior to installing the grout, the stressing pockets shall be clean of any dirt, grease, oil, or other material that may prevent bonding. Grouting shall be completed within 10 days of lateral post-tensioning. No vehicular traffic, including the Contractor's equipment shall be allowed on the bridge until post-tensioning is complete.

535.27 Erection of Precast Deck Panels Precast deck panels shall be erected as shown on the plans. Foam temporary supports shall be attached to the outside edges of the top flanges of the girders with an adhesive applied in accordance with the manufacturer's published recommendations. The foam shall be field-cut to adjust the bottom-of-slab elevations as required. If threaded jacking devices are cast into the panels, the bottom-of-slab elevations shall be adjusted with the jacks.

After the precast deck panels have been erected, adjusted and sealed, the void between the top of the girder flange and the bottom of the panels shall be filled with a non-shrink, flowable, cementitious grout with a design compressive strength of 42 MPa [6000 psi.]. The grout shall be one of the products listed on the Maine Department of Transportation's list of Pre-qualified Grout Materials for Keyways. The grout shall be mixed, placed and cured in accordance with the manufacturer's published recommendations. Vent holes shall be provided at 1 m [3 ft] intervals to prevent air lock.

Before placing cast-in-place concrete on the precast deck panels, the joints shall be caulked to prevent seepage of concrete paste.

Oil, grease and other contaminants that may prevent a bond between the precast deck panels and the cast-in-place concrete shall be removed by abrasive blast cleaning.

535.28 Method of Measurement Prestressed structural concrete will be measured by the lump sum.

535.29 Basis of Payment All work done under Prestressed Structural Concrete will be paid for at the contract lump sum price. Payment will be full compensation for furnishing all materials in the precast/pre-stressed unit including anchor dowels, reinforcing steel, and related materials and work. Related materials and work will include, but not be limited to, preformed pads, erecting the products, drilling and grouting of anchor dowels, grouting of keyways and ducts, post-tensioning operations and concrete admixtures used.

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

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 900 mm [36 in]. 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 1.8 m by 1.8 m [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 1.5 m [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 125 mm [5 in] 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 3.17 mm [0.125 in], 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 900 kg [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, 300 mm [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 300 mm [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 300 mm [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 300 mm [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 25 mm in 1 m [1 inch 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 meter [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 meter [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 meter [Cubic Yard]
601.211	Gabions, Galvanized and Hand Filled	cubic meter [Cubic Yard]

601.22	Gabions, PVC Coated	cubic meter [Cubic Yard]
601.221	Gabions, PVC Coated and Hand Filled	cubic meter [Cubic Yard]
601.23	Mattresses, Galvanized: _____	cubic meter [Cubic Yard]
601.24	Mattresses, PVC Coated: _____	cubic meter [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
Corrugated Steel, Metallic Coated Pipe	707.02
Fiber-bonded Corrugated Steel Pipe & Pipe Arches	707.04
Corrugated Aluminum Alloy Pipe & Pipe Arches	707.06
Polymer Precoated, Galvanized Corrugated Steel	707.07
Pipe & Pipe Arches	
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 1200 mm [48 in] 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 68 mm by 13 mm [$2^2/_3$ in by ½ in] corrugations shall be not less than 265 mm [10½ in] 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.

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):

Fiber-bonded Corrugated Steel Pipe
Corrugated Aluminum Alloy Pipe
Polyvinylchloride (PVC) Pipe
Polymer-Precoated Galvanized Corrugated Steel Pipe
Reinforced Concrete Pipe
Corrugated Polyethylene 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 Engineer. 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 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 Pipe for Option III to ensure the vertical deflection does not exceed the maximum allowable deflection. Maximum allowable deflection shall be 5 percent of the sum of the nominal inside diameter minus a 1.5 percent 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 600 mm [24 in] 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 600 mm [24 in], 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	Minimum Mandrel Diameter
mm [in]	mm [in]
300 [12]	285 [11.23]
375 [15]	356 [14.02]
450 [18]	428 [16.84]
600 [24]	570 [22.46]
750 [30]	713 [28.07]
900 [36]	856 [33.69]
1050 [42]	998 [39.30]
1200 [48]	1141 [44.92]

When deflection testing reveals overdeflected 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 1050 mm [42 in] 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 1050 mm [42 in] 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 percent 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 degrees of vertical. Elliptically reinforced concrete pipe shall be placed with the vertical axis, indicated by the manufacturer, within 5 degrees 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 1200 mm [48 in] 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 percent 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 16 mm [⅝ in] diameter threaded 180 mm [7 in] at both ends with washers and nuts. The length of the rods shall be the diameter of the pipe plus 200 mm [8 in]. The rods shall be placed on the horizontal axis of the pipe at 600 mm [2 ft] spacing and

located halfway between the circumferential riveting. A block of soft wood 50 mm by 100 mm by 300 mm long [2 in by 4 in by 12 in 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 percent 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 16 mm [⅝ in] 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 1.5 m [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 375 mm [15 in] 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 75 mm [3 in] but no greater than the thickness of the layer being placed. The embankment construction around the pipe shall continue up to an elevation 375 mm [15 in] 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 1 m [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 300 mm [1 ft]. A trench, equal in width to the outside horizontal diameter of the pipe, shall then be excavated to within 300 mm [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 1/4 to 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 meter [linear foot] 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 1 additional meter [3 additional linear feet] of the largest pipeline involved.

Inlet grate units will be measured by each unit installed, complete in place, and accepted.

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 meter [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 measured and paid for 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.

Payment will be made under:

Pay Item		Pay Unit
603.15	300 mm [12 in] Culvert Pipe Option I	meter [Linear Foot]
603.16	375 mm [15 in] Culvert Pipe Option I	meter [Linear Foot]
603.17	450 mm [18 in] Culvert Pipe Option I	meter [Linear Foot]
603.18	525 mm [21 in] Culvert Pipe Option I	meter [Linear Foot]
603.19	600 mm [24 in] Culvert Pipe Option I	meter [Linear Foot]
603.20	750 mm [30 in] Culvert Pipe Option I	meter [Linear Foot]
603.21	900 mm [36 in] Culvert Pipe Option I	meter [Linear Foot]
603.159	300 mm [12 in] Culvert Pipe Option III	meter [Linear Foot]
603.169	375 mm [15 in] Culvert Pipe Option III	meter [Linear Foot]
603.179	450 mm [18 in] Culvert Pipe Option III	meter [Linear Foot]
603.189	525 mm [21 in] Culvert Pipe Option III	meter [Linear Foot]
603.199	600 mm [24 in] Culvert Pipe Option III	meter [Linear Foot]
603.2009	675 mm [27 in] Culvert Pipe Option III	meter [Linear Foot]
603.209	750 mm [30 in] Culvert Pipe Option III	meter [Linear Foot]
603.2019	825 mm [33 in] Culvert Pipe Option III	meter [Linear Foot]
603.219	900 mm [36 in] Culvert Pipe Option III	meter [Linear Foot]
603.229	1050 mm [42 in] Culvert Pipe Option III	meter [Linear Foot]
603.239	1200 mm [48 in] Culvert Pipe Option III	meter [Linear Foot]
603.249	1350 mm [54 in] Culvert Pipe Option III	meter [Linear Foot]
603.259	1500 mm [60 in] Culvert Pipe Option III	meter [Linear Foot]
603.269	1650 mm [66 in] Culvert Pipe Option III	meter [Linear Foot]
603.279	1800 mm [72 in] Culvert Pipe Option III	meter [Linear Foot]
603.289	2100 mm [84 in] Culvert Pipe Option III	meter [Linear Foot]
603.30	525 mm [21 in] span 375 mm [15 in] rise Pipe Arch Option III	meter [Linear Foot]
603.31	600 mm [24 in] span 450 mm [18 in] rise Pipe Arch Option III	meter [Linear Foot]
603.32	700 mm [28 in] span 500 mm [20 in] rise Pipe Arch Option III	meter [Linear Foot]
603.33	875 mm [35 in] span 600 mm [24 in] rise Pipe Arch Option III	meter [Linear Foot]
603.34	1050 mm [42 in] span 725 mm [29 in] rise Pipe Arch Option III	meter [Linear Foot]
603.35	1225 mm [49 in] span 825 mm [33 in]rise Pipe Arch Option III	meter [Linear Foot]
603.36	1425 mm [57 in] span 950 mm [38 in] rise	

	Pipe Arch Option III	meter [Linear Foot]
603.37	1600 mm [64 in] span 1075 mm [43 in] rise	
	Pipe Arch Option III	meter [Linear Foot]
603.38	1650 mm [66 in] span 1275 mm [51 in] rise	
	Pipe Arch Option III	meter [Linear Foot]
603.39	1825 mm [73 in] span 1375 mm [55 in] rise	
	Pipe Arch Option III	meter [Linear Foot]
603.40	2025 mm [81 in] span 1475 mm [59 in] rise	
	Pipe Arch Option III	meter [Linear Foot]
603.41	610 mm [24 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.42	762 mm [30 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.43	914 mm [36 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.44	1067 mm [42 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.45	1219 mm [48 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.46	1372 mm [54 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.47	1524 mm [60 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.48	1676 mm [66 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.49	1829 mm [72 in] Reinforced Conc. Pipe Class IV	meter [Linear Foot]
603.73	Remove and Relay Metal Pipe: _____	meter [Linear Foot]
603.7315	Remove and Relay 375 mm [15 in] Metal Pipe: __	meter [Linear Foot]
603.7318	Remove and Relay 450 mm [18 in] Metal Pipe: __	meter [Linear Foot]
603.7324	Remove and Relay 600 mm [24 in] Metal Pipe: __	meter [Linear Foot]
603.733	Remove and Relay 750 mm [30 in] Metal Pipe: __	meter [Linear Foot]
603.7336	Remove and Relay 900 mm [36 in] Metal Pipe: __	meter [Linear Foot]
603.7348	Remove and Relay 1200 mm [48 in] Metal Pipe: __	meter [Linear Foot]
603.7372	Remove and Relay 1800 mm [72 in] Metal Pipe: __	meter [Linear Foot]
603.74	Remove and Relay Concrete Pipe: _____	meter [Linear Foot]
603.7415	Remove and Relay 375 mm [15 in] Concrete Pipe:	meter [Linear Foot]
603.7418	Remove and Relay 450 mm [18 in] Concrete Pipe:	meter [Linear Foot]
603.7421	Remove and Relay 525 mm [21 in] Concrete Pipe:	meter [Linear Foot]
603.7424	Remove and Relay 600 mm [24 in] Concrete Pipe:	meter [Linear Foot]
603.743	Remove and Relay 750 mm [30 in] Concrete Pipe:	meter [Linear Foot]
603.7436	Remove and Relay 900 mm [36 in] Concrete Pipe:	meter [Linear Foot]
603.7442	Remove and Relay 1050 mm [42 in] Concrete Pipe:	meter [Linear Foot]
603.7448	Remove and Relay 1200 mm [48 in] Concrete Pipe:	meter [Linear Foot]
603.7454	Remove and Relay 1350 mm [54 in] Concrete Pipe:	meter [Linear Foot]
603.746	Remove and Relay 1500 mm [60 in] Concrete Pipe:	meter [Linear Foot]
603.7472	Remove and Relay 1800 mm [72 in] Concrete Pipe:	meter [Linear Foot]
603.75	150 mm [6 in] Inlet Grate Unit	Each
603.76	300 mm [12 in] Inlet Grate Unit	Each
603.77	375 mm [15 in] Inlet Grate Unit	Each
603.78	450 mm [18 in] Inlet Grate Unit	Each
603.79	525 mm [21 in] Inlet Grate Unit	Each
603.80	600 mm [24 in] Inlet Grate Unit	Each
603.81	750 mm [30 in] Inlet Grate Unit	Each
603.82	900 mm [36 in] 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	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

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 12 mm [½ in] 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 150 mm [6 in] 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.

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.

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.

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 2.5 m [8 ft] from the top of the grate or cover to the top of the floor, measured to the nearest 0.5 m [ft], will be one unit. 1/5 of a unit [⅛ of a unit] will be added for each additional 0.5 m [ft] over 2.5 m [8 ft] measured to the nearest 0.5 m [ft]. 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 altered 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 measured and paid for as provided in Section 206 - Structural Excavation.

Payment will be made under:

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
604.10	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	600 mm [24 in] Catch Basin Type E	Each
604.14	750 mm [30 in] 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	Alter 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	200 mm [8 in] Trap	Each
604.20	300 mm [12 in] Trap	Each
604.21	375 mm [15 in] Trap	Each
604.22	450 mm [18 in] 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, 75 mm [3 in] in depth, prepared in the trench. 150 mm [6 in] 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 200 mm [8 in] layers, loose measure and thoroughly compacted except that the initial layer of backfill around the pipe may be placed in a layer not exceeding 300 mm [12 in]. For underdrains placed under areas not proposed to be paved, the initial layer of backfill shall not exceed 300 mm [12 in] 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 metal pipe 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 meters [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 1 additional meter [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 meter [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 measured and paid for 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	150 mm [6 in] Underdrain Type B	meter [Linear Foot]
605.10	150 mm [6 in] Underdrain Outlet	meter [Linear Foot]
605.11	300 mm [12 in] Underdrain Type C	meter [Linear Foot]
605.12	375 mm [15 in] Underdrain Type C	meter [Linear Foot]
605.13	450 mm [18 in] Underdrain Type C	meter [Linear Foot]
605.14	525 mm [21 in] Underdrain Type C	meter [Linear Foot]
605.15	600 mm [24 in] Underdrain Type C	meter [Linear Foot]
605.17	750 mm [30 in] Underdrain Type C	meter [Linear Foot]
605.18	900 mm [36 in] Underdrain Type C	meter [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. The types of guardrail are designated as follows:

Type 3-Galvanized steel "w" beam, wood posts or galvanized steel posts.
Type 3a-Galvanized steel "w" beam, wood posts, wood or composite offset brackets.
Type 3aa-Corrosion resistant steel "w" beam, wood posts, wood or composite offset brackets.
Type 3b-Galvanized steel "w" beam, galvanized steel posts, galvanized steel offset brackets.
Type 3c-Galvanized steel "w" beam, wood posts or galvanized steel posts, wood or composite offset brackets.
Type 3d-Galvanized steel "w" beam, galvanized steel posts, wood or composite offset brackets.
Thrie Beam-Galvanized steel thrie beam, wood posts or galvanized steel posts.

Median barriers shall consist of two beams of the above types, mounted on single posts. Except for thrie beam, median barriers may include rub rails when called for.

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 brackets if specified, back-up plates 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 backup plates at intermediate posts, Adding offset brackets, 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 endpost 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 guardrail delineators shall be "U" channel steel, 2.44 m [8 ft] long, 3.72 kg/m [2½ lb/ft] minimum and have 9.5 mm [⅜ in] round holes, 25 mm [1 in] center to center for a minimum distance of 610 mm [2 ft] from the top of the post.

Retroreflective beam guardrail delineators shall be steel conforming to ASTM A635/A635M, galvanized in accordance with AASHTO M111 (ASTM A123) with a minimum thickness of 2.8 mm [12 gauge].

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.

The sole patented supplier of multiple mailbox assemblies is Foresight Products, Inc. of Northglenn, Colorado.

The Guardrail 350 Flared Terminal shall be a terminal with a 1.2 M (4 ft) offset as shown in the Manufacturer’s installation instructions.

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.

Guardrail delineator posts shall be set plumb with the outstanding legs of the channel facing the oncoming traffic. Posts, which become bent or otherwise damaged, shall be removed and replaced with new posts.

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 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 13 mm [½ in]. 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 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.

606.045 Offset Brackets Offset brackets shall be of the same material as the posts specified except Guardrail Types 3c and 3d or when an alternative composite material is substituted. The same 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 meter [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.

Terminal section, sloped end, modified eccentric loader terminal, breakaway cable terminal, low volume end, 350 flared terminal, delineator post, terminal end, 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 measured by the cubic meter [cubic yard] determined from the actual depth of the hole and a hypothetical circle diameter of 600 mm [2 ft].

606.09 Basis of Payment The accepted quantities of guardrail will be paid for at the contract unit price per meter [linear foot] for the type specified, complete in place. Reflectorized silver white beam guardrail delineators shall be mounted on all new guardrail installations, spaced at 19 M [62.5 ft], meet the requirements of section 719.01, and mounted on the guardrail beam at the posts. Beam guardrail delineators will not be paid for directly, but will be considered incidental to the guardrail items. Terminal section, buffer end, flared end, bridge connection and single post will be paid for at the contract unit price each for the kind specified complete in place.

NCHRP 350 end treatments, breakaway cable terminals, low volume guardrail ends, and modified eccentric loader 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, brackets, "w" rail, 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. 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 Pay Item 206.07. Type III Retroreflective Adhesive Sheeting shall be applied to the approach buffer end sections and sized to substantially cover the end section. On two-way roadways, the ends shall be yellow on the left and white on the right for approaching traffic. On one-way or divided roadways, only the leading ends will receive the sheeting (yellow on the left and white on the right). Guardrail 350 flared terminal shall also include a set of installation drawings supplied to the Resident, and the Contractor shall provide one complete set of replacement parts per contract and deliver the spare parts to the local Division Office.

Anchorages 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 45 m [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 meter and will be full compensation for adjusting to grade. Payment shall also include adjusting terminal end treatments where required.

Modify guardrail will be paid for at the contract unit price per meter and will be full compensation for furnishing and installing offset brackets, backup plates, additional posts, and other specified modifications; removing, modifying, installing, and adjusting to grade existing posts and beams; removing plate washers and all incidentals necessary to complete the work. Payment shall also include removing and resetting terminal ends where required

Remove and Reset guardrail will be paid for at the contract unit price per meter 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 terminal ends when required. 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.

Remove, Modify, and Reset guardrail will be paid for at the contract unit price per meter 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.

Payment will be made under:

Pay Item		Pay Unit
606.15	Guardrail Type 3a-Single Rail	meter [Linear Foot]
606.151	Guardrail Type 3aa-Single Rail	meter [Linear Foot]
606.17	Guardrail Type 3b-Single Rail	meter [Linear Foot]
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	meter [Linear foot]
606.18	Guardrail Type 3b - Double Rail	meter [Linear foot]
606.19	Guardrail Type 3a - 4.5 m [15 ft] radius and less	meter [Linear Foot]
606.191	Guardrail Type 3aa - 4.5 m [15 ft] radius and less	meter [Linear Foot]
606.20	Guardrail Type 3a - over 4.5 m [15 ft] radius	meter [Linear Foot]
606.201	Guardrail Type 3aa - over 4.5 m [15 ft] radius	meter [Linear Foot]
606.21	Guardrail Type 3b - 4.5 m [15 ft] radius and less	meter [Linear Foot]
606.22	Guardrail Type 3b - over 4.5 m [15 ft] radius	meter [Linear Foot]
606.23	Guardrail Type 3c - Single Rail	meter [Linear Foot]
606.2301	Guardrail Type 3c - Double Rail	meter [Linear Foot]
606.231	Guardrail Type 3c - 4.5 m [15 ft] radius and less	meter [Linear Foot]
606.232	Guardrail Type 3c - over 4.5 m [15 ft] radius	meter [Linear Foot]
606.24	Guardrail Type 3d - Single Rail	meter [Linear Foot]
606.2401	Guardrail Type 3d - Double Rail	meter [Linear Foot]
606.241	Guardrail Type 3d - 4.5 m [15 ft] radius and less	meter [Linear Foot]
606.242	Guardrail Type 3d - over 4.5 m [15 feet] radius	meter [Linear Foot]
606.25	Terminal Connector	Each
606.257	Terminal Connector - Thrie Beam	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
606.35	Guardrail Delineator Post	Each
606.351	Remove and Reset Guardrail Delineator Post	Each
606.357	Guardrail, Modify, Type 3b	meter [Linear Foot]
606.361	Guardrail, Removed and Reset, Type 3b	meter [Linear Foot]
606.362	Guardrail, Adjust	meter [Linear Foot]
606.364	Guardrail, Remove, Modify, and Reset, Type 3b	meter [Linear Foot]
606.367	Replace Unusable Existing Guardrail Posts	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
606.55	Guardrail Type 3 - Single Rail	meter [Linear Foot]
606.551	Guardrail Type 3 - Single Rail with Rub Rail	meter [Linear Foot]
606.56	Guardrail Type 3 - Double Rail	meter [Linear Foot]
606.561	Guardrail Type 3 - Double Rail with Rub Rail	meter [Linear Foot]
606.566	Guardrail, Modify Type 3b-Double Rail	meter [Linear Foot]
606.59	Guardrail Type 3 - 4.5 m [15 ft] radius and less	meter [Linear Foot]
606.60	Guardrail Type 3 - over 4.5 m [15 ft] radius	meter [Linear Foot]
606.621	Twisted End Section - Guardrail Type 3	Each
606.63	Thrie Beam Rail Beam	meter [Linear Foot]
606.64	Guardrail Thrie Beam - Double Rail	meter [Linear Foot]
606.65	Guardrail Thrie Beam - Single Rail	meter [Linear Foot]
606.66	Terminal End Thrie Beam	Each
606.70	Transition Section - Thrie Beam	Each
606.71	Guardrail Thrie Beam - 4.5 m [15 ft] radius and less	meter [Linear Foot]
606.72	Guardrail Thrie Beam - over 4.5 m [15 ft] radius	meter [Linear Foot]
606.73	Guardrail Thrie Beam - Single Rail Bridge Mounted	meter [Linear Foot]
606.74	Guardrail Type 3 - Single Rail Bridge Mounted	meter [Linear Foot]
606.751	Widen Shoulder for Breakaway Cable Terminal	Each
606.752	Widen Shoulder for Modified Eccentric Loader Terminal	Each
606.753	Widen Shoulder for Low Volume Guardrail End - Type 3	Each
606.754	Widen Shoulder for Guardrail 350 Flared Terminal	Each
606.76	Modified Eccentric Loader Terminal	Each
606.77	Breakaway Cable Terminal	Each
606.78	Low Volume Guardrail End - Type 3	Each
606.79	Guardrail 350 Flared Terminal	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:

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 600 mm [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 200 mm [8 in] 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 30º, bracing will be required. At changes in horizontal alignment of 15º to 30º, bracing may be called for on the plans or required by the Resident. At changes in horizontal alignment angles of less than 15º, bracing will not be required except at intervals of 200 m [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 150 mm [6 in] 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 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 1.8 m [6 ft] in height that are installed with a top rail shall not require any brace rails. Fences less than 1.8 m [6 ft] in height installed without a top rail and all fences with heights of 1.8 m [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 10 mm [⅜ in] diameter truss rod and tightened. At changes in horizontal alignment of less than 15º, bracing will not be required except at intervals of 100 m [330 ft]. At changes in alignment of 15º to 30º, bracing may be required as called for on the plans or requested. At changes in alignment in excess of 30º, 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 150 m [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 seven gage galvanized wire shall be used in place of the top rail.

607.06 Method of Measurement Fence will be measured by the meter [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 meter [cubic yard] determined from the actual depth of the drilled hole in the rock and a hypothetical circle diameter of 600 mm [2 ft].

607.07 Basis of Payment The accepted quantities of fence will be paid for at the contract unit price per meter [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 and assembling 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 Pay Item 206.07.

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.

Payment will be made under:

Pay Item		Pay Unit
607.08	Woven Wire Fence - Wood Posts	meter [Linear Foot]
607.09	Woven Wire Fence - Metal Posts	meter [Linear Foot]
607.10	Barbed Wire Fence - Wood Posts	meter [Linear Foot]
607.11	Barbed Wire Fence - Metal Posts	meter [Linear Foot]
607.12	Barway - Wood Posts	Each
607.13	Barway - Wood Posts	Each
607.14	Walk Gateway 1.2 m [4 ft] - Metal	Each
607.15	Drive Gateway 4.9 m [16 ft] - Metal	Each
607.16	Chain Link Fence - 1.2 m [4 ft]	meter [Linear Foot]
607.163	Chain Link Fence - 1.2 m [4 ft] - PVC Coated	meter [Linear Foot]
607.165	Chain Link Fence - 1.2 m [4 ft] - without Top Rail	meter [Linear Foot]
607.17	Chain Link Fence - 1.8 m [6 ft]	meter [Linear Foot]
607.173	Chain Link Fence - 1.8 m [6 ft] - PVC Coated	meter [Linear Foot]
607.175	Chain Link Fence - 1.8 m [6 ft] - without Top Rail	meter [Linear Foot]
607.22	Cedar Rail Fence	meter [Linear Foot]
607.23	Chain Link Fence Gate	Each
607.24	Remove and Reset Fence	meter [Linear Foot]
607.25	Remove and Reset Chain Link Fence	meter [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 Construct asphalt, brick paved, or concrete sidewalks.

608.02 Materials Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Preformed Expansion Joint Filler	705.01
Welded Steel Wire Fabric	709.02
Brick for Paving	704.02

Portland cement concrete for sidewalks shall be class LP and meet the requirements of Section 502 - Structural Concrete.

Bituminous paved sidewalks shall meet the requirements of Section 403 - Hot Bituminous Pavement.

The new aggregate required to build new sidewalk shall meet the requirements of Standard Specification 703.06(a) Aggregate Base and Subbase, Type B. New aggregate for regrading an existing sidewalk shall meet the requirements of Section 703.10 - Untreated Surface Course and Leveling.

Standard compacting will be required for all areas where 150 mm [6 in] or more new or disturbed aggregate is placed. Where 150 mm [6 in] or less is placed, compaction will be achieved by plate compactor, hand tamp or other means approved by the Resident.

608.03 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 on the plan. 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 surface shall be finished with a wooden float, which shall be moved in a circular motion to produce a shell-like pattern. No plastering of the mortar will be permitted. All outside edges of the slab and all joints shall be rounded with a 6 mm [¼ in] radius-edging tool.

e. Joints Joints shall be located as shown on the plans. 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 curb, building, retaining wall, or other fixed structure, a preformed joint filler 6 mm [¼ in] 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, white-pigmented curing compound or by other approved methods. 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 directed.

608.04 Hot Bituminous 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 on the plan. All soft and yielding material shall be removed and replaced with acceptable material.

b. Base Course Base course material shall be placed as shown on the plans and each layer thoroughly compacted.

c. Placing Bituminous Sidewalk Material Bituminous 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 900 kg [1 ton] with a minimum of 1160 kg/m [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 bituminous sidewalk material shall be uniformly compacted.

608.41 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 on the plan. All soft and yielding material shall be removed and replaced with acceptable material.

608.42 Construct Sidewalk The work shall consist of excavating the existing ground, placing and compacting new aggregate as necessary to build the sidewalk in the new location as shown on the plans and typical sections.

608.43 Regrading Sidewalk The 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 on the plans and typical sections.

608.05 Method of Measurement Construct sidewalk, regrading sidewalk, Portland cement concrete sidewalks, and brick sidewalk will be measured by the square meter [square yard] of finished surface. Bituminous concrete sidewalks will be measured by the megagram [ton] of bituminous mixture placed.

608.06 Basis of Payment The accepted quantities of sidewalk will be paid for at the contract unit price per square meter [square yard] for portland cement concrete sidewalk and brick sidewalk, per megagram [ton] for hot bituminous sidewalk and cubic meter [cubic yard] for base course material complete in place. Excavation will be paid for under Section 203 - Excavation

and Embankment. Expansion joint material, joint filler, and other related items will not be paid for separately but the cost thereof shall be included in the cost of the sidewalk. Base and subbase material will be paid for under Section 304 - Aggregate Base and Subbase Course. Bituminous mixture for sidewalk will be paid for under Section 403 - Hot Bituminous Pavement.

For constructing sidewalk, payment will be for excavation, new aggregate and necessary incidentals to bring the grade to prepave grade. For regrading sidewalk, payment will be for removing existing pavement regrading existing gravel base and adding new material as necessary.

Payment for reinforcement will be considered included in the contract unit price for reinforced concrete sidewalk.

Payment will be made under:

Pay Item		Pay Unit
608.07	Plain Concrete Sidewalk	square meter [Square Yard]
608.08	Reinforced Concrete Sidewalk	square meter [Square Yard]
608.10	Brick Sidewalk (Remove and Rebuild)	square meter [Square Yard]
608.15	Brick Sidewalk with Bituminous Base	square meter [Square Yard]
608.16	Brick Driveway Aprons with Bituminous Base	square meter [Square Yard]
608.45	Construct Sidewalk	square meter [Square Yard]
608.46	Regrading Sidewalk	square meter [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 - Precast Portland Cement 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:

Joint Mortar	705.02
Reinforcing Steel	709.01
Portland Cement Concrete for Concrete Curb	712.03
Stone Curbing and Edging	712.04
Epoxy Resin	712.35
Bituminous Curbing	712.36

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.

609.03 Vertical Stone Curb, Terminal Section and Transition Sections and Portland Cement Concrete Curb, Terminal Sections and Transition Sections

a. 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 6 mm [¼ in] and no greater than 15 mm [⅝ in].

b. 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 200 mm [8 in] 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.

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 guide lines. The foundation shall be uniformly painted with tack coat at a rate of 0.2 to 0.7 L/m^2 [0.04 to 0.14 gal/yd^2].

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. Sealing The curb will be sealed with bituminous sealing compound, only when directed by the Resident, in accordance with Section 612 - Bituminous Sealing. Before sealing, the curb shall be clean, dry and shall have reached the ambient temperature.

d. 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 with bituminous sealing compound.

e. 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.

f. Polyester fibers shall be uniformly incorporated into the dry mix at a rate of 0.25 percent of the total batch weight. Certification shall be provided from the supplier with each shipment meeting the following requirements:

Average Length	6.35 mm ±0.127 [0.25 in ± 0.005]
Average Diameter	20 m± 2.5 [0.0008 in ±0.0001]
Specific Gravity	1.32-1.40
Melting Temperature	250 °C [480 °F] Minimum
Color	Natural (White)

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 40 mm [1½ in] 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 two days. Bedding and pointing mortar for joints shall be cured as required under Section 502 - Structural Concrete.

b. Joints Vertical joints shall be 13 mm [½ in] in width plus or minus 3 mm [⅛ in]. Whenever possible, the face and top of the joint shall be pointed with joint mortar to a depth of 40 mm [1½ in], before the bedding mortar has set. Joints which cannot be so pointed, shall be prepared for pointing by raking them to a depth of 40 mm [1½ in] 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 meter [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.

609.10 Basis of Payment The accepted quantities of curbing will be paid for at the contract unit price per meter [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 meter [linear foot] for the type of curb installed.

Vertical Curb Type 1 and Type 2 required to have a radius of 20 m [60 ft] or less, will be paid for as Vertical Curb Type 1 - Circular.

Curb, Type 5 required to haven a radius of 10 m [30 ft] or less will be paid for as Curb Type 5 - Circular.

There will be no separate payment for cement, 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.

Payment will be made under:

Pay Item		Pay Unit
609.11	Vertical Curb Type 1	meter [Linear Foot]
609.12	Vertical Curb Type 1 - Circular	meter [Linear Foot]
609.13	Vertical Bridge Curb Type 1	meter [Linear Foot]
609.131	Vertical Bridge Curb Type 1A	meter [Linear Foot]
609.132	Vertical Bridge Curb Type 1B	meter [Linear Foot]
609.142	Vertical Bridge Curb Type 1B - Circular	meter [Linear Foot]
609.15	Sloped Curb Type 1	meter [Linear Foot]
609.151	Sloped Curb Type 1 - Circular	meter [Linear Foot]
609.19	Vertical Curb - Type 2	meter [Linear Foot]
609.20	Vertical Curb - Circular-Type 2	meter [Linear Foot]
609.23	Terminal Curb Type 1	Each
609.234	Terminal Curb Type 1 - 1.2 m [4 ft]	Each
609.237	Terminal Curb Type 1 - 2.1 [7 ft]	Each
609.2371	Terminal Curb Type 1 - 2.1 [7 ft] - Circular	Each
609.238	Terminal Curb Type 1 - 2.4 m [8 ft]	Each
609.244	Terminal Curb-Type 2 - 1.2 m [4 ft]	Each
609.247	Terminal Curb-Type 2 - 2.1 m [7 ft]	Each
609.26	Curb Transition Section B Type 1	Each
609.31	Curb Type 3	meter [Linear Foot]
609.34	Curb Type 5	meter [Linear Foot]
609.35	Curb-Type 5 - Circular	meter [Linear Foot]
609.38	Reset Curb Type 1	meter [Linear Foot]
609.39	Reset Curb Type 2	meter [Linear Foot]
609.40	Reset Curb Type 5	meter [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

610.031 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.

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.

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.

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 meter [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 meter [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 meter [Cubic Yard]
610.08	Plain Riprap	cubic meter [Cubic Yard]
610.09	Hand Laid Riprap	cubic meter [Cubic Yard]
610.11	Stone Blanket	cubic meter [Cubic Yard]
610.16	Heavy Riprap	cubic meter [Cubic Yard]
610.18	Stone Ditch Protection	cubic meter [Cubic Yard]

SECTION 611 - SLAB FOR BACKSLOPE PROTECTION

611.01 Description This work shall consist of slabs of stone or precast concrete placed on backslopes in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or established.

611.02 Materials Materials shall conform to the requirements specified in the following Sections of Division 700 - Materials:

Joint Mortar	705.02
Reinforcing Steel	709.01
Precast Concrete Slab	712.37
Stone Slab	712.38

611.03 Excavation The slope behind the slabs shall be carefully graded, by hand if necessary, to avoid disturbing earth beyond the designated limits.

611.04 Placement of Slab The slabs shall be placed to conform to the required line and grade. They shall be fitted together to form a vertical joint of not less than 5 mm [¼ in] and not greater than 20 mm [¾ in] wide. The space behind the slabs shall be backfilled with approved granular material thoroughly compacted. Special care shall be taken not to disturb the slabs.

The vertical joints shall be filled with approved caulking compound and neatly smoothed. The surface of the slab shall be protected from all caulking compound.

The slabs shall be protected and kept in good condition with particular care being taken to prevent discoloration of exposed surfaces. All exposed surfaces smeared or discolored shall be cleaned and restored to a satisfactory condition or removed and replaced with a new slab.

Lift holes shall be filled with cement mortar.

611.05 Method of Measurement Slab for backslope protection will be measured by the square meter [square yard] of slab complete in place, measured parallel to the slope but not to exceed the dimensions shown on the plans or authorized by the Resident.

611.06 Basis of Payment The accepted quantity of slab for backslope protection will be paid for at the contract unit price per square meter [square yard] complete in place including caulking of joints.

Excavation to the face of the slab will be measured and paid for as provided in Section 203 - Excavation and Embankment. Excavation and backfill beyond the face of the slab will be considered incidental to the various contract items and no separate payment will be made.

Payment will be made under:

Pay Item		Pay Unit
611.16	Stone Slab for Backslope Protection	square meter [Square Yard]
611.17	Concrete Slab for Backslope Protection	square meter [Square Yard]

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 1.25 L to 2.25 L [0.25 gal to 0.50 gal] of diluted sealer per square meter [square yard]. The second coat shall be diluted only to the extent necessary to obtain workability and applied at a rate of 1.1 L to 2.2 L [0.25 gal to 0.50 gal] of diluted sealer per square meter [square yard].

612.04 Method of Measurement Bituminous sealing will be measured by the square meter [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 meter [square yard] complete in place.

Payment will be made under:

Pay Item		Pay Unit
612.06	Bituminous Sealing-Black	square meter [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 150 mm [6 in] deep and overlapped on the adjoining ends no less than 75 mm [3 in]. Parallel strips shall be overlapped 100 mm [4 in] on the sides. Approved anchor staples shall be placed at a maximum spacing of 900mm [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 meter [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 meter [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 meter [Square Yard]

SECTION 614 - VACANT

SECTION 615 - LOAM

615.01 Description This work shall consist of furnishing and placing loam 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:

Humus	717.09

Loam shall meet the following requirements:

Organic Content	Percent by Volume
Humus	10% - 20%, as determined by Ignition Test.
pH	5.5 - 8.0

Mineral Content	Percent by Volume
Sand - 2.0mm - 0.05mm [0.08 in to 0.002 in] diameter	45% - 75%
Silt - 0.05mm - 0.002mm [0.002 in to 0.00008 in] diameter	20% - 40%
Clay - less than 0.002mm [0.00008 in] diameter	5% - 15%

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.

The Contractor shall submit loam testing results; the cost of testing shall be considered incidental to the Pay Item for Loam.

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 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 50 mm [2 in].

615.04 Placing 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 50 mm [2 in] in its greatest diameter and all other foreign matter, shall be removed. On areas to be seeded under Method Number 1, all rocks over 25 mm [1 in] 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 45 kg [100 lb] roller or other approved means. Loam thickness shall meet the specified depth after compaction.

615.05 Method of Measurement Loam will be measured by the cubic meter [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 will be paid for at the contract unit price per cubic meter [cubic yard] complete in place. Existing topsoil removed from within the lines of improvement and stockpiled for later use as loam will be paid for under Pay Item 203.20, Common Excavation, after removal and stockpiling, and will be paid for under Pay Item 615.07, Loam, when placed in its final position. Grading surplus topsoil, salvaged but not required for use on slopes as loam, 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 meter [Cubic Yard]
615.0701	Loam - Plan Quantity	cubic meter [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.

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 50 mm [2 in].

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 12 mm [½ in].

Pegs for holding sod shall be of approved sound wood and at least 19mm [¾ in] in thickness and at least 200 mm [8 in] in length.

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 300 mm [12 in] and a minimum length of 300 mm [12 in] 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 50mm [2 in] 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 and agricultural ground limestone shall be applied to the soil by a mechanical spreader or other approved method capable of maintaining a uniform, measurable rate of application. The fertilizer and limestone shall not be applied simultaneously. Fertilizer and limestone shall be applied before laying sod, at the rate of 1.8 kg/100m^2 [4 lb/1000 ft^2] for fertilizer and 6 kg/100 m^2 [13 lb/1000 ft^2] for limestone. On hard packed soil, the areas under preparation shall be scarified or otherwise loosened to a depth of at least 50 mm [2 in] 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. The pegs shall be spaced no more than 600 mm [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.

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 meter [square feet], 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 meter [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 meter [Square Yard]

SECTION 617 - SOIL CONDITIONERS

Reserved

SECTION 618 - SEEDING

618.01 Description This work shall consist of furnishing and applying a 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, and cellulose fiber mulch 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, and fertilizer to existing soils 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 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 then 30 days. Seed for Temporary Seeding shall be oats, wheat, rye, or other seed conforming to the requirements of Section 717.03(e).

f. Crown Vetch Seeding shall consist of the application of seed, inoculant, and lime 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
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 100 m^2 [1000 ft^2].

a. The Contractor shall apply agricultural ground limestone at the rate of 15 kg [33 lb] per unit. Liquid lime shall be applied at the rate of 0.25 liters [1 cup] per unit, hydraulic method. Liquid lime shall be one part lime with a minimum of 10 parts water.

b. The fertilizer application rate for seed establishment shall be 4 kg [9 lb] per unit, Seeding Method 1 and 2 only.

c. The seed mixture sowing rate for Seeding Method 1 and 2 shall be 1.8 kg [4 lb]/unit.

d. The seed mixture sowing rate for Seeding Method 3 shall be 1.0 kg [2 lb] per unit.

e. The Temporary Seed sowing rate shall be 1.5 kg [3 lb] per unit.

f. The Crown Vetch Seed sowing rate shall be 0.5 kg [1 lb] per 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 25 mm [1 in]. 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, limestone, and mulch in a 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. Mulch for Seeding Method Number 1 shall be cellulose fiber mulch as specified in Section 619.04(b).

618.08 Mulching After seeding, the Contractor shall place hay 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 . 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.

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 50 mm [2 in] immediately before seeding or mulching. The Contractor shall remove all stones over 100 mm [4 in] 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. Cellulose fiber mulch only shall be applied with Method 1, and may be used with Method 2.

b. Temporary Seeding

1. The Contractor shall apply agricultural ground limestone to the prepared areas as specified in Sections 618.05 and 618.07.

2. The Contractor shall sow seed onto existing ground as specified in Sections 618.06 and 618.07.

3. 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 1or 2 upon attainment of a reasonably thick uniform stand of permanent grass species with at least 90 percent 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 percent 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 Department. 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 621.0024 and 616.05. Applied Water shall be authorized by the Department. The Contractor shall use Applied Water from approved sources 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 100 m^2 [1000 ft^2] along the slope of the ground. The quantity of seeding measured for payment will be the number of units shown in the Schedule of Items in the contract. This quantity will be considered final, and no adjustments will be made, except when the actual area seeded varies from the number of units shown in the Schedule of Items by more than 15 percent.

The Department will measure Applied Water for payment by the cubic meter [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 percent of the Contract price for the appropriate item.

When authorized, the Department will pay for Applied Water at the Contract price per cubic meter [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
618.1301	Seeding Method Number 1, Plan Quantity	Unit
618.1401	Seeding Method Number 2, Plan Quantity	Unit
618.1411	Seeding Method Number 3, Plan Quantity	Unit
618.143	Special Seeding	Unit
618.15	Temporary Seeding	Unit
618.16	Crown Vetch Seeding	Unit
618.25	Applied Water	Cubic Meter [gallon]

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 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.

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 3.5 Mg to 4.5 Mg/ha [1.5 ton to 2 ton/acre]. 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 2.3 Kg/Unit [5 lbs/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 20 kg [40 lb] of mulch material per 100 m² [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 and erosion control mix shall be placed to cover the slope with a 100 mm [4 in] 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 Hay and straw mulch measured and accepted for payment will be the number of units of 100 m² [1000 ft²] each, shown in the Schedule of Items in the contract.

This quantity will be considered final, and no adjustments will be made, except when the actual area mulched varies from the number of units shown in the Schedule of Items by more than 15%.

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, 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 for Pay Item 619.1201.

Payment will be made under:

Pay Item		Pay Unit
619.1201	Mulch, Plan Quantity	Unit
619.1301	Bark Mulch	cubic meter [Cubic Yard]
619.1401	Erosion Control Mix	cubic meter [Cubic Yard]

SECTION 620 - GEOTEXTILES

620.01 Description This work shall consist of the furnishing and installing of woven geotextile fabric or nonwoven 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 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.

All joints between adjacent fabric roll ends that may occur on the slope shall be overlapped shingle style. 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 300 mm [1 ft]. Stone with a mass of more than 100 kg [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 1 m [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 200 mm [8 in] 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 200 mm [8 in] of compacted cover material. Ruts shall be filled with additional cover material to maintain the minimum 200 mm [8 in] 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 300 mm [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 722.03 - Geotextiles is needed.

c. Non-Woven Geotextile Non-woven Erosion Control Geotextiles require Class 2 geotextile class designation. All other Non-woven Geotextiles require Class 1 geotextile class designation.

The Non-woven Geotextile class selection is appropriate for conditions of equal or less severity than either of the following:

1. Armor layer stone weights do not exceed 100 kg [220 lb], stone drop height is less than 1 m (3 feet), and no aggregate bedding layer is required.

2. Armor layer stone weighs more than 100 kg [220 lb], stone drop height is less than 1 m [3 ft], and the geotextile is protected by a 150 mm [6 in] 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 100 kg [220 lb], stone drop height is less than 1 m [3 ft], and the geotextile is protected by a 150 mm [6 in] thick aggregate bedding layer designed to be compatible with the armor layer.

d. Armor layer stone weights do not exceed 100 kg [220 lb] and stone is placed with a zero drop height. Note: 703.25 Stone Fill has stones up to 225 kg [500 lb], 703.26 Plain and Hand Held Riprap has stones up to 100 kg [220 lbs, 703.27 Stone blanket has stones up to 1,500 kg [3,300 lb], 703.28 Heavy Riprap has stones up to 450 kg [990 lb]

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.

All joints between adjacent fabric roll ends that may occur on the slope shall be overlapped shingle style. 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 300 mm [1 ft]. Stone with a mass of more than 100 kg [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 1 m [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 and Seams Adjacent lengths of fabric shall be joined by overlapping a minimum of 450 mm [18 in] 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 1 vertical to 3 horizontal: Sewn seams or minimum 1 m [3 ft] overlaps with no pinning or staking allowed.

b. For slopes flatter than 1 vertical to 3 horizontal: Sewn seams or minimum 450 mm [18 in] 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.

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 Kevlar aramid, polyethylene, polyester, or polypropylene 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 200 to 400 stitches per meter shall be used for lighter-weight geotextiles while heavier geotextiles shall have 150 to 200 stitches per meter. All field seams shall be double stitched with two parallel passes and the 2 rows of stitching shall be approximately 13 mm [½ in] apart and shall not cross at any point. All stitching shall be at least 25 mm [1 in] from the fabric edge.

For seams that are sewn in the field, the Contractor shall provide at least a 2 m [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. 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 D 4884 - Standard Test Method for Seam Strength of Sewn Geotextiles.

a. Stabilization/Reinforcement and Separation Geotextile Adjacent geotextile rolls shall be overlapped, 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:

AASHTO Classification	Minimum Overlap
A-1, A-2, A-3, A-4	450 mm [18 in]
A-5, A-6, A-7	1 m [3 ft] or sewn[a]
All roll ends	1 m [3 ft] or sewn[a]
[a]Seems 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 300 mm [1 ft], with the upstream sheet overlapping the downstream sheet. In trenches

equal to or greater than 300 mm [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 300 mm [1 ft]. In trenches of less than 300 mm [1 ft] but greater than 100 mm [4 in] wide, the overlap shall be equal to the width of the trench. Where the trench is less than 100 mm [4 in] 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. Overlapped seams of roll ends shall be a minimum of 450 mm [18 in] except where placed under water. In such instances the overlap shall be a minimum of 1 m [3 ft]. Overlaps of adjacent rolls shall be a minimum of 450 mm [18 in] 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 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 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.

620.06 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.

620.07 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 71°C [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 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 450 mm [18 in], 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 1 m [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.

620.08 Method of Measurement The quantity of geotextile will be measured by the number of square meters [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.

620.09 Basis of Payment Geotextiles will be paid for at the contract unit price per square meter [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 meter [Square Yard]
620.55	Stabilization/Reinforcement Geotextile (sewn seams)	square meter [Square Yard]
620.56	Drainage Geotextile	square meter [Square Yard]
620.57	Drainage Geotextile (sewn seams)	square meter [Square Yard]
620.58	Non-woven Geotextile	square meter [Square Yard]
620.59	Non-woven Geotextile (sewn seams)	square meter [Square Yard]
620.60	Separation Geotextile	square meter [Square Yard]
620.61	Separation Geotextile (sewn seams)	square meter [Square Yard]

SECTION 621 - LANDSCAPING

621.0001 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 establishment period, all in accordance with the specifications, 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.

b. Class B Planting will consists of planting into the existing soil without amendments.

Unless otherwise specified, all planting shall be Class A.

621.0002 Materials - General All non-planting material shall conform to the requirements specified in the following Sections of Division 700 - Materials.

Fertilizer	717.01
Mulch	717.04
Organic Humus	717.09

Water shall be free from oil, acids, alkalines, salts, or any other substances harmful to plantings.

621.0003 Plant Material-All Classes

a. All plants shall conform to the current edition of the "USA Standard for Nursery Stock" sponsored by the American Association of Nurserymen (AAN), 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.

"Bush-form" trees shall be those with branches, which start from the main trunk close to 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.

621.0004 Plant Size and Root Balls

Class A Plants The plant sizes specified in the "USA Standard for Nursery Stock" are the minimum sizes acceptable. 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 USA Standard.

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 percent 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.

Caliper of trees shall be the diameter of the trunk taken 150 mm [6 in] above the root collar.

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 "USA 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.

621.0006 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. Unsatisfactory work will not be paid for during the establishment period.

621.0017 General Construction Requirements Planting operations shall be performed in accordance with the plans and specifications and as directed by the Resident.

621.0018 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 Contractor as directed by the Resident at least 48 hours before herbicides are applied and any

plant pits or beds are dug. Equipment, labor and approved labeled stakes for this purpose are to be furnished by the Contractor.

The Contractor shall furnish the stakes for use in marking plant locations. Stakes shall be wire survey flags at least 375 mm [15 in] tall. Layout stake samples shall be approved by the Resident before the Contractor commences any work on the project.

The Contractor will be required to mark the stakes legibly with indelible marking material and will 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 four 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.

621.0019 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 750 mm [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 75 mm [3 in] 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 0.25 m^3 [¼ yd^3] 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 0.25 m^3 [¼yd^3] 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 root spreads or ball diameters up to 600 mm [2 ft], pit diameters shall be 1½ times the root spread. For root spreads or ball diameters over 600 mm [2 ft] and less than and including 1200 mm [4 ft], pit diameters shall be 600 mm [2 ft] greater. For root spreads or ball diameters over 1200 mm [4 ft], the pit diameter shall be 900 mm [3 ft] greater.

The plant pit shall be deep enough so that when installed the top of the root ball is even with to 12 mm [½ in] higher then 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. Where shown on the plans or directed by the Resident such pits may also require drains. When such drains are required, they 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 75 mm [3 in] 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.

621.0020 Planting Seasons Seasons for planting, unless otherwise directed, shall be within the following dates:

Bare Root Plants except Evergreen Seedlings	Spring	April 1st to May 31st
	Fall	Sept. 15th to Nov. 15th
Evergreen Seedlings		April 1st to May 15th only
Potted & Container Grown Plants	Spring	April 1st to July 15th
	Fall	August 15th to Nov. 15th
Balled & Burlapped Plants	Spring	April 1st to June 15th
	Fall	August 15th to Oct. 15th

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.

621.0023 Setting Plants The 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 to 12 mm [½ inch] above the surrounding ground surface.

621.0024 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. 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 bareroot 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. If watering during the establishment period is unsatisfactory, no payment will be made.

621.0025 Fertilizing

a. Water Soluble Fertilizer The Contractor shall liquid feed the plants as the first watering, unless otherwise directed by the Resident. All seedlings will be liquid fed during planting.

Liquid fertilizer shall be completely dissolved and mixed in water at the rate of 3 kg [6 lb] of the fertilizer concentrate to 400 L [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:

Class C evergreen plants - 0.5 L [1 pint] per plant.
Class C deciduous plants - 2 L [2 qt] per plant.
Class A and B plants-plants up to 600 mm [2 ft] in height shall receive 3.4 L [4 qt].
Plants above 600 mm [2 ft] and up to 1800 mm [6 ft] shall receive 6 L [6 qt].
Plants above 1800 mm [6 ft] and up to 3600 mm [12 ft] shall receive 11 L [12 qt].
Plants above 1800 mm [12 ft] shall receive 15 L [16 qt].

b. Slow Release Fertilizer Tablets All woody plants except evergreen seedlings shall be fertilized with slow release fertilizer tablets 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 150 to 200 mm [6 to 8 in] below ground level. .

The application rates shall be as follows:

Types of Plants	No. of Tablets

Evergreen Trees	
Under 450 mm [18 in] height	1 tablet
450 mm to 900 mm [18 in to 3 ft] height	2 tablets
900 mm to 1800 mm [3 ft to 6 ft] height	3 tablets
Over 1800 mm [6 ft] height	4 tablets
Deciduous Trees	
Under 1800 mm [6 ft] height	2 tablets
1800 mm to 3600 mm [6 ft to 12 ft] height or under 100 mm [4 in]caliper	3 tablets
Over 100 mm [4 in] caliper	4 tablets
Shrubs	
Under 600 mm [2 ft] height or spread	1 tablet
600 mm to 900 mm [2 ft to 3 ft] height or spread	2 tablets
Over 900 mm [3 ft] height or spread	3 tablets
Vines and Ground Covers	1 tablet

621.0026 Mulching The disturbed surface area of plant beds and pits shall be evenly and uniformly covered to a depth 100 mm [4 in] with bark mulch or as directed by the Resident.

Mulching will not be required on Class B evergreens, unless otherwise stated herein.

Measurement of the depth of mulch will be made after one heavy rain or after a three-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 621.0019(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 in excess of 50 mm [2 in] of thickness. Plants shall be mulched at the time of installation.

621.0027 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.

621.0030 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 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.

621.0031 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.

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.

621.0033 Protection From Rodents It will be the responsibility of the Contractor to take necessary steps to protect all plants from rodents during the life of the contract. Protection from rodents will be included in the cost of the individual plants and the Contractor will receive no extra compensation for this work. No payment will be made for unsatisfactory work during the establishment period or planting season.

621.0034 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.

621.0035 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 Final Acceptance.

621.0036 Establishment Period During the months of March through November, the Contractor shall make monthly visits to the site. The Contractor shall supply the Department with an approved written report monthly, detailing the activities performed and the condition of the plant material during the visit.

The acceptability of the plant material furnished and planted under this contract shall be at the end of a period of establishment, 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. No payment shall be made for unsatisfactory work during the establishment period.

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 period of establishment shall commence at the initial acceptance of each planting and shall extend for two years after that date unless otherwise directed. Necessary replacements shall be made so that at the time of Final Acceptance 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 time of Final Acceptance.

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 Final Acceptance date. Any small quantity of plants, which fail between the end of the planting season and the Final Acceptance date, shall be canceled from the list of accepted plants and the Contractor will receive no payment for them. If a sizable number fails the Resident may extend

the date of Final Acceptance to the subsequent planting season, in which case, the Contractor will be subject to liquidated damages. 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.

621.0037 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.

621.0038 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 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.

The establishment item will be paid on a lump sum basis.

Payment will be made under:

Pay Item		Pay Unit
621....	Name plant or plant group as detailed in Schedule of Items in Proposal Book	Each
621.80	Establishment Period	Lump Sum

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 Loam Loam shall conform to the requirements of Section 615.02. Fertilizer shall meet the requirements specified in Section 717.01.

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 Standard for Nursery Stock" sponsored by the AAN.

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 450 mm [18 in] 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. Loam shall be placed to a thickness of not less than 200 mm [8 in] 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 shall be mixed evenly into the backfill soil at the rate of 0.4 kg/m [¼ lb/ft] of height for each plant. Water soluble fertilizer and slow release fertilizer packets shall be applied at the following rates.

Shrubs to 600 mm [2 ft] high or spread	4 L[4 qt] water soluble or 1 packet
Shrubs to 1200 mm [4 ft] high or spread	6 L[6 qt] water soluble or 2 packets
Shrubs to 1800 mm [6 ft] high or spread	8 L[8 qt] water soluble or 3 packets

d. Time of Transplanting Plants shall be dug and transplanted only when dormant, preferably in the early spring, 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, hay, 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. Mulch After removing all weeds and grass, the ground surface over the entire area of the planting pit shall be covered to a depth of 100 mm [4 in] with a mulch of bark, stone or other approved material. Sawdust, hay, or straw will not be accepted as mulching material.

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 300 mm [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 1200 mm [48 in] diameter. For balls over 1200 mm [48 in] diameter the ball shall have sufficient depth to maintain a solid structure and to encompass all the feeding roots under the ball area. Power shovels and similar machinery may not be used in digging the ball except with written permission.

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. Loam shall be placed to a distance of not less than 300 mm [12 in] under the ball and around the periphery of the ball. Loam 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 621.0025 b.

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, preferably in the early spring, 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 the plants during the life of the contract. 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 insect pests. Should damage occur it shall be repaired by the Contractor, according to the best horticultural practice.

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 hedges will be measured by the meter [linear foot] in place after transplanting, measured from the extremities of the branches at each end. A hedge shall be defined as an evenly spaced row of plants of uniform size, growing close to each other so that the branches are intermingled.

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 hedges will be paid for at the contract unit price per meter [linear foot] of hedges properly transplanted and accepted, which price and payment shall include digging, binding, moving, replanting, pruning, mulching, care and maintenance and if required, replacement of the hedges and for all loam, mulch and all other materials and incidentals necessary to complete the item.

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 loam, mulch and other materials, and for all incidentals necessary to complete the item.

Payment will be made under:

Pay Item		Pay Unit
622.09	Transplanting Hedge	meter [Linear Foot]
622.10	Transplanting Shrub	Each
622.11	Transplanting Tree	Each

SECTION 623 - MONUMENTS

623.01 Description This work shall consist of furnishing and placing, or removing and resetting right-of-way monuments and survey monuments at locations shown on the plans or otherwise designated.

623.02 Materials Monuments shall be of granite or of reinforced portland cement concrete. When of granite, the stone shall be of a quality conforming to the applicable requirements of Section 712.04. When concrete is called for, portland cement concrete for monuments shall be of Class A and shall meet the requirements of Section 502 - Structural Concrete. Reinforcement shall conform to the requirements of Section 503 - Reinforcing Steel.

623.03 General Monuments shall be placed in vertical positions in excavated holes at depths shown on the plans or designated, with two sides approximately parallel with the roadway. The backfill material shall be placed in layers not exceeding 200 mm [8 in] in depth, loose measure and firmly tamped.

When removing and resetting monuments, special care shall be taken that the stone shall not be broken or damaged. Monuments broken or damaged by the Contractor shall be replaced with monuments of similar type without added compensation.

When a monument is to be set and it is found that rock exists below ground, it will be permissible to cut off the monument at an authorized length to allow setting on the rock. A concrete collar with dowels shall be placed around the monument to secure it to the rock, as shown on the plans. If the rock is rough enough to provide firm attachment for the concrete, collar dowels will not be necessary. The concrete shall meet the requirements of Section 502 - Structural Concrete. The class of concrete shall be optional.

When a monument is to be set in the surface of exposed rock it may consist of a bronze pin marker embedded in the ledge as shown on the Standard Detail Sheets.

623.04 Method of Measurement Monuments and markers, both new and reset, will be measured by each unit. Excavation in solid rock will be measured by the cubic meter [cubic yard] determined from the actual depth of the hole and a hypothetical circle diameter of 600 mm [2 ft].

623.05 Basis of Payment The accepted quantities of monuments and markers will be paid for at the contract unit price each complete in place. Payment for placement of monuments in solid rock shall be considered included in the contract unit bid price except that actual excavation into solid rock will be paid for under Pay Item 206.07 - Structural Rock Excavation, Drainage and Minor Structures.

Payment will be made under:

Pay Item		Pay Unit
623.06	Right-of-Way Monument	Each
623.07	Survey Monument	Each
623.08	Bronze Pin Marker	Each
623.09	Remove and Reset Monument	Each

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 meter [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 meter [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	19 mm (¾ in) Copper Tubing	meter [Linear Foot]
625.082	25 mm (1 in) Copper Tubing	meter [Linear Foot]
625.083	32 mm (1¼ in) Copper Tubing	meter [Linear Foot]
625.084	38 mm (1½ in) Copper Tubing	meter [Linear Foot]
625.085	44 mm (1¾ in) Copper Tubing	meter [Linear Foot]
625.086	50 mm (2 in) Copper Tubing	meter [Linear Foot]
625.101	19 mm (¾ in) Non-metallic Pipe-Flexible	meter [Linear Foot]
625.102	25 mm (1 in) Non-metallic Pipe-Flexible	meter [Linear Foot]
625.103	32 mm (1¼ in) Non-metallic Pipe-Flexible	meter [Linear Foot]
625.104	38 mm (1½ in) Non-metallic Pipe-Flexible	meter [Linear Foot]
625.105	44 mm (1¾ in) Non-metallic Pipe-Flexible	meter [Linear Foot]
625.141	50 mm (2 in) Pipe Sleeve	meter [Linear Foot]
625.142	75 mm (3 in) Pipe Sleeve	meter [Linear Foot]
625.143	100 mm (4 in) Pipe Sleeve	meter [Linear Foot]
625.144	150 mm (6 in) Pipe Sleeve	meter [Linear Foot]
625.145	200 mm (8 in) Pipe Sleeve	meter [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, highway signing, and traffic signal installations in accordance with these specifications and in reasonably close conformity with the plans.

626.02 General 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 on the plans or as directed.

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.

Reinforcing Steel	709.01
Precast Concrete Units	712.06
Steel Conduit	715.02

Non-metallic Conduit	715.03
Prewired Conduit	715.04
Metallic Junction and Fuse Box	715.05
Anchor Bolts	720.07

626.021 Miscellaneous Material Gravel backfill shall meet the requirements for Aggregate Base-Screened, Section 703.06 a., Type A.

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 satisfactory to the Resident shall be used.

All concrete foundations shall be constructed of Class A concrete in accordance with the applicable requirements of Section 502 - Structural Concrete.

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 plans. 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 on the plans 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.

626.031 Conduit If the trench for conduit is located in wet, spongy or otherwise unsuitable ground, the trench shall be further excavated to a depth sufficient to overcome this condition and shall be backfilled with approved gravel. The gravel shall be compacted in layers not exceeding 200 mm [8 inches], 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 the depth shown on the plans or as directed.

Junction or pull boxes shall be installed as shown on the plans.

Where conduits enter exposed junction boxes, they shall be sloped to drain towards the conduit entrance holes, unless otherwise directed. Weepholes of 6 mm [¼ in] 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 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 200 mm [8 in], and thoroughly tamped.

All underground conduit shall be placed to at least the depth shown on the plans and shall not interfere with poles, guardrail posts, sign foundations or other objects.

All conduit ends shall be capped with conduit caps until wiring has begun. Prewired conduit shall be sealed during construction to prevent entry of moisture, dirt, or rocks.

The size and type of conduit required will be noted on the plans, 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 weatherhead on conduit risers on Utility Company poles shall not be less than 300 mm [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 3 mm [⅛ in] 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 Number 9 US Steel Wire Gauge galvanized iron pull-wire in all unused conduits. The ends of the wire shall be secured in such manner as to prevent accidental withdrawal of the wire.

626.032 Metallic Conduit Installation Conduits shall be of the sizes noted on the plans, 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 concrete superstructure of bridges and similar structures shall be securely supported and fastened, in order to maintain the conduits' position within the concrete superstructure, as shown on the plans. Pull boxes shall be located as shown on the plans. Clearance between conduit runs shall preferably be 50 mm [2 in], 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 on the plans or approved. Fasteners or supports shall not be placed more than 1.8 m [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, hereafter called PVC conduit, shall be installed in accordance with the applicable methods as specified in Section 626.032 for metallic conduits.

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 45º [⅛ 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 concrete superstructure of bridges and similar structures shall be securely supported and fastened, in order to maintain the conduits' position within the concrete superstructure, as shown on the plans. Pull boxes shall be located as shown on the plans. Clearance between conduit runs shall preferably be 50 mm [2 in], 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 75 mm [3 in] of sand or soil cushion. The bottom of trenches for PVC conduit shall be lined with a 75 mm [3 in] minimum bedding of tamped sand or soil before laying the conduit. Backfill to a compacted depth of 150 mm [6 in] above the top of the conduit shall be sand or soil, free from rocks or hard lumps.

At locations shown on the plans, or otherwise designated, conduit shall be constructed of schedule 80, PVC non-metallic conduit pipe encased in approved granular material as shown on the detail sheets.

When prewired conduit is installed, only those junction boxes necessary for underground splices shall be installed, unless otherwise directed.

Conduit and wire sizes of prewired conduit shall be as shown on the plans.

If the Contractor elects to plow-in the prewired conduit, the plowing shall be done with approved vibratory plowing equipment.

When prewired conduit is installed in a trench, the trench shall be prepared as previously noted in this Section for PVC conduit.

626.034 Concrete Foundations 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 poles or as shown on the plans. Anchor bolts for use with breakaway couplings, longitudinally grooved-type, shall be 25 mm [1 inch] diameter and shall project between 65 mm to 75 mm [2½ in and 3 in] above the top of the foundation. All other anchor bolts shall be a minimum of 25 mm [1 in] 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 13 mm [½ in] below the leveling nut and 6 mm [¼ inch] above the top nut. At least two threads on each anchor bolt shall project beyond the outside of the nuts holding the plumbed pole.

Foundations shall be constructed of reinforced concrete with anchor bolts in accordance with the applicable requirements of Section 502, Section 503 and in conformity with the dimensions and details shown on the plans or the Contractor's approved design.

If the foundation is located in wet, spongy, or otherwise unsuitable material, the hole shall be further excavated to a depth sufficient to overcome this condition and backfilled with aggregate subbase material. The aggregate material shall be firmly compacted in layers not more than 200 mm [8 in], loose measure. Backfilling of foundation material shall conform to Section 206.03.

The surface area around the foundations shall be loamed and seeded in accordance with the requirements of Section 615 and Section 618.

Concrete foundations designated to be modified or removed shall be modified or removed as shown on the plans. Debris resulting from the modification or removal shall be removed f

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. The area shall then be seeded in accordance with Section 618.

Backfilling around the foundations shall conform to the requirements of Section 206.03. Backfill material shall be excavated material, unless considered unsatisfactory, in which case the material used for backfill shall meet the requirements of Aggregate Base-Screened. 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. 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.

When solid rock is encountered at less than the required distance below existing ground level, the construction method shown on the plans shall be followed.

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.

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 on the plans.

626.04 Method of Measurement Precast Concrete Junction Box, Foundations (all) and Remove or Modify Concrete Foundation will be measured by each unit.

All conduit will be measured by the number of meters [linear feet].

The quantity of structural earth excavation to be measured for payment below grade will be the amount actually excavated from 300 mm [1 ft] below the bottom of the foundation, junction box or sand bedding to the required elevation, provided the maximum allowable horizontal dimensions do not exceed those bounded by vertical surfaces 230 mm [9 in] each side of the installation, as shown on the plans. The quantity of structural rock excavation to be measured for payment will be the number of cubic meters [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 of foundations will be paid for at the contract unit price each for the number of foundations of the respective types. This payment shall include: anchor bolts, reinforcing steel, conduit within the foundation and extending 300 mm [12 in] from the foundation, loam, seeding, mulching and all incidentals necessary to complete the work.

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 300 mm [12 in] outside the box.

Payment will be made for the total number of meters [linear feet] of each type of underground or exposed conduit actually furnished, installed, and accepted at the contract price per meter [linear foot]. This price shall include the cost of: furnishing and installing the conduit; excavating; furnishing special backfilling materials, pull wire, fittings, groundings and bonding; test cleaning interiors of conduits and all materials, labor, equipment and incidentals necessary to complete the work.

Excavating and backfilling for junction boxes, foundations and excavating, backfilling and sand bedding for conduit ducts will be considered included in the respective contract unit prices and no separate payment will be made, except as hereafter provided.

Excavating and backfilling as shown on the plans, 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 meters [linear feet] of prewired conduit actually furnished, installed, and accepted at the contract price per meter [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 300 mm [12 in] from the foundation and for loam, seeding, mulching and all incidentals necessary to complete the work.

Prewired conduit within the foundations and extending 300 mm [12 in] from the foundation, and prewired conduit within the junction box and extending 300 mm [12 in] outside the junction box, shall be considered incidental to the respective contract unit prices for light standard foundations and junction boxes and no additional payment will be made.

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 prices for each related item, except as otherwise provided.

Payment will be made under:

Pay Item	Pay Unit

626.11	Precast Concrete Junction Box: ___	Each
626.21	Metallic Conduit	meter [Linear Foot]
626.22	Non-metallic Conduit	meter [Linear Foot]
626.23	Prewired Conduit Secondary Wiring	meter [Linear Foot]
626.24	Prewired Conduit Primary Wiring	meter [Linear Foot]
626.31	450 mm [18 in] Foundation	Each
626.32	600 mm [24 in] Foundation	Each
626.33	750 mm [30 in] Foundation	Each
626.331	900 mm [36 in] Foundation	Each
626.34	Signal Pole Foundation	Each
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

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 curbing 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.

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.

627.04 General All pavement lines and markings shall be applied in accordance with 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 shown on the plans.

Broken lines shall consist of alternate 3 m [10 ft] painted line segments and 9m [30 ft] gaps.

Temporary pavement marking lines, defined in Special Provision Section 652, Maintenance of Traffic, Temporary Centerline**,** 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, except where specified otherwise in Special Provision 652 Maintenance of Traffic, Temporary Centerline. Delineators will be applied at 12 m [40 ft] intervals.

In overnight lane closure areas that are not to be overlaid, temporary plastic lines or raised pavement markers shall be used through the length of the taper.

Newly painted lines, markings and curb shall be protected from traffic by the use of cones, stationary vehicles 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 0.1 m² [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 0.400 mm [16 mils].

On other final pavement markings and on curb, where the paint is applied by hand painting or spraying, application shall be in two uniform covering coats, each at least 0.25 mm [10 mils] thick. Before the second coat of 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.

Glass beads shall be applied to the final and temporary pavement lines, marking and curb at the rate of 0.54 kg/L [4.5 lb/gal] of paint and in sufficient quantity to assure complete and uniform coverage of hand painted surfaces.

Temporary painted lines and markings shall be applied as specified for permanent painted lines, except that the thickness shall be a minimum of 0.400 mm [16 mils].

Temporary pliant polymer marking material shall be used for temporary markings on the final pavement and on pavements not to be resurfaced when such pavement markings do not conform to the final pavement markings pattern.

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 six-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 six months. At the end of the establishment period, a minimum of 95% of the plastic pavement lines and markings shall still be in place to be acceptable.

If less than 95% of the plastic pavement lines and markings are in place after six 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 six 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 grinding, high temperature flame, sand blasting, solvent or other acceptable means. The method chosen must be capable of completely eradicating the existing line or marking without damage to the pavement. Burning and grinding to remove temporary markings from final pavement or from existing pavement not to be resurfaced will not be permitted.

627.09 Method of Measurement The quantity of permanent pavement marking lines measured for payment will be the number of meters [feet] shown in the Schedule of Items in the contract. 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.

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. Temporary pavement marking lines will be measured as one lump sum for work accepted. All other pavement markings will be measured by the square meter [square foot] for work actually done.

Reflectorized curb will be measured or computed by the square meter [square foot] of curb surface actually painted and reflectorized.

The accepted quantity of removing existing pavement markings will be measured by the square meter [square foot].

Temporary Bi-directional Yellow Delineators will be measured by each unit, complete in place, maintained, and accepted.

627.10 Basis of Payment The accepted quantity of permanent pavement marking lines will be paid for at the contract unit price per meter [foot]. No adjustment will be made to the quantity for payment, except as described under Method of Measurement above. All other

permanent pavement markings will be paid for at the contract unit price per square meter [square foot].

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 temporary pavement marking lines will be paid for at the contract lump sum 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.

Payment will be made under:

Pay Item		Pay Unit
627.18	300 mm [12 in] Solid White Pavement Marking Line	Meter [Linear Foot]
627.711	White or Yellow Pavement Marking Line - Plan Quantity	Meter [Linear Foot]
627.75	White or Yellow Pavement & Curb Marking	Square Meter [Square Foot]
627.76	Temporary Pavement Marking Line, White or Yellow	Lump Sum
627.77	Removing Existing Pavement Marking	Square Meter [Square Foot]
627.407	Reflectorized Plastic, White or Yellow Pavement Marking	Square Meter [Square Foot]
627.4071	Reflectorized Plastic, White or Yellow Pavement Marking Line - Plan Quantity	Meter [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:

Equipment	Description	Minimum Size
Air Compressor	Gasoline or diesel powered unit with compressor, receiver and adequate air hose	2.4 m^3 [85 ft^3] per minute at 690 kPa [100 psi]
Air Tool	Single compressed air driven hand drill, tamper, hammer, chipper, or pavement breaker	
All Purpose Excavator	Approved truck, mounted type class	2.75 Mg [3 ton] capacity lifting at 4.5 m [15 ft] radius
Heavy Duty Purpose Excavator	Approved truck, mounted type class	6.3 Mg [7 ton] capacity lifting at 4.5 m [15 ft] radius
Bulldozer	Crawler or pneumatic tired tractor with pushing blade	69 kW [93 hp] (flywheel), Weight(tractor) 7900 kg [8.75 ton]
Small Bulldozer	Crawler with pushing blade	22 kW [30 hp]

Chain Saw - Gasoline or electric powered with endless chain type blade	450 mm [18 in] cutting blade
Culvert Cleaner - Water Jet nozzle, pump and tank	130 L [35 gal] per minute 8620 kPa [1,250 psi]
Front End Loader - Front end scoop mounted on pneumatic tires	1.5 m^3 [2 yd^3] rated capacity
Small Front End Loader - Front end scoop mounted on crawler or pneumatic tires	0.17 m^3 [6 ft^3] minimum rated capacity
Grader - Tandem drive	6350 kg [7 ton]
Road Broom - Engine driven rotary broom	2.1 m [7 ft] broom
Roller (earth or base course) - Self-propelled pneumatic tire type	Gross wt. 3700 kg/m [2,500 lbs/ft] of rolling width. 1 m [40 in] width Tire ground pressure 450 kPa [65 psi]
Roller (pavement) - Self-propelled pneumatic minimum, 7 wheels	Gross weight 25,400 kg [28 ton] 300 mm by 600 mm [12 in by 24 in] smooth tread tires capable of 760 kPa [110 psi] inflation pressure; pressure fully ballasted wheel loads = 3600 kg [8,000 pounds] or more
Rototiller - Rotary cultivator mounted on pneumatic tired tractor	18 kW [25 hp]
Stump Chipper - Gasoline powered stump chipping machine	44 kW [60 hp]
Truck, small - Pneumatic tired with dump body rated capacity	3.8 m^3 to 6.1 m^3 [5 yd^3 to 8 yd^3], manufacturers rating
Truck, large - Pneumatic tired with dump body rated capacity	Over 6.1 m^3 [8 yd^3] manufacturers rated

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:

Pay Item		Pay Unit
631.10	Air Compressor (including operator)	Hour
631.11	Air Tool (including operator)	Hour
631.12	All Purpose Excavator (including operator)	Hour
631.121	Heavy Duty 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
631.14	Grader (including operator)	Hour
631.15	Roller, earth and base 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
631.29	Rototiller (including operator)	Hour
631.32	Culvert Cleaner (including operators)	Hour
631.36	Foreman	Hour

SECTION 632 and 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 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 1175 mm [46 in] high, 1050 mm [42 in] wide, and 1050 mm [42 in] 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 hot-dipped galvanized in accordance with ASTM A153.

Screened sand for bedding and covering direct buried cables shall meet the requirements of Section 703.14, except that there shall be 0-10% passing the 75 μm [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 15 m [50 ft].

The design materials and fabrication of structural supports for luminaires shall meet the requirements of the current edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" and interims thereto, except as otherwise indicated within these specifications or on the contract plans. Light standards with a luminaire mounting height in excess of 15 m [50 ft] shall be designed using wind speeds based on a 50-year mean recurrence interval. Minimum design default values for these structures shall be: $I_r = 1.00$; $C_v = 1.00$; K_z = as specified in Table 3-5 in the current edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" and interims thereto; and G = 1.14. Light standards with a luminaire mounting height of 15 m [50 ft] or less shall be designed using wind speeds based on a 25-year mean recurrence interval. Minimum design default values for these structures shall be: $I_r = 0.87$; $C_v = 0.93$; K_z = as specified in Table 3-5 in the current edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" and interims thereto; and G = 1.14. 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 luminaire supports 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 3 meters [10 ft] below the base of the light standard.

The design weight of luminaires shall be 27 kg [60 lb] with an effective projected area of 0.2 m^2 [2.5 ft^2], except that poletop-mounted luminaires shall have an effective projected area of 0.45 m^2 [5.0 ft^2].

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 225 kg [500 lb] transverse load, applied at 450 mm [18 in] below the pole top with a maximum deflection of 5% of the nominal pole length. A computer simulation or detailed computation using full design load (as specified in the AASHTO Standard 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 23 kg [50 lb] and a concurrent vertical load of 45 kg [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 contract drawings 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 material 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 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 the light standards, bracket arms and associated hardware, fittings and breakaway

devices, as submitted. A Registered Professional Engineer 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 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).

634.026 High Mast Light Standard For all high mast light standards, as defined in this Section, the Contractor shall submit, 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 Registered Professional Engineer. Approval will be based on the applicable provisions of Section 105.7.

The shaft shall be provided with an equipment access opening approximately 0.19 m^2 [2 ft^2] and centered approximately 600 mm [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 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.

634.04 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 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.

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 except in junction boxes, hand holes in poles, transformer bases or locations shown on the plans. The wire for secondary circuits, which is pulled through ducts, shall be fed slack from the feed end.

Cables in junction boxes shall be provided with adequate slack for splicing and shall be arranged as directed. After cables have been installed and before permanent splicing, the end of each section of cable in light standards, junction boxes and panel boxes shall be carefully sealed, using rubber tape, and painted with a sealing-type of waterproof compound. 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.

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 locations. All splices in underground junction boxes shall be made with cast epoxy splice kits to provide a waterproof splice. 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 Light Standard To provide continuously aligned lamp post installations, light standards shall be located in accordance with the details governing the spacings and set backs 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 23 kg to 34 kg [50 lb 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 passing beneath it.

Light standards shall be erected in a vertical position, with a maximum deviation from the vertical of 6 mm [¼ in] in 1500 mm [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 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.

The connections between the luminaires and connector kits shall be made with single conductor, number 12 wires AWG copper stranded THHN, minimum size. A 355 mm [14 in] 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, 9.5 mm [⅜ in] diameter and 38 mm [1½ in] long, unless otherwise indicated on the plans. Wiring connections in the under-bridge lighting units shall be made with 150°C [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.

634.08 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 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 two 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.

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 and in the presence of the Resident, the Contractor shall cause the following tests to be made on all lighting circuits.

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 15°C [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 two 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.

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.

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), 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 - PREFABRICATED BIN TYPE RETAINING WALL

635.01 Description This work shall consist of the construction of bin type retaining wall in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or established.

635.02 Materials Materials shall meet the requirements specified in the following Section of Division 700 - Materials:

Gravel Borrow	703.20
Precast Concrete Units	712.06
Metal Bin Type Retaining Wall	713.07

Bedding and backfill material shall be gravel borrow.

635.03 Shop Drawings The Contractor shall prepare shop detail erection and other working plans and shall submit two copies for approval. Approval of the plans shall be obtained before fabrication of the work is commenced. Changes in the approved plans shall be subjected to further approval and the Resident shall be supplied with a record of such changes. The drawings shall use the same units found in the project plans.

The Contractor will be responsible for the correctness of their plans, even though plans have been approved.

635.04 Excavation and Foundation Excavation for erection of the retaining wall shall be in accordance with Section 203 - Excavation and Embankment, to a width sufficient to allow the proper erection of the wall.

The foundation under the entire area of the wall shall be firm. The bedding and backfill material shall be thoroughly compacted. If ledge rock is encountered, a gravel foundation of at least 300 mm [12 in] in thickness shall be provided.

635.05 Erection The retaining wall members shall be erected in accordance with the manufacturer's instructions and as shown on the plans. Members shall be handled carefully and all members that are damaged shall be replaced at the Contractor's expense. All bolts for metal walls shall be placed so that heads will be exposed and the nuts tightened on the inside.

635.06 Backfill The backfilling of the interior of the wall and behind the wall shall progress simultaneously. The material shall be placed in layers not over 200 mm [8 in] in depth, loose measure and thoroughly compacted by mechanical or vibratory compactors. Puddling for compaction will not be allowed.

635.07 Method of Measurement Bin type retaining wall will be measured by the square meter [square foot] of front surface not to exceed the dimensions shown on the plans or authorized. The area of each panel shall be determined by multiplying the width of each panel, center-to-center distance of the columns, by the total height of the panel.

635.08 Basis of Payment The accepted quantity of bin type retaining wall will be paid for at the contract unit price per square meter [square foot] complete in place.

Excavating beyond the face of the wall, including excavating for bedding and backfill, and furnishing and placing bedding, and backfill 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
635.10	Concrete Bin Type Retaining Wall, Closed Face	square meter [Square Foot]
635.11	Concrete Bin Type Retaining Wall, Open Face	square meter [Square Foot]
635.12	Galvanized Metal Bin Type Retaining Wall	square meter [Square Foot]
635.13	Galvanized Metal Bin Type Retaining Wall with Fiber Coating	square meter [Square Foot]

SECTION 636 - MECHANICALLY STABILIZED EARTH RETAINING WALL

636.01 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.

636.02 Quality Assurance The MSE retaining wall system shall be one of the approved wall systems noted in the Contract Documents. Alternate systems will not be considered. Value engineering is not applicable to the work of this Item.

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 Geotechnical Engineer'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 stamped by a Professional Engineer registered in 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 manufacturers and as specified herein.

Requirements for the precast facing panels are different from the standard panels from the approved systems. The Contractor shall prepare appropriate, alternate details.

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 to advise the Contractor and the Engineer 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 3 levels of panels erected, to maintain verticality.

636.03 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.

In general, the MSE wall system shall be designed in accordance with the manufacturer's requirements, as specified herein and shown on the plans, and in accordance with the Special Provisions. Where conflicting requirements occur, the more stringent requirement 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. 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 1.22 meters [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 are used, the wall face shall extend up into the coping or barrier a minimum of 50 mm [2 in].

The MSE walls shall be dimensioned so that the allowable bearing pressures, noted on the plans, are 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 the Special Provisions and be analyzed so that the soil stabilizing components extend sufficiently beyond the failure plane within the reinforced soil mass, as determined by the specified design code, 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) MSE walls shall be designed to resist failure by overturning, sliding, instability of temporary construction slope, bearing capacity, reinforcement pullout, panel connection pullout or rupture. The design methodology shall be as noted in the Special Provisions.

Calculations for stresses and factors of safety shall be based upon assumed conditions at the end of the design life.

The actual applied bearing pressures under the MSE Mass for each reinforced length shall be clearly indicated on the design drawing.

Passive pressure in front of the wall mass shall be assumed to be zero for design purposes. Calculations for stresses and factors of safety shall be based on assumed conditions at the end of the design life.

(c) 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.

(d) 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 2.44 meters [8 ft], but shall not be less than 0.7 H for walls with level surcharges or 0.7 H1 for walls with a sloped surcharge or walls supporting an abutment. The mechanical height, H or H1, shall be the vertical difference between the leveling footing and the elevation at which the failure surface, as described above, intercepts the ground surface supported by the wall.

(e) Steel Reinforcement For steel reinforcements, all structural connections, tie strips and loop inserts, the following galvanization and carbon steel loss rates shall be assumed:

	microns/year/side
Zinc galvanizing (first 2 years)	15
Zinc galvanizing (subsequent years to depletion):	4
Carbon Steel (after galvanizing depletion):	12
Carbon Steel (75 to 100 years)	12

When the expected differential settlement normal to the wall exceeds 75 mm [3 in], the lower level reinforcement facing connections shall be designed to accommodated the increased tensile forces due to settlement.

(f) Facing Panel Requirements

1. The wall facing shall be designed to accommodate differential settlements of 305 mm [1.0 in] in 30.5 meters [100 ft].

2. The minimum spacing between adjacent panels shall be 19 mm [¾ in] 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 19 mm [¾ in]. 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.

3. 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.

636.04 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 Geotechnical Engineer 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 Geotechnical Engineer.

636.041 Reinforced Concrete Facing Panels Reinforced concrete facing panels shall meet the requirements specified in the following subsections:

Structural Precast Concrete Units	712.061

636.0411 Precast Panel Tolerances and Surface Finish Concrete surface for the front face shall be 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 6 mm [¼ in]. All uncoated steel projecting from the panel unit shall be galvanized in accordance with AASHTO M111 (ASTM A123) with a minimum coating thickness of 610g/m^2 [2oz/ft^2]

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 ± 5 mm [3/16 in].
2. Panel thickness: ± 6 mm [¼ in].
3. Squareness. The length difference between the two diagonals shall not exceed 12 mm [½ in].
4. Distance between the centerline of dowel and dowel sleeve, and to centerline of reinforcing steel shall be ± 3 mm [⅛ in].
5. Face of panel to centerline of dowel and dowel sleeve, and to centerline of reinforcing steel shall be ± 3 mm [⅛ in].
6. Position of panel connection devices Tie Strip shall be ± 25 mm [1 in].
7. Location of Coil and loop Imbeds shall be ± 3 mm [⅛ in].
8. Warping of the exposed panel face shall not exceed 6 mm [¼ in] in 1.52 meters [5 ft].
9. Surface defects on smooth-formed surfaces measured over a length of 1.52 meters [5 ft] shall not exceed 3 mm [⅛ in]. Surface defects on textured-finished surfaces measured over a length of 1.52 meters [5 ft] shall not exceed 5 mm [5/16 in].

636.042 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 32M/M 32 (ASTM A 82) yield strength minimum of 450 MPa [65 ksi] and shall be welded into the finished mesh fabric in accordance with AASHTO M 55M/M 55 (ASTM A 185). Galvanizing shall be in accordance with AASHTO M 111 (ASTM A 123) after fabrication. The minimum coating thickness shall be 610g/m^2 [2 oz/ ft^2]. 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 610g/m^2 [2 oz/ ft^2].

B. Reinforcing Strips shall be fabricated from hot rolled bars to the required shape and dimensions. Their physical and mechanical properties shall conform to ASTM A572/A 572M Grade 450 (65), or approved equal. Reinforcing strips shall be hot dipped galvanized in accordance with AASHTO M111 (ASTM A 123) after fabrication. The minimum galvanization coating thickness shall be 610g/m^2 [2 oz/ ft^2]. Any damage done to the mesh galvanization prior to the installation shall be repaired 610g/m^2 [2 oz/ ft^2].

C. Tie strips shall be fabricated of hot rolled steel conforming to ASTM A 570/A 570M Grade 345(50) or equivalent. Tie strips shall be hot dipped galvanized in accordance with

AASHTO M111 (ASTM A 123) after fabrication. The minimum coating thickness shall be 610g/m^2 [2 oz/ ft^2].

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.

636.043 Attachment Devices

A. Loop Embeds shall be fabricated of cold drawn steel wire conforming to ASTM A510M, UNS G 10350 or AASHTO M 32M/M32 (ASTM A82). Loop imbeds shall be welded in accordance with AASHTO M 55M/M55 (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 M164M (ASTM A325M) or equivalent.

C. Connector Pins and mat bars shall be fabricated from AASHTO M 183M/ M 183 (ASTM A 36/A 36M) steel and welded to the soil reinforcement mats as shown on the plans. Galvanization shall conform to AASHTO M111 (ASTM A123) with a minimum coating thickness of 610g/m^2 [2 oz/ ft^2]. Connector bars shall be fabricated of cold drawn steel wire conforming to the requirements of ASTM A 82 (AASHTO M32) and galvanized in accordance with ASTM A 123.

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 636.042 (c).

636.044 Joint Materials Joint material shall be installed to the dimensions and thickness 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 either preformed EPDM rubber pads conforming to ASTM D2000 for 4AA, 812 rubbers or neoprene elastomeric pads having a Durometer Hardness of 55 ±5.

636.045 Nonwoven Drainage Geotextile The Cover all joints between panels on the back side of the wall with a geotextile fabric. 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 300 mm [12 in]. Lap fabric at least 100 mm [4 in] 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 Geotechnical Engineer.

636.046 Concrete Leveling Pad The cast-in-place leveling pad shall be constructed of Class B concrete conforming to the requirements of Section 502 - Structural Concrete. Leveling pad

shall have minimum dimensions of 150 mm [6 in] thickness and 300 mm [12 in] width and be placed at the design elevation shown on the shop drawings within a 3 mm [⅛ in] tolerance.

636.049 Backfill Materials All backfill materials used in the MSE Walls volume shall conform to Gravel Borrow conforming to the requirements of Section 703.20, with the maximum aggregate size limited to 100 mm [4 in] and the following additional requirements:

A. 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 T104 (ASTM C88), of less than 30% after four cycles.

B. Electrochemical Requirements The backfill materials shall meet the following criteria:

Requirements		Test Methods
Resistivity	>3,000 ohm centimeters	AASHTO T288
pH between	5 and 10, inclusive	AASHTO T289
Chlorides	<100 parts per million	AASHTO T291
Sulfates	<200 parts per million	AASHTO T290
Organic Content	<1%	AASHTO T267-86

C. The plasticity index (P.I.) as determined by AASHTO T90 shall not exceed 6.

D. The select backfill material shall exhibit an angle of internal friction of not less than 34°, as determined by the standard Direct Shear Test, AASHTO T236 (ASTM D3080-72), on the portion finer than the 2 mm [#10] sieve, compacted to 95 percent of AASHTO T99, Methods C or D (with oversized correction as outlined in Note 7) at optimum moisture content. No testing is required for backfills where 80 percent of sizes are greater than 19 mm [¾ in]. Before construction begins, the borrow 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.

636.050 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 Section 703.31.

636.051 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 0.3 m [1 ft] beyond the MSE reinforcement. The geomembrane shall have a minimum thickness of 0.8 mm [1/32 in].

The geomembrane shall have both sides textured with a rough finish to improve resistance against sliding. The texture shall be approved by the Geotechnical Engineer before installation.

The geomembrane shall be shown on the design drawings of the MSE submittal of the Contractor.

636.052 Acceptance of Material The Contractor shall furnish to the Geotechnical Engineer 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 Geotechnical Engineer. Acceptance will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Geotechnical Engineer.

636.07 Submittals

A. Design computations demonstrating compliance with the criteria specified herein and shown on the plans, shall be prepared, signed and stamped by a registered professional engineer license in the State of Maine and specializing in geotechnical engineering.

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.

3. Analyses or studies demonstrating durability and corrosion resistance of retaining wall systems for the proposed location and environment. The designers 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 15 meters [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 maximum calculated 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 the summary 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.

636.08 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 -29º C [-20º F]

C. Contractor shall prevent excessive mud, wet cement, epoxy and like substances that 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.

636.09 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.

636.10 Foundation Preparation The foundation for the structure shall be graded level for a width equal to the length of reinforcement elements plus 1.52 meters [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 4536 kg [5 ton]. 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 Geotechnical Engineer 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 +3mm [0.01 ft] and -6 mm [-0.02 ft] from the design elevations. Placement of wall panels may begin after 24 hours curing time of the concrete leveling pad.

636.11 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 6 mm per meter [¼ in/yd]. During construction, the maximum allowable offset in any panel joint shall be 19 mm [¾ in]. The overall vertical tolerance of the wall (for top to bottom) shall not exceed 4 mm per meter of wall height.

636.12 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 element. Any wall materials, which become damaged during backfill placement, shall be removed and replaced at the Contractor's expense. The Contractor, at their expense, shall correct any misalignment or distortion of the wall facing panels due to placement of backfill outside the limits of this specification. 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 percent of maximum density as determined by AASHTO T99, Method C or D (with oversize correction, as outlined in Note 7. If 30 percent or more of the backfill material is greater than 19 mm [¾ in] in size, the acceptance criterion for control of compaction shall be either a minimum of 70 percent of the relative density of the material as determined by ASTM D4253 and D4254, or a method of compaction consisting of at least 4 passes by a heavy roller. Where spread pads support bridge or other structural loads, the top 1.5 m [5.0 ft] below the pad elevation shall be compacted to 100 percent of the maximum density as determined by AASHTO T99, Method C or D (with oversize correction, as outlined in Note 7).

The moisture content (determined in accordance with AASHTO T99, Method C or D) of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials 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 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 300 mm [12 in]. 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 900 mm [3 ft] of the wall face. Compaction within 900 mm [3.0 ft] of the back face of the wall shall be achieved by at least 3 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 1.0 meter [3.28 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 Geotechnical Engineer.

At the end of each day's operation, the Contractor shall slope the least 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.

636.13 Reinforcement Placement Prior to placing the first layer of reinforcements (strips, mats or grids), backfill shall be placed and compacted in accordance with 636.12 - Backfill Placement.

Bending of reinforcements in the horizontal plane that results 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 Engineer. 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 15º 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.

636.14 Method of Measurement Mechanically Stabilized Earth Retaining Wall will be measured by the square meter [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 facing units, 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 are, as shown on the plans, includes the surface area of nominal panel joint openings and wall penetrations such as pipes and other utilities.

636.15 Basis of Payment The accepted quantity of Mechanically Stabilized Earth Retaining Wall will be paid for at the contract unit price per square meter [square foot]. Payment shall be full compensation for design, fabrication and erection of MSE retaining walls, furnishing all labor, equipment and materials including concrete face panels, fasteners, reinforcing mesh, reinforcing strips, tie strips, hardware, joint fillers, coping, woven drainage geotextile, impervious membrane, select backfill and technical field representative. Cost of cast-in-place concrete for leveling pad will not be paid for separately, but will be considered incidental to the Mechanically Stabilized Earth Retaining Wall.

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.

The unit price for Mechanically Stabilized Earth Wall shall include costs 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 Geotechnical Engineer.

2. All materials, including transportation, for the MSE walls, including facing panels, MSE reinforcing elements, attachment devices, fasteners, bearing blocks and shims, joint

materials, copings, vertical corner elements, concrete masonry, reinforcing steel, crushed stone, select backfill and incidentals.

3. All labor and equipment required to excavate and prepare the wall foundation, 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, 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.

There will be no allowance for excavating and backfilling for the Mechanically Stabilized Earth Retaining Wall beyond the limits shown on the approved submitted plans, except for excavation required to remove unsuitable subsoil in preparation for the foundation.

Payment will be made under:

Pay Item	Pay Unit
636.40 Mechanically Stabilized Earth Retaining Wall	Square meter [square foot]

SECTION 637 - DUST CONTROL

637.01 Description This work shall consist of controlling dust that results from traffic on the project and the Contractor's operations by applying water and/or calcium chloride as directed by the Resident. In addition to this Special Provision, the requirements of Special Provision 656 and the pertinent Sections of the Standard Specifications will apply.

637.02 Materials The water shall not be salt or brackish and shall be free from oil, acid and injurious alkali or vegetable matter.

The calcium chloride shall conform to Subsection 712.02 except that the requirements for total alkali chloride and impurities shall not apply.

637.03 Sprinkling Water shall be applied by approved methods and with equipment including a tank with a pressure pump and a nozzle-equipped spray bar.

637.04 Calcium Chloride Calcium chloride shall be used when authorized for controlling dust on the roadway under construction and on approved haul roads from the pits to the project or in the area of dwellings and where dust constitutes a hazard to traffic. Calcium chloride shall be applied by mechanical spreaders or by hand at the rate designated.

637.05 Method of Measurement Water for sprinkling will be measured by the cubic meter [1,000 gal (MG)] in calibrated tanks or distributors or by accurate water meters.

Calcium chloride will be measured for payment by the number of megagrams [tons] satisfactorily applied.

Delivery slips as specified in Section 108.1.3-f will be required except that weight for calcium chloride shall be determined from the weight stated on each bag and the number of bags used.

Water and calcium chloride acceptably applied for the item Dust Control will be measured for payment as one lump sum.

637.06 Basis of Payment Water for sprinkling will be paid for at the contract unit price per cubic meter [MG].

Calcium chloride will be paid for at the contract unit price per megagram [ton].

Water and calcium chloride for the item Dust Control will be paid for at the contract lump sum price. Payment will be full compensation for furnishing and applying water and calcium chloride as required. When no item for Dust Control item or individual items are included in the schedule of items, payment for the work will be considered incidental to the contract.

Payment will be made under:

Pay Item		Pay Unit
637.07	Sprinkling	cubic meter [1000 gallon]
637.08	Calcium Chloride	megagram [Ton]
637.071	Dust Control	Lump Sum

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 used by the Engineer as field offices or testing laboratories. 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.

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 Engineer. Windows shall be equipped with latches so they may be locked on the inside. Window screens and screen doors shall be supplied when necessary.

639.04 Field Offices Field Offices are designated Type A or Type B. Buildings, including trailers, may be provided if they substantially equal or exceed the following requirements. Air conditioning 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 Engineer. The office trailer shall be winterized and completely enclosed at the bottom, if the trailer will be used in cold weather.

Testing facilities furnished under this section shall include all facilities for testing as described and shall be available for the exclusive use by the Resident for the duration of the project.

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 915 mm [36 in] 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 760 mm [30 in] and the minimum clear width shall be 915 mm [36 in]. Nowhere shall the cross slope of an accessible route exceed 1:50. Changes in level up to 6 mm [¼ in] may be vertical and without edge treatment. Changes in level between 6 mm [¼ in] and 13 mm [½ in] 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 810 mm [32 in] with the door opened 90 degrees, 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 1220 mm [48 in] above finished floor.

When parking space is designated, then all related requirements will conform to the following: One 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 1525 mm [60 in].

If a ramp run has a rise greater than 150 mm [6 in] or a horizontal projection greater than 1830 [72 in], 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 300 mm [12 in] 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 40 mm [1½ in].

4) Gripping surfaces shall be continuous.

5) Top of handrail gripping surfaces shall be mounted between 860 [34 in] and 965 mm [38 in] 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 32 mm to 40 mm [1¼ in to 1½ in], or the shape shall provide an equivalent gripping surface.

Firm and sturdy steps shall also be provided with 180 mm [7 in] maximum riser and 280 mm [11 in] minimum depth, and at least one handrail extending from the top of the steps to a minimum 305 mm [12 in] 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
Floor Area - m^2 (ft^2)	29 (312)	15 (160)
Inside Wall Height - m (ft)	2.134 (7)	2.134 (7)
Window Area - m^2 (ft^2)	5.1 (55)	3.3 (35)
Drafting Table Surface Area - m^2 (ft^2)	1.4 (15)	1.4 (15)
Drafting Stools - each	2	1
Office Desks - each	2	1
Ergonomic Swivel Chairs - each	3	2
Folding Chairs - each	3	2
Lighting Units - each	4	2
Electric Wall Outlets - each	6	3
Wall Closets - each	1	1
Plan Rack for minimum of 6 sets of plans	1	1
Toilet Facility	1	1
Wastebaskets - each	2	1

All windows shall be provided with shades or blinds.

The toilet facility shall be for the exclusive use of State personnel.

The Resident will have the option to reject any furniture or supplies provided to the field office based on general condition.

One hundred ten volt, 60 cycle, continuous electric service shall be supplied for lighting and 15 amp duplex wall outlets. Lighting shall consist of florescent light units with rapid start bulbs located over the work areas for a minimum of 538 lx [50 foot candles] overall.

Drafting surfaces shall be 1000 mm [40 in] above the floor and have shelves beneath. Shelves for plans and rolls shall also be furnished overhead. Drafting stools shall be approximately 700 mm [28 in] 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 525 mm [21 in] wide, 375 mm [15 in] deep, and at least 1200 mm [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 desktop copier, 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 a water cooler, with hot and cold dispenser, and shall be responsible for supplying bottled water compatible with the water cooler to maintain a constant potable water supply for the duration of the project. All maintenance and supplies shall be the responsibility of the Contractor.

The Contractor shall provide a 4 cubic-foot 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 Testing Facilities-Soils The building and facilities shall:

a) Be the minimum size and quality as a Field Office, Type B, and placed in an approved location near the project.

b) Have adequate heat and ventilation. The method of heating shall be such that a minimum temperature of 18°C [65°F] can be maintained at all times. Air conditioning shall be provided.

c) Be equipped with a gravity or pressure water system with at least 380 L [100 gal] capacity. The tank shall be piped to a gooseneck faucet at an approved sink within the laboratory. The sink shall have approved outside drainage.

d) Have a bench, 1500 mm long by 600 mm wide, 900 mm [5 ft long by 2 ft wide, 3 ft] above the floor, suitable for supporting a sieve shaker and electric hot plate.

e) Have a chair, and desk or writing table, 1200 x 750 mm [4 ft by 2.5 ft], 750 mm [30 in] above the floor with 2-drawer (minimum) filing cabinet.

f) Have three electric wall outlets; one 15 amp. outlet to be located in the desk area, and two 20 amp. outlets to be located 150 mm (6 in) above the workbench described in d) above.

g) Have 1 stool, 700 mm [28 in] high.

h) Be equipped with the following test equipment and supplies. All equipment and supplies shall be in conformance with revisions of AASHTO T11, AASHTO T27, and AASHTO T191. The Maine Department of Transportation Independent Assurance Sampling and Testing program will be conducted to monitor the precision and accuracy of

acceptance tests. All testing equipment shall be of commercial quality and acceptable to the Resident and all equipment determined to be substandard by this testing program shall be replaced. The Contractor shall install and maintain the equipment in good condition at all times.

1. Coarse series shaker: Mechanical shaker having trays with a minimum of 0.129 m² [200 in²] of surface area or; a manually operated shaker box manufactured to close conformity of the plans available at the MDOT Testing Office. Woven wire sieves conforming to the requirements of AASHTO M92. Sieve sizes 75 mm [3 in], 25 mm [1 in], 19 mm [¾ in], 12.5 mm [½ in] shall be provided for each type of shaker used.

2. Motorized Sieve Shaker with timer, either a combination rocking and tapping action, or rheostat controlled vibrating type. The shaker shall be capable of holding a nest of six 200 mm [8 in] full height sieves and pan.

3. Set of U.S. Standard Brass or Stainless Steel 200 mm [8 in] diameter woven wire sieves conforming to the requirements of AASHTO M92 and the sieves required shall include the following sizes: 25 mm [1 in]; two 19 mm [¾ in]; 12.5 mm [½ in]; 9.5 mm [⅜ in]; 6.3 mm [¼ in]; 4.75 mm [No. 4]; 2.36 mm [No. 8]; 2.0 mm [No. 10]; two 1.18 mm [No. 16]; 850 µm [No. 20]; 600 µm [No. 30]; 425 µm [No. 40]; 300 µm [No. 50]; 150 µm [No. 100]; two 75 µm [No. 200]; pan and cover

4. Balance: Electric digital 2,000 gram (4.5 lb) minimum capacity, sensitive to 0.1 gram (.0035 oz) and conforming to AASHTO M231 Class G-2.

5. Balance: at least 34 kg [75 pounds] capacity sensitive to 0.02 kg [0.05 lb] conforming to AASHTO M231 Class G100.

6. 2 hot plates, each with two burners 700 to 800 Watt, 3 prong grounded plug, with adjustable control for each burner.

7. 6 Drying Pans: 250 x 375 x 50 mm [10x15x2 in] deep heavy gauge aluminum.

8. Heat Resistant Gloves: Long cuff leather welding gloves.

9. Two D-Handle square end shovels - 240 mm [9½ in] wide.

10. One long handle spade.

11. Two 1.5 x 1.5 m [5x5 ft] imperious vinyl coated nylon canvas for quartering samples.

12. One sample splitter - a stainless steel splitter, conforming to AASHTO T248 paragraph 6.1, with curled safety edges.

13. Miscellaneous small tool and equipment: one 0.45 kg [16 oz] steel hammer; one screwdriver 300 mm [12 in] long with a 10 mm [⅜ in] shaft; two 38 mm [1½ in] paint

brushes; three 375 mm [15 in] heavy gauge stainless steel spoons; one brass bristle sieve brush; one 2 m [6 ft] folding rule; one 500 ml. squeeze bottle; one wash bottle (a 3.785 L [1 gal] wide mouth plastic bottle or a 150 x 300 mm [6 in x 12 in] plastic concrete cylinder mold); one floor broom.

14. A 10 person general-purpose first aid kit. The first aid kit shall be periodically inspected and refilled as necessary.

The balances described above in sections h)-4 and h)-5 shall be calibrated by an independent calibration service at a minimum frequency of once per year. A current certification sticker shall be displayed on the balance, and calibration records shall be maintained at the testing facility for Department inspection.

639.08 Heat Heat shall be supplied by the Contractor to maintain an acceptable room temperature during occupancy.

639.09 Telephone The Contractor shall provide three telephone lines and two telephones, touch-tone models in areas where touch-tone service is available, in all field offices for the exclusive use of the State personnel. At least one phone shall be cordless. These telephones shall be on a private line, if available and shall be listed under "State of Maine, Maine Department of Transportation". One telephone line shall have “Call Waiting” installed, if available. Each line shall have jacks installed at each end of the field office. 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 telephone company directly to the Contractor. During seasonal suspension periods, the telephone company shall be notified to discontinue or suspend the services and the Contractor shall assume all charges. Upon resumption of work, the telephone service shall be reinstated.

The Contractor shall also provide a telephone-answering device in all field offices where a telephone is provided capable of answering calls and recording incoming messages. The Contractor shall be responsible for all maintenance costs for the answering device.

639.10 Method of Measurement Field office and testing facilities 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 or testing facilities will be paid for at the contract unit price each or lump sum which payment shall be full compensation for furnishing, erecting, equipping, maintaining, furnishing electricity, heating, installing and maintaining toilet facilities and if necessary removing the buildings or office trailers. Payment for testing facilities shall include furnishing all buildings and facilities as required by these specifications for the testing of materials by the State.

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.

Testing facilities, bituminous liquids and Portland cement, will not be paid for directly but all costs will be considered incidental to the various contract items.

Payment will be made under:

Pay Item		Pay Unit
639.18	Field Office, Type A	Each
639.19	Field Office, Type B	Each
639.21	Testing Facilities - Soils	Lump Sum

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 meter [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 meter [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 meter [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, 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. 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 by the Fabrication Engineer. Functionally, any substitute shall give equal or better service than the specified material. Existing signal equipment to be used shall be cleaned, repainted, and reconditioned as noted on the plans. 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. All work shall be done to the satisfaction of the Resident. The meaning of specific terms shall be as defined in MUTCD, NESC, and the ITE Standards for traffic control equipment.

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
Loop Vehicular 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
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

643.022 Paint Aluminum paint shall conform to AASHTO M69, Type II. Green or yellow enamel paint, as indicated on the plans, shall meet or exceed the latest Federal Specification TT-E-489. The color shall match Federal Color Standard Number 14062.

643.023 Design and Fabrication The design and fabrication of traffic signal support structures shall meet the requirements of the current edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" and interims thereto, except as otherwise indicated within these specifications or on the contract plans. All poles and mast arms shall be designed to withstand the maximum forces generated on the design configuration by the loads specified in Section 3 of the "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", using the 50-year mean recurrence interval for wind speeds. Minimum design default values for these structures shall be: $I_r = 1.00$; $C_v = 1.00$; $K_z = 0.94$; and $G = 1.14$.

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 3 sets of the manufacturer's drawings of all poles proposed to furnished and erected under this Contract. The drawings shall be of sufficient detail to indicate material and dimensional conformance with these specifications and the contract drawings. Each drawing shall contain a reference to the design criteria and a certification that the design criteria have been met by the poles, mast arms and associated hardware and fittings, as submitted. The certification shall be signed by a Registered Professional Engineer 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 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 contract drawings 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.

643.024 Miscellaneous Materials Span wire shall be minimum 7.9 mm [$^5/_{16}$ in] 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 strandvise feed-thru 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 6 mm [¼ in] 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°C [-40°F] to +60°C [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 300 mm [12 in] indications including power supply shall not exceed 20w.

643.03 General Installation details will be shown on the plans. 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 6 mm in 1500 mm [¼ inch 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 100 mm [4 in] thick. Each layer shall be moistened and thoroughly compacted.

Strain poles, pedestal poles and mast arm poles shall be erected in a vertical position, with a maximum deviation from the vertical of 6 mm in 1500 mm [¼ inch in 5 ft] 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 foundation 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.

643.05 Loop Detector and Loop Detector Wire Installation The detector unit shall be located in the controller. No more than four loops shall be connected to a single detector amplifier.

Detectors shall be installed according to the manufacturer's recommendation, subject to approval. Each detector shall be supplied complete with comprehensive installation instructions. The pavement slot for wire shall be 50 mm to 75 mm [2 in to 3 in] below the finished surface and not closer than 450 mm [18 in] 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.

Loop detector wire shall be number 14 or number 12 AWG copper conductors drawn through vinyl plastic tubing approximately 6 mm [¼ in] in diameter. 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. All loop lead-ins shall be of the same conductor with no splicing. The lead-in from the amplifier to the beginning of the loop shall be shielded pairs, as shown on the plans.

All debris and moisture shall be removed from the loop pavement slot before installation of loop wires. The pavement slot shall be filled to the road surface with an approved sealing compound to form a waterproof bond with the pavement after installing the wire loop.

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 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 75 mm [3 in] 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 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 service ground rod shall be installed if the service meter trim is not grounded.

The Contractor shall be responsible for grounding the system to 5 OHMS or less. The grounding shall be performed using a ground meter with reference grounds. All testing will be done in the presence of the Resident.

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:

Red Wire	Red, artery
Orange Wire	Yellow, artery
Green Wire	Red, side street
Orange with Tracer	Yellow, side street
Green with Tracer	Green, side street
White and white with tracer	Common for all signals and bond
Blue	All steady burning arrows
Blue with Tracer	Intermittent arrows
Remaining	Detectors and pedestrian signals

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 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 mast arm pole and span wire mounted vehicular heads shall be 4.88 m [16 ft]; clearance for pole mounted vehicular heads shall be 3 m [10 ft]; clearance for pedestrian heads shall be 5.5 m [8 ft] unless otherwise specified. Clearance for span wire mounted flashing beacon heads shall be a minimum of 5.2 m [17 ft] and a maximum of 5.5 m [18 ft].

643.12 Painting All exterior parts of the following equipment shall be delivered to the project finished with green or yellow enamel:

Vehicular Signal Heads
Pedestrian Signal Heads
Pedestrian Push Button Detectors

The outside of the steel controller cabinet shall be painted with aluminum paint.

The Contractor shall apply one coat of green 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 4°C [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, and in the presence of the Resident, the Contractor shall conduct the following tests on all traffic signal equipment and circuits.

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 1000 s [10 megohms] on all circuits, except for inductive loop detector circuits, which shall have an insulation resistance value of not less than 10,000 s [100 megohms].

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 10 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 10 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 Friday 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 Timing The controller shall be timed as noted on the plans. The Contractor shall notify the Resident, at least 1 week in advance, of their intention to initially operate the signals.

At the time of initial operation of the new signals, 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 the specification.

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 State Traffic Engineer (207-624-3620) 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 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 meter [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 750 mm [30 in].

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, guys, controllers, vehicular heads, pedestrian heads, flashing beacons, wiring, cable, pole risers, LED lamps, and all appurtenances and incidentals 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.

Video 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, supervisory PC software, and all appurtenances and incidentals required for a complete functioning installation.

Payment for excavation of solid ledge rock for the placement of wood poles will be made under Section 206.07.

Payment will be made under:

Pay Item		Pay Unit
643.60	Flashing Beacon at:	Lump Sum
643.71	Traffic Signal Modification:	Lump Sum
643.72	Temporary Traffic Signal:	Lump Sum
643.80	Traffic Signals at:	Lump Sum
643.81	Traffic Signal Control System	Lump Sum
643.83	Video Detection System	Lump Sum
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 furnishing and installing new signs, sign supports, delineators, 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 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:

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.

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 plans.

645.023 Support Structures The design, materials and fabrication of sign support structures and foundations shall meet the requirements of the current edition of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" and interims thereto, except as otherwise indicated within these specifications or on the plans. Beam mounted signs and their supports shall be designed using wind speeds as determined from the 25-year mean recurrence interval isotach map. Minimum design default values for these structures shall be: $I_r = 0.87$; $C_v = 0.93$; $K_z = 0.87$; and $G = 1.14$. Bridge, cantilever, and butterfly sign supports and associated signs and hardware shall be designed using the wind speeds as determined from the 50 year mean recurrence interval isotach map, as contained in the above referenced AASHTO Specifications. Minimum design default values for these structures shall be: $I_r = 1.00$; $C_v = 1.00$; $K_z = 0.94$; and $G = 1.14$. For sign supports mounted on bridge structures and 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 3 m [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 3 sets of drawings, and computations if prescribed below, of all sign supports 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 and, in the case of bridge, cantilever and butterfly type sign supports, shall be sufficiently detailed to show all structural significant details.

Approval for deviations from the contract drawings 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 "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals".

A Certificate of Compliance shall be provided for all material in accordance with the requirements of the General Statement of Division 700 - Materials.

a. Beam Mounted Signs The beams for beam-mounted 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 plans, and each drawing shall contain a reference to the design criteria and a certification by a Professional Engineer registered in accordance with the State of Maine regulations, over their official stamp, 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, Cantilever, and Butterfly Type Sign Supports The Contractor shall be responsible for the design of the support structure including its foundation. Foundation design shall follow requirements of Section 645.024 - Bridge, Cantilever, and Butterfly Support Structure Foundations, as well as this Section.

Signs shall be placed on the support structure such that the bottom edges are aligned while accommodating the minimum height requirement. The Contractor shall use the Contract Drawings 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 a minimum of 1.5 times the sign area on each structure as shown on the contract documents. This additional theoretical sign load shall be computed by: Increasing the sign lengths an additional 25% and increasing sign height by an additional 25% while maintaining the approximate prescribed sign center line locations, height from roadway and bottom edge alignment.

Bridge type 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 of L/40, where L is the length of upright member, as determined from design loads calculated in accordance with the AASHTO “Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals”.

The base plates of uprights for all types of 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 computations, including fatigue considerations, in accordance with Section 11, Fatigue Design, in the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", and interims thereto, for the entire structure. Erection lifting points shall be clearly depicted on the shop drawing.

The computations shall be sufficiently detailed to allow the Engineer to check and approve the computations. Computer printouts will not be accepted unless they meet the above criteria. All plans and design calculations, sign support structure and foundation, shall be signed by a Professional Engineer registered 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.

c. Bridge Overpass Mounted Sign Supports Overpass 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.

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 The Contractor may select a foundation system meeting the design criteria of Section 13 of the current edition of AASHTO "Standard Specifications for Structural Supports for Highway Sign, Luminaries and Traffic Signals", unless otherwise specified by the Department. Geotechnical design of the foundations shall be in accordance with Section 13 of the afore-mentioned AASHTO code. The design criteria for the resistance of drilled caisson and spread footing foundations against overturning, sliding and bearing capacity failure shall meet the requirements of Section 4 of the current edition of AASHTO "Standard Specifications for Highway Bridges". The structural design of foundations shall meet the requirements of the current edition of AASHTO "Standard Specifications for Highway Bridges". The Contractor shall submit to the Fabrication Engineer for approval, detailed plans and calculations, prepared by a licensed Professional Engineer, of

the proposed sign foundation. Construction of the foundation shall not commence until the Department has approved the foundation design.

For estimating and bidding purposes, in the absence of boring samples and standard penetration tests, or the actual determination of soil properties at the proposed footing location, the Department will accept an assumed allowable soil bearing pressure of 72 kPa [1.5 kips/ft²] for the design of the footing. The actual, existing, soil classification, analysis and footing design shall be determined by the Contractor's qualified firm or person by use of hollow stem auger boring samples. All costs associated with the work required to sample, classify and analyze the soil, design the footing and prepare submittals shall be incidental to related Contract items. All unsuitable material (peat, organic material, material that has been dumped, etc.) within the limits of a footing must be removed at the direction of the Resident and the shaft depth of drilled caissons shall be increased to bear on suitable material. Concrete for the footing shall be placed immediately after excavation to prevent water from collecting in the excavated area. The structural design of foundations shall meet the requirements of the current edition of AASHTO "Standard Specifications for Highway Bridges". Concrete shall be Class LP in accordance with Section 502 - Structural Concrete. Drilled shaft foundation holes, except in ledge, shall be excavated by auger method to the neat line of the outside dimensions of the footing without disturbing the soil around or below the proposed footing. Precast foundations shall not be permitted. In areas where rock or ledge is encountered above the proposed bottom of footing, the Contractor will have the option of removing rock and placing the footing at the design depth shown on the Contractor's Working Drawings, or constructing a grouted rock-anchored foundation system. This rock-anchored system shall be designed by the Contractor and approved by the Department. Back fill for pedestal foundations shall be granular borrow for underwater back fill meeting the requirements of Section 703.20 - Gravel Borrow, of the Standard Specification. The granular borrow shall be placed in layers not exceeding 150 mm [6 in] in depth before compaction. Each layer of back fill shall be thoroughly compacted by use of power tampers to at least 95% of the maximum density as measured in the field per AASHTO T191 or by an approved method using calibrated nuclear device. All back filling and compacting shall be in accordance with the applicable provisions of Section 206, of the Standard Specifications. The Contractor shall submit 3 copies of all foundation design work, structural and geotechnical, together with computations and plans used for design purposes, as specified in Section 645.023.

645.03 Classification of Signs Sign sizes, color and legend designs shall conform to these specifications, the plans, and MUTCD requirements. The signs are classed according to the intended use as follows:

a. Type I guide signs shall consist of high intensity, reflectorized sheeting or reflectorized, demountable letters, numerals, symbols and border mounted on a high intensity, reflective sheeting background adhered to a sign panel constructed of extruded aluminum planks.

b. Type I regulatory, warning, and route marker assembly signs shall consist of high intensity, reflective sheeting letters, numerals, symbols, and border on a high intensity, reflective sheeting background adhered to a sign panel constructed of sheet aluminum.

c. Type II guide signs shall consist of engineering grade, reflective sheeting letters, numerals, symbols and border on an engineering grade, reflective sheeting background attached to a sign panel constructed of plywood.

d. Type II regulatory, warning and route marker assembly signs shall consist of engineering grade reflective sheeting letters, numerals, symbols and border on an engineering grade 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 2 mm [0.080 in] 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 or engineering grade 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 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 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, 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 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 or engineering grade 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 or engineering grade, 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 engineering grade 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, engineering-grade 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 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 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, 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 of the current edition of AASHTO “Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals”, and interims thereto. If, at any time after their erection, bridge, 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.

Bridge-mounted sign supports shall be fabricated and assembled in accordance with the details as shown on the contract drawings and with Section 504. Additionally, if required to be painted, bridge-mounted sign supports shall be painted in accordance with Section 506

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 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 plans. Sign panels on overhead structures shall provide a minimum clearance of 5.2 m [17 ft] to the roadway surface. Sign panels on bridge-mounted sign supports shall be installed with the bottom edge of the sign approximately 100 mm [4 in] 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 85º +/- 3º.

Ground-mounted signs located 1.2 m to 9 m [4 ft to 30 ft] from the edge of shoulder shall form an angle of 93º between the approach roadway and the sign.
Signs located more than 9 m [30 ft] from the edge of the shoulder shall form an angle between the approach roadway and the sign face equal to 87º -1º for each additional 3 m beyond 9 m [10 ft beyond 30 ft].

Unless otherwise shown on the plans, or designated by the Resident, a minimum lateral clearance of 1.2 m [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 2.1 m [7 ft] above the elevation of the edge of the traveled way, at the sign location, or in case of a curb section, 2.1 m [7 ft] above the elevation of the outer edge of the roadway, unless authorized otherwise.

Signs located 9 m [30 ft] or more from the edge of traveled way shall be 1.5 m [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 2.4 m [8 ft] above the outer edge of the traveled way, or a minimum of 2.4 m [8 ft] above the edge of the traveled way, in curbed sections; the bottom edge of the second sign must be at least 1.5 m [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 1.8 m [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 1.5 m [5 ft] in rural areas or 2.1 m [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 300 mm [1 foot] 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.

a. Sign Supports Support posts for Type II signs shall be U-channel posts weighing 3.7 kg/m [2½ pounds per foot] for signs of less than 0.58 m² [6.24 ft²] in area, 100 by 100 mm [4 in by 4 in] wood posts or two U-channel posts weighing 3.7 kg/m [2½ lb/ft] for signs of area 0.59 m² to 0.84 m² [6.24 ft²to 9 ft²], 100 mm by 150 mm [4 in by 6 in] wood posts for signs of area 0.85 m² to 1.49 m² [9 ft²to 16 ft²], and 150 mm by 150 mm [6 in by 6 in] wood posts for signs of area over 1.49 m² [16 ft²]. All signs 1500 mm [60 in] wide or wider shall be mounted on two wood posts. Wood posts shall be set to a depth of 1.2 m [4 ft]. U-channel posts shall be set to a minimum depth of 760 mm [30 inches]. Leading signs less than 0.84 m² [9 ft²] on the apex of islands will be installed on U-channel posts. 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 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 200 mm [8 in] 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.

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 1200 mm [4 ft] from the outside edge of shoulder, 1200 mm [4 ft] from the face of curb and 1200 mm [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 1200 mm [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 plans.

645.063 Installation of Breakaway Devices Breakaway devices shall be installed at locations indicated on the 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 plans or approved.

Breakaway devices shall be attached to new foundations in accordance with the recommendations of the breakaway device manufacturer and as approved.

645.07 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 two 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 0.24 kg/L [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 4°C [40°F].

645.08 Method of Measurement Demount Signs, Demount Poles, Reinstall Signs, and Reinstall Poles will be measured by each unit.

Bridge, cantilever and butterfly type sign supports, including the foundations, support structures and sign panels, complete in place, as called for on the plans, will be measured by each unit.

Bridge Overpass-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 meters [square feet], computed to nearest hundredth of a square meter [0.01 ft^2], 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 kilogram [lb], determined from the nominal weight per meter [ft] for each size and the lengths as indicated on the plans.

Demountable reflectorized delineators will be measured by the number of units of each type 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, cantilever and butterfly type sign supports 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, foundations, and incidentals necessary to complete the work.

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.

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 meter [ft^2]. Such payment

will be full compensation for furnishing and installing signs, assembly hardware, and all incidentals necessary to complete the work.

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 kilogram [lb], complete in place as shown on the 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.

Excavating rock will be paid for as provided in Section 206.

Payment will be made under:

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 meter [Square Foot]
645.261	Bridge Guide Sign, Type I	square meter [Square Foot]
645.271	Regulatory, Warning, Confirmation and Route Assembly Sign, Type I	square meter [Square Foot]
645.281	125 mm [5 Inches] Aluminum Pole	Each
645.282	150 mm [6 Inches] Aluminum Pole	Each
645.283	175 mm [7 Inches] Aluminum Pole	Each
645.284	200 mm [8 Inches] Aluminum Pole	Each
645.285	250 mm [10 Inches] Aluminum Pole	Each
645.286	300 mm [12 Inches] Aluminum Pole	Each
645.289	Steel H-Beam Poles	kilograms [Pounds]
645.291	Roadside Guide Signs Type II	square meter [Square Foot]
645.292	Regulatory, Warning, Confirmation and Route Marker Assembly Signs Type II	square meter [Square Foot]
645.301	Demountable Reflectorized Delineator, Single	Each
645.302	Demountable Reflectorized Delineator, Double	Each

SECTION 646 through 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, the applicable provisions of Section 105.4.5 - Special Detours, and the plans.

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 NCHRP 350 guidelines.

All signs shall be fabricated with high intensity retroreflective sheeting conforming to Section 719.01. All barricades, drums, and vertical panel markers shall be fabricated with high intensity orange and white retroreflective sheeting conforming to Section 719.01.

Construction signs shall be fabricated from materials that are flat, free from defects, retroreflectorized, and of sufficient strength to withstand deflections using a wind speed of 130 km/hr [80 miles/hr].

All barricades, cones, drums, and construction signs may be constructed from new or recycled plastic.

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 Board The flashing arrow board shall consist of at least 15 hooded amber sealed beam lamps arranged to present 4 horizontal messages; left arrow, right arrow, double arrow, and light bar only. In the three arrow signals, the second light from the arrow point shall not operate. The arrow shall be mounted on at least a 1200 mm by 2400 mm [4 ft by 8 ft] flat black board with the bottom of the sign approximately 2100 mm [7 ft] above ground.

Circuitry shall be solid state. The arrow board shall be equipped with a manual control and a solid state photocell control to reduce intensity a minimum of 50% when ambient light falls below 54 lx [5 foot candles].

Each flashing light shall use Lamp No. 4412 A, sealed beam par 46, 8800 candlepower with a flash rate of not less than 25 per minute, dwell time 50% per cycle.

Power for the flashing arrow board shall be from either a self-contained generator unit of sufficient power to operate the lamps at their rated output, or commercial power if available.

The flashing arrow board with generator and independent power drive shall be mounted on a pneumatic-tired trailer vehicle or other suitable support for hauling to various locations as directed.

652.2.4 Other Devices Vertical panel markers shall be orange and white striped, 200 mm wide by 600 mm high [8 in wide by 24 in high]. On the Interstate System, vertical panel markers shall be orange and white striped, 300 mm wide by 900 mm high [12 in wide by 36 in high].

Cones shall be orange in color, at least 710 mm [28 in] high, and retroreflectorized. Retroreflection shall be provided by a white band of retroreflective sheeting conforming to Section 719.01, 150 mm [6 in] wide, no more than 75 mm to 100 mm [3 in to 4 in] from the top of the cone, and a 100 mm [4 in] wide white band at least 50 mm [2 in] below the 150 mm [6 in] band.

Drums shall be of plastic or other yielding material, and shall be approximately 900 mm [36 in] high and a minimum of 450 mm [18 in] in diameter. There shall be at least two retroreflectorized orange and at least two retroreflectorized white stripes at least 100 mm [4 in] 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.

STOP/SLOW paddles shall be the primary and preferred hand-signaling device. Flags shall be limited to emergencies. The paddle shall have an octagonal shape and be at least 450 mm

[18 in] wide with letters at least 150 mm [6 in] high and should be fabricated from light semi-rigid material.

Type I barricades shall be 600 mm minimum, 2400 mm maximum [2 ft minimum, 8 ft maximum] in length with a 200 mm [8 in] wide rail mounted 900 mm [3 ft] minimum above the ground. Type II barricades shall be 600 mm [2 ft] in length with two 200 mm [8 in] wide rails, and the top rail shall be mounted 900 mm [3 ft] minimum above the roadway. Type III barricades shall be 2400 mm [8 ft] in length with three 200 mm [8 in] wide rails, and the top rail shall be mounted 1500 mm [5 ft] minimum above the roadway.

The cross members of all barricades shall be of 13 mm [½ in] or 16 mm [⅝ in] thick plywood or other lightweight rigid material such as plastic, fiberglass or fiberwood 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.

The portable message sign shall be a Winko-matic, or an approved equal. The sign message shall have a minimum of three lines and eight characters per line. It shall have a minimum clear visibility of 275 m [900 ft]. The changeability of the sign message shall be done with so-called, LED technology. The sign shall be lighted form above and below the message for night use. The sign shall be mounted on a heavy duty trailer. The trailer shall have leveling jacks and a 50 mm [2 in] ball hitch. The sign shall have capability of being raised to a minimum of 2 m [7 ft] above the trailer, measured for the bottom of the sign. It shall be capable of being rotated 360º with respect to the trailer. The sign shall be solar powered. The controller shall be a high performance laptop computer with LCD display. It shall have a standard 72 Keyboard. The controller shall have the capability of a minimum 200 messages with a minimum 150 preprogrammed commonly used messages and 50 user created messages. It shall be enclosed in a weather proof cabinet on the trailer. The sign shall have the capability of flashing the message. There shall be a battery back-up power source in the event of failure.

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 (cellular phone, pager, if any) of the Contractor's employee (the "Responsible Person") with overall responsibility for

following the TCP, and who is empowered to immediately resolve any traffic control deficiencies or issues.

b. Proposed construction phasing or sequencing that reasonably minimizes traffic impacts. The Contractor shall conduct the Work such that traffic delays do not exceed 5 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 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. For a related provision, see Section 105.2.2 - 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.

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. No review or comment by the Department, or any failure to review or comment, shall operate to absolve 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.

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 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.

The Contractor shall not store material or park equipment within 4.6 m [15 ft] of the edge of the established travel lanes. Equipment parked overnight between 4.6 and 9.1 m [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 15 m [50 ft], shall be used in guardrail areas when neither the existing guardrail nor the new guardrail is in place. The Contractor shall not remove guardrail until absolutely necessary for construction operations in that area. The guardrail shall be replaced as soon as possible thereafter.

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 600 mm [2 ft] shoulder should be maintained and the effective slope of the earth excavation beyond the 600 mm [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 600 mm [2 ft] shoulder. In the case of cuts over 1.5 m [5 ft] deep, an earth berm 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 miles per hour 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 75 mm [3 in] or less exposed vertical face at the edge of the traveled way, channelization devices shall be placed 0.61 m [2 ft] outside the edge of the pavement at intervals not exceeding 183 m [600 ft] and a 1.2 m by 1.2 m [48 in by 48 in] W8-9 Low Shoulder sign shall be placed at a maximum spacing of 0.80 km [½ mile]. When paving operations or shoulder grading leave greater than a 75 mm [3 in] exposed vertical face at the edge of the traveled way, the Contractor shall place shoulder material for a width of at least 1.2 m [4 ft] to meet the pavement grade, and place channelizing devices as above, before the lane is opened to traffic.

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 Signs shall be erected on temporary sign supports approved crashworthy devices in conformance with NCHRP 350 requirements so that the bottom of the sign is either 1) 300 mm [12 in] or 2) greater than 1.5 m [5 ft] above the traveled way. Post-mounted signs shall be erected so the bottom of the sign is no less than 1500 mm [5 ft] above the traveled way, and 2100 mm [7 ft] above the traveled way in business, commercial, and residential areas. 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 1200 mm [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 150 mm [6 in] 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 designates a new location or discontinuance of service.

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 6.7 m [22 ft] for two-way traffic and 3.4 m [11 ft] for one-way traffic. The existing travelway 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. 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, shall be considered maintenance of traffic control devices. No separate payment will be made. 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 shall be considered maintenance of traffic control devices and will be paid for under the appropriate Contract 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. All flaggers must carry an official certification card with them while flagging. Flaggers shall wear a vest, shirt, or jacket that is orange, yellow, yellow-green, or fluorescent versions of these colors, together with a hardhat with reflectivity. For nighttime conditions, similar outside garments shall be retroreflectorized, and shall be visible at a minimum distance of 300 m [1000 ft]. Lighted hand signal equipment shall be used, and the flagger station illuminated as needed, to assure visibility.

Flagger stations shall be located far enough in advance of the workspace so that approaching road users will have sufficient distance to stop before entering the workspace. 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, 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 10 minute breaks every two hours, and a lunch period away from the workstation. The Contractor shall furnish sufficient spare trained flaggers to provide continuous flagging during required or necessary breaks and during lunch periods.

652.41 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 150 m [500 ft] of the designated warning light location, power operated flashing lights shall be installed. Two alternately flashing lamps shall be mounted approximately 600 mm [24 in] above the sign, spaced approximately 600 mm [24 in] 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 150 mm [6 in] above the sign, spaced approximately 300 mm [12 in] 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.

652.6 Night Work When work is scheduled during the hours of dusk or darkness, the Contractor shall provide and maintain lighting on all equipment and at all work stations.

The lighting facilities shall be capable of providing light of sufficient intensity (20 foot-candle, minimum) 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 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.

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 750 mm by 1500 mm [30 in by 60 in], Black and Orange, Type III FP-85. The older type "Construction Vehicle - Do Not Follow" signs may be used until the end of their service life.

All vehicles used on the project 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 so as to be visible 360º. The vehicle flashing system shall be in continuous operation while the vehicle is on any part of the project.

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 the related contract items.

652.7 Method of Measurement Signs and panel markers will be measured by the square meter [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 retroreflectivity.

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 meter [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.

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, including replacing temporary pavement marking lines.

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 or not 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 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, including replacing temporary pavement marking lines.

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 or not 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, with no additional payment for overtime. 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 and pavement marking removal will be made under the respective pay item 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 the pay items in Section 652 - Maintenance of Traffic, for devices furnished or maintenance work required 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 meter [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 M230.

Pegs shall be hard wood, approximately 150 mm by 6 mm [6 in by ¼ in] 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 13 mm [½ in] 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 150 mm [6 in] loose measure. The aggregate subbase sand shall be spread with a crawler type bulldozer of not more than 390 kg/m² [80 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 which produce more than 390 kg/m² [80 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 one day.

653.08 Method of Measurement Polystyrene plastic insulation will be measured by the square meter [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 meter [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	25 mm [1 in] Polystyrene Plastic Insulation	square meter [Square Yard]
653.21	38 mm [1½ in] Polystyrene Plastic Insulation	square meter [Square Yard]
653.22	50 mm [2 in] Polystyrene Plastic Insulation	square meter [Square Yard]
653.23	75 mm [3 in] Polystyrene Plastic Insulation	square meter [Square Yard]

SECTION 654 - VACANT

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.

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 its 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.

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. If the Work could disturb soils in the

watersheds of any sensitive waterbodies identified in the Contract Documents or listed in Appendix A of the BMP Manual, then the SEWPCP must be in accordance with the higher standards for soil erosion and water pollution contained in Section II (B) - "Guidelines for Sensitive Waterbodies" of the BMP Manual.

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 Prime 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 disposal sites including expansion of existing sites.

d. Incorporation of permanent erosion 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.

f. Emergency procedures for storms, including availability of Materials and procedures and time frames for corrective action if controls fail.

g. A discussion of how the SEWPCP meets or exceeds the Standards and Commitments contained in Section II of the BMP Manual.

h. Type and location of all temporary erosion and sedimentation control measures. Temporary winter stabilization must be used between November 1 and April 1, 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 with some 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. If temporary winter stabilization practices are used, spring procedures for permanent stabilization shall also be described in the SEWPCP.

i. Mulching type and frequency of application for disturbed soil areas.

j. Location and frequency of application of temporary seeding.

k. Description of all dust control procedures for roadways, haul roads, work areas, and all other contractor activities.

l. Location and method of temporary sediment control for existing and proposed catch basins and all other drainage inlet and outlet areas.

m. Describe all in-stream work, with timing and plans for temporary stream diversions and cofferdams.

n. Describe the design, location, and plans for sedimentation basins used for dewatering cofferdams.

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. Temporary erosion control features for any designated mitigation site that is specified in the Contract.

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 on site 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;

3. 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;

4. 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 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".

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. 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.

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.

IMPLEMENTATION OF SEWPCP

656.4.1 Preconstruction Field Review Before commencing any Work, that could disturb soils or impact water quality, the preparer of the SEWPCP and the Environmental Coordinator must field review the project. The Contractor shall provide the Department at least three days prior notice of this review.

656.4.2 Preconstruction Installation of Controls/Certification Before commencing any Work, which could disturb soils or impact water quality, initial soil erosion and water pollution controls must be installed in compliance with the Contractor's SEWPCP and the Environmental Coordinator must so certify to the Department in writing.

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 three 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.

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.

Failure by the Contractor to comply with its SEWPCP and/or failure to implement additional measures will result in a reduction in payment, computed by reducing the 90% balance (a) by the number of days deficient divided by the number of days from start of work to project completion or (b) $100 for each day deficient, whichever is greater. Payment may be further adjusted as provided in Section 656.1 - Responsibility of the Contractor - Prepare and Follow Plan.

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.

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

657.01 Description This work shall consist of grading and treating the surface of pit areas in accordance with these specifications and as directed.

657.02 Materials Materials shall meet the requirements specified in the following Sections of Division 700 - Materials:

Fertilizer	717.01
Agricultural Ground Limestone	717.02
Seed	717.03

Seed shall be in accordance with the provisions for Method No. 2. When used for the rehabilitation of areas except loam and sod fields, the following seed shall be added to each 45 kg [100 lb] of the seed mixture: 2 kg [5 lb] of Orchard Grass, 2 kg [5 lb] of Bird's Foot Trefoil, and 2 kg [5 lb] of Ladino Clover.

657.03 Grading Upon the completion of excavating the pit, the Contractor shall grade the pit area compatible with the surroundings. Strippings shall be redistributed over the pit area as directed.

The area where granular material is exposed shall be graded to a slope of 1 vertical to 1 horizontal or flatter. The areas of all non-granular slopes shall be graded to a slope of 1 vertical to 2 horizontal or flatter. Tree stumps, roots, and other debris shall be covered. The areas of pits of solid or broken ledge rock shall be trimmed of loose rock and the bottom of the pit graded to be compatible with the surroundings.

Wherever ponds are left within the pit, a slope of 1 vertical to 4 horizontal to or flatter, shall extend into the water at least 5 m [16 ft] to assure that the pond will not be a hazard to the public.

657.04 Surface Treatment After completion of the grading and distribution of the strippings, the ground surface shall be fertilized and seeded as directed.

Fertilizing and seeding shall be done in accordance with the procedures of Section 618 - Seeding, Method Number 2 except for the added seed mixture to be used when required. The seed shall be applied at the rate of 1.8 kg [4 lb] of seed mixture per unit.

Mulching shall be applied in accordance with Section 619 - Mulch.

657.05 Method of Measurement Seeding pits will be measured by the 100 m² [1,000 ft²] unit of land seeded, measured along the slope of the ground from the extremities of seeded area, except as noted in Section 657.06 - Basis of Payment.

657.06 Basis of Payment The accepted quantity of seeding pits will be paid for at the contract price per unit, which price shall be full compensation for furnishing and applying agricultural ground limestone, fertilizer, and the designated type seed at the specified rate, and for tilling the soil to implant the seed.

Cost of grading of slopes and bottoms of pits, grading of stripping piles over the pit and grading of all other pit areas distributed by the Contractor under this project shall be considered incidental to the various contract items and no additional payment will be made.

Mulching, when called for, will be paid for under Section 619 - Mulch.

When the bid schedule does not contain an estimated quantity for Seeding Pits, the work, equipment and materials required to meet the requirements of Section 657 - Rehabilitation of Pits and Section 619 - Mulch will not be paid for directly but will be considered incidental to the other contract items.

Payment will be made under:

Pay Item		Pay Unit
657.24	Seeding Pits	Unit

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 one year.

Only materials on the following list of approved acrylic latex coating shall be used.

PREQUALIFIED ACRYLIC COLOR FINISH SYSTEMS

Company Name:	California Prod. Corp. Cambridge, MA	Nova Sport USA Framingham, MA	A. D. Rossi St. Johnsbury, VT	Touraine Paints, Inc. Everett, MA
Product:	Fortified Plexipave (Ready to Use) Light Green	NS501 Grass Green	Elite - Color Light Green	Tru-Flex TRC 81 Green
Dilution:	No Dilution	1 to 1		1 to 1
Pavement Surf. Temp. °C [°F]				
Min	10 [50] and rising	10 [50] and rising	10 [50] and rising	10 [50] and rising
Max	60 [140]	60 [140]	60 [140]	60 [140]

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 part 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 meter [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 meter [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 As part of the Contractor's equal employment opportunity affirmative action program, the primary objective on-the-job training shall be to train and upgrade minorities and women toward journey worker status.

660.02 Requirements Contractors, where seasonal workforce for the preceding year did not meet craft tradesperson goals of 6.9 percent for women and 0.05 percent for minorities in skilled and semi-skilled areas, and a Laborer level of 10 percent for women and 0.05 percent for minorities, shall: (a) provide on-the-job training (OJT) aimed at developing full journey workers in the types of trades or job classifications involved on a Contract; and (b) when a Contractor has complied with the above cited women and minority employment goals, no further training is required provided the numbers remain at or above the given percentages. The method for determining company-wide compliance shall be the actual hours worked by women and minorities during the preceding season from April 1st through November 15th annually. Such record shall be provided to the Department's OJT and Contract Compliance Consultant at time of award. Contractors in compliance with craft goals shall no longer be required to provide

training provided the workforce does not fall below the required levels. If it does, Contractors shall begin training in accordance with Section 660.

Total training hours will be the amount listed in the Schedule of Items.

If OJT is required, then the Contractor shall complete and forward to the Department's OJT and Contract Compliance Consultant the Letter of Intent, along with the OJT Registration form including the Workforce Breakdown form, prior to commencing any project work. The Contractor shall submit the Registration/Enrollment form to the OJT and Consultant indicating each classification to be used in the course of meeting this requirement.

Training classifications shall be distributed among work classifications needed by a Contractor in the skilled and semi-skilled craft levels identified on the Letter of Intent.

The Contractor shall receive credit only when the Department's representative has approved the program. For this reason, Contractors are reminded to register candidates at the onset of the Project work in order to guarantee the maximum training time for the enrollee to complete their program. Contractors will be reimbursed for such hours as are approved.

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 minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The Contractor shall be responsible for demonstrating the steps taken in pursuance thereof, before determination as to whether the Contractor is in compliance. If, in accordance with Section 660 - On-The-Job-Training, the Contractor is acting affirmatively and has achieved the semi-skilled and skilled craft employment goals of 6.9 percent women and 0.05 percent minorities, and 10 percent for women, and 0.05 percent for minorities in unskilled classes, then the Contractor will have no further training obligation for the periods that the levels are maintained. If the Contractor falls below these standards, it shall immediately reinstate an Affirmative Action Program to increase the employment and retention of women and minorities.

Trainees shall not be enrolled in a classification in which they have successfully completed a training course leading to journey worker status, or for which they have held employment as a journey worker. No contractor shall enroll trainees who possess post secondary degrees, certification, or diploma without first securing written approval. 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 or its representative. 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 likely to meet the equal employment opportunity obligations that bring women and minorities into the industry and retain them. By design, it will lead to qualifying the average trainee for journey worker status in

the classification used. Contractors are encouraged to examine training opportunities, which fit their need.

Contractors whose OJT hours are waived, may establish a training obligation to a subcontractor. Section 660 shall be included in all contracts to subcontractors. Subcontractors are expected to comply with craft goals. As with other Sections applied to a sub, the Contractor retains obligations accordingly.

If training is required, the Contractor shall maintain records, and furnish the Department or its representative with documentation of each trainee's progress using the Weekly OJT Evaluation form.

660.03 Method of Measurement The OJT item will be by the number of hours worked according to the approved training program. At enrollment, trainees shall be paid at least 75 percent of the average wage paid for craftspeople in the stated classification on the project. Provided a trainee achieves the objectives of the program, the Contractor must provide incremental wage increases to each enrollee as they progress in their program. By completion, a trainee is expected to earn a comparable wage to that of other journeyed workers, employed by the contractor in this classification.

660.04 Basis of Payment The OJT shall be at the contract unit price per hour. Payment will be made even though the Contractor received additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other payment. No payment shall be made to the Contractor, if the Department determines the Contractor failed to provide the required training, or if able, the contractor did not hire the trainee as a tradesperson when their program is completed. The Department shall work with any contractor whose efforts have been deemed not consistent with the spirit or intent of the Program.

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. 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 either: 1) the weekly training report, or 2) the Contractors usual daily/weekly time card. The Contractor will have fulfilled the responsibilities by specifically providing the maximum training opportunity as required in this Special Provision.

When the Department determines the Contractor has not complied with this Section, the number of training hours remaining to be completed for each training hour required will be multiplied by the prevailing wage rate plus fringes for that particular trainee's classification. The resulting figure shall be deducted from any monies due the Contractor, as determined by the Resident. The Department shall move within ten days of the ruling to advise the Contractor, in writing, so a corrective action plan may be developed in order to avoid similar future findings. If subsequent efforts fail, sanctions may be imposed

Payment will be made under:

Pay Item	Pay Unit
660.21 On-The-Job Training	Hour

SECTION 700 - MATERIALS

GENERAL STATEMENT

For all materials used in the work for which there is no specified 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 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 are in conformity with the applicable drawings and/or standards of 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 three 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. Certified materials, which fail to meet specification requirement, may not be accepted.

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.

For Performance-Graded Binder, the Contractor shall arrange for the Supplier to furnish a Quality-Control Plan and 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 Testing Engineer, Maine Department of Transportation, P.O. Box 1208, Bangor, Maine 04402-1208.

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 l08.1.3 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 T27 except that the sample may be separated on the 12.5 mm [½ in] screen. Testing as specified in AASHTO T11 shall be performed on any materials for which there is a specification limit on the amount of material passing a 75 μm [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 45 kg [100 lb]. All new Work Zone Category 1 and Category 2 Devices purchased by the Contractor shall meet NCHRP Report 350 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.

Contractors may use existing Work Zone Category 1 Devices (purchased before October 1, 1998) until the end of their service life. Existing Work Zone Category 2 Devices (purchased before October 1, 2000) may be used until the end of their service life or October 30, 2003, whichever occurs first. When a device reaches the end of its service life, it shall be replace with a NCHRP 350 and MUTCD compliant device.

SECTION 701 - STRUCTURAL CONCRETE RELATED MATERIAL

701.01 Portland Cement and Portland Pozzolan Cement Portland cement shall conform to the requirements of AASHTO M85, Type II.

A Type II or Type III cement meeting AASHTO M85 may be used when making precast units.

A Type IP (MS) portland-pozzolan cement (blended hydraulic cement with moderate sulfate resistance) meeting the requirements of AASHTO M240, may be used instead of Type II or where Type I portland cement, meeting the requirements of AASHTO M85, is allowed. The definitions of the two hydraulic cements mentioned above are as follows: (See ASTM C219)

Portland cement - a hydraulic cement produced by pulverizing portland cement clinker, and usually containing calcium sulfate.

Portland-pozzolan cement - a hydraulic cement consisting of an intimate and uniform blend of portland cement or portland blast furnace slag cement and fine pozzolan produced by intergrinding portland cement clinker and pozzolan, by blending portland cement or portland blast furnace slag cement and finely divided pozzolan, or a combination of intergrinding and blending, in which the amount of the pozzolan constituent is within specified limits.

Only one brand of cement shall be used on any one contract unless otherwise permitted, in writing, by the Resident.

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 by comparison with water of known satisfactory quality. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength. Any indication of unsoundness, marked change in time of setting or a reduction of more than l0% in strength from results obtained with mixtures containing water of known satisfactory quality shall be sufficient cause for rejection of the water that is being tested. 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 Admixtures Air-entraining admixtures shall be in accordance with the requirements of AASHTO M154.

The material used shall be one of the products listed on the Maine Department of Transportation's Approved Product List.

701.04 Water Reducing Admixtures Water reducing admixtures shall conform to the requirements of AASHTO M194, Type A.

The material used shall be one of the products listed on the Maine Department of Transportation's Approved Product List.

701.0401 High Range, Water Reducing, Admixture High range, water-reducing admixture, commonly referred to as both super-water-reducers and/or superplasticizers, shall conform to the requirements of AASHTO M194, Type F.

The material used shall be one of the products listed on the Maine Department of Transportation's Approved Product List.

701.05 Set-retarding Admixtures Set-retarding admixtures shall conform to the requirements of AASHTO M194, Types B or D.

The material used shall be one of the products listed on the Maine Department of Transportation's Approved Product List.

701.06 Curing Materials Sheet materials for curing concrete shall conform to the requirements of AASHTO M171. Burlap cloth shall conform to the requirements of AASHTO M182 Class 3, 310 g/m [10 oz/yd]. Liquid membrane-forming compounds shall conform to the requirements of AASHTO M148 and shall be one of the products listed on the Maine Department of Transportation's Approved Product 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.

701.09 Styrene-Butadiene Latex Modifier for Concrete and Mortar The formulated styrende-butadiene latex modifier, hereinafter referred to as latex admixture, shall be a nonhazardous, film forming, polymeric emulsion in water to which all stabilizers have been added at the point of manufacture, and shall be homogeneous and uniform in composition. This styrene-butadiene latex modifier shall be used in the mortar or concrete and shall be one of the following:

(a) Dow Modifier A; Dow Chemical Company; Midland, Michigan

(b) Deco-Rez 4776; General Polymers Corp.; Cincinnati, Ohio
(c) Thermoflex 8002 (also called Reichold 8002);Reichold Chemicals, Inc.; Dover, Delaware
(d) Arco Dyles 1186; Arco Polymers, Inc.; Monaca, Pennsylvania

The prime Contractor shall be responsible for the cooperation and coordination with the latex supplier or manufacturer or both for the satisfactory performance of the work.

The latex admixture formulation shall conform to the following requirements:

Polymer Styrene-butadiene emulsion. 66 ± 1½% styrene, 31½ ± 1½ %butadiene

Percent 46.5 to 49.0%

Stabilizers The polymeric emulsion shall be stabilized with an anionic, nonionic and polyorganosiloxane fluid surfactant in which the anionic surfactant is a sodium alkyl sulfate.

Average Size of Particles 1,900 to 2,500 Angstroms

PH 8.5 to 11.0

Freeze-Thaw Stability 5.0 percent maximum in 300 cycles. AASHTO T 161; except modified with 3 percent. NaC1 solution instead of plain water

Shelf life Minimum of 2 years

Color White

Weight per gallon 3.81 to 3.84 kg [8.4 to 8.47 lb] @ 25°C [77°F]

Water AASHTO T 26

Method of Determining Total Solids-Latex Admixture, Percent

Scope This involves the determination of the percent solids on all latex admixture samples. It involves weighing a sample of wet latex admixture, drying in an oven and then expressing the weight ratio of dry/wet in percent.

Procedure

(a) All samples to be tested must be at room temperature. If the sample is warm, it can be cooled in a pan of cold tap water.
(b) The level of the balance should be checked and adjusted if necessary. In addition, the zero of the balance should be checked and adjusted correspondingly.

(c) Weigh 3 aluminum cups and record the weight of each (tare weight). NOTE: Every sample tested must be done in triplicate.

(d) Mix by hand each sample when cool by inverting the container 5 to 10 times.

(e) Weigh approximately 1 gram [0.035 oz] of latex admixture to the nearest milligram into each preweighed aluminum cup.

(f) Place all 3 samples in the oven to dry for 120 minutes (oven temperature 140 ± 1°C [285 ± 2°F]).

(g) Remove the samples from the oven and place immediately in a desicator for a few minutes or until cool. This prevents moisture pick up from the air while cooling.

(h) Reweigh each sample out of the desicator to the nearest milligram and record.

(i) Calculations.

$$\text{Total solids in percent} - \frac{C-A}{B-A} \times 100$$

Where:

A - The weight of the empty aluminum cup.
B - The weight of the aluminum cup and the wet sample.
C - The weight of the aluminum cup and the dried sample.

(j) Results

(1) If all three samples are within 2 percent, average the 3 samples to obtain the percent solids.

(2) If all 3 samples are not within 2 percent, but 2 samples are within 1 percent, the average between the 2 samples within 1 percent is reported as the percent solids and the third determination is discarded.

(3) If all 3 samples are not within 2 percent and no 2 are within 1 percent, all the values must be discarded and the solids procedure must be repeated.

701.10 Fly Ash Fly Ash shall conform to the following chemical and physical requirements for mineral admixtures, Class F as listed in AASHTO M295 .

Physical Requirements:

Fineness Amount retained when wet screened on a 45 μm [No. 325] sieve. Maximum 34% allowed as per AASHTO T192.

Strength Activity Index at 7 Days with Portland Cement Meeting a minimum 75% of control.

Autoclave Expansion or Contraction Maximum 0.8% allowed per AASHTO T107 Footnote $_c$ shall apply.

Uniformity requirements The specific gravity and fineness of individual samples shall not vary from the average established by the 10 preceding tests, or by the preceding tests if the number is less than 10, by more than 5%.

Chemical Requirements:

Silicon dioxide (SiO_2) plus aluminum oxide (Al_2O_3) plus iron oxide (Fe_2O_3) Shall meet a minimum 70% per AASHTO T105 (ASTM C114).

SO_3 Sulfate ion reported as Sulfur trioxide. Maximum 5% allowed per AASHTO T105 (ASTM C114).

Moisture content Shall be a maximum 3% per AASHTO T105 (ASTM C311)

Loss of ignition (LOI) Shall be 6% maximum per AASHTO T105 (ASTM C311)

Source, Acceptance, Quality Control Conformance to these specifications will be assured by a program of testing, including quality control (QC) exercised by the fly ash producer, and quality acceptance (QA) exercised by the department.

a. Source The fly ash supplier's source shall receive acceptance based on forwarding detailed information on the following.

1. Source of raw materials.
2. Fly ash recovery process and type of collection equipment.
3. Fly ash properties and past variability's.
4. Storage facilities.
5. Frequency and results of suppliers quality control testing program.

b. Acceptance The approval of fly ash we will be based on comparative testing performed by the department on samples obtained from storage silos located at the redimix concrete plants.

Samples will be obtained for testing during the annual plant inspection. Further sampling will be on a per project basis at a frequency to be determined by the department.

c. Quality Control The quality control procedures employed by the supplier shall be such that only fly ash conforming to this Section is presented to the department for acceptance consideration.

701.11 Calcium Nitrite Solution Calcium nitrite solutions shall conform to the requirements of AASHTO M194, Type C (accelerating admixtures). 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 Approved Product List.

701.12 Silica Fume The silica fume material for use in Portland Cement Concrete shall be one of the products listed on the Maine Department of Transportation's Approved Product List.

701.13 Ground Granulated Blast Furnace Slag Ground granulated blast furnace slag shall conform to the following chemical and physical requirements for mineral admixtures, Grade 120 as listed in AASHTO M302.

Physical Requirements:

Fineness Amount retained when wet screened on a 45 μm [No. 325] sieve. Maximum 20% allowed as per AASHTO T192 (ASTM C430)

Air Content Air content of slag mortar mix. Maximum 12% allowed as per AASHTO T137 (ASTM C185)

Strength Activity Index Meeting the requirements listed in AASHTO M302 (ASTM C989) Table No. 1.

Chemical Requirements:

SO^3 Sulfate ion reported as Sulfur Trioxide. Maximum 4% allowed as per AASHTO T105 (ASTM C114)

Source, Acceptance, Quality Control Conformance to these specifications will be assured by a program of testing, including quality control (QC) exercised by the slag producer, and quality acceptance (QA) exercised by the department.

a. Source The Slag supplier's source shall receive acceptance based on forwarding detailed information on the following.

1. Source of raw materials.
2. Slag recovery process and type of collection equipment.
3. Slag properties and past variability's.
4. Storage facilities.
5. Frequency and results of suppliers quality control testing program.

b. Acceptance The approval of slag we will be based on comparative testing performed by the department on samples obtained from storage silos located at the redi-mix concrete plants.

Samples will be obtained for testing during the annual plant inspection. Further sampling will be on a per project basis at a frequency to be determined by the department.

c. Quality Control The quality control procedures employed by the supplier shall be such that only slag conforming to this Section is presented to the department for acceptance consideration.

702.01 Asphalt Cement Performance Graded Asphalt Binder shall conform to the requirements of AASHTO M 320.

702.03 Cutback Asphalt AASHTO M82.

702.04 Emulsified Asphalt AASHTO M140. Cationic emulsified asphalt shall conform to AASHTO M208.

702.05 Temperature Application Range, °C [°F]

Type and Grade of Material	*Spray*	*Mix*
RC 70	27 to 66 [80 to 150]	27 to 66 [80 to 150]
RC 250	28 to 79 [82 to 175]	27 to 66 [80 to 150]
RC 800	71 to 107 [160 to 225]	57 to 85 [135 to 185]
RC 3000	93 to 135 [200 to 275]	85 to 107 [185 to 225]
MC 30	10 to 49 [50 to 120]	10 to 49 [50 to 120]
MC 70	27 to 66 [80 to 150]	27 to 66 [80 to 150]
MC 250	38 to 93 [100 to 200]	38 to 99 [100 to 210]
MC 800	85 to 127 [185 to 260]	93 to 121 [200 to 250]
MC 3000	109 to 135 [230 to 275]	93 to 121 [200 to 250]
All emulsions	10 to 71 [50 to 160]	10 to 71 [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 16°C [60°F].

EMULSIFIED ASPHALTS	ASPHALTS (from ASTM D1250)			ASPHALTS (from ASTM D1250)			ASPHALTS (from ASTM D1250)		
All Types and Grades	T °C [°F]	Group0 Sp. Grave. 0.966+	Group1 Sp. Grave. 0.850 0.966	T °C [°F]	Group0 Sp. Grave. 0.966+	Group1 Sp. Grave. 0.850 0.966	T °C [°F]	Group0 Sp. Grave. 0.966+	Group1 Sp. Grave. 0.850 0.966
1	10 [50]	1.0035	1.0040	66 [150]	.9689	.9647	121 [250]	.9352	.9268

1	13 [55]	1.0017	1.0020	68 [155]	.9672	.9628	124 [255]	.9336	.9249
1.0000	16 [60]	1.0000	1.0000	71 [160]	.9655	.9609	127 [260]	.9319	.9231
.9988	18 [65]	.9983	.9980	74 [165]	.9638	.9589	129 [265]	.9302	.9212
.9975	21 [70]	.9965	.9960	77 [170]	.9621	.9570	132 [270]	.9286	.9194
.9962	24 [75]	.9948	.9940	79 [175]	.9604	.9551	135 [275]	.9269	.9175
.9950	27 [80]	.9930	.9921	82 [180]	.9587	.9532	138 [280]	.9253	.9157
.9938	29 [85]	.9913	.9901	85 [185]	.9570	.9513	141 [285]	.9236	.9138
.9925	32 [90]	.9896	.9881	88 [190]	9553	.9494	143 [290]	.9220	.9120
.9912	35 [95]	.9878	.9861	91 [195]	.9536	.9475	146 [295]	.9204	.9102
.9900	38 [100]	.9861	.9842	93 [200]	.9520	.9456	149 [300]	.9187	.9083
.9988	41 [105]	.9844	.9822	96 [205]	.9503	.9437	152 [305]	.9171	.9065
.9875	43 [110]	.9826	.9803	99 [210]	.9486	.9418	154 [310]	.9154	.9047
.9862	46 [115]	.9809	.9783	102 [215]	.9469	.9399	157 [315]	.9138	.9029
.9850	49 [120]	.9792	.9763	104 [220]	.9452	.9380	160 [320]	.9122	.9010
.9338	52 [125]	.9775	.9744	107 [225]	.9436	.9361	163 [325]	.9105	.8992
.9825	54 [130]	.9758	.9725	110 [230]	.9419	.9343	166 [330]	.9089	.8974
.9812	57 [135]	.9740	.9705	113 [235]	.9402	.9324	168 [335]	.9073	.8956
.9800	60 [140]	.9723	.9686	116 [240]	.9385	.9305	171 [340]	.9057	.8938
.9788	63 [145]	.9706	.9666	118 [245]	.9369	.9286	174 [345]	.9040	.8920
.9775	66 [150]	.9689	.9647	121 [250]	.9352	.9268	177 [350]	.9024	.8902

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 M190 or of AASHTO M320, Table 1, for PG 64-28.

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 free from injurious amounts of organic impurities. Should the fine aggregate, when subjected to the colorimetric test for organic impurities, AASHTO T21

(ASTM C40), produce a color darker than the reference standard color solution (laboratory designation Plate III), the fine aggregate shall be rejected.

The fine aggregate shall be well graded from coarse to fine material and shall meet the following grading requirements when tested according to AASHTO T11 and AASHTO T27.

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
9.5 mm	⅜ inch	100
4.75 mm	No. 4	95-100
2.36 mm	No. 8	80-100
1.18 mm	No. 16	50-85
600 µm	No. 30	25-60
300 µm	No. 50	10-30
150 µm	No. 100	2-10
75 µm	No. 200	0-5.0

Fine aggregate failing to meet the minimum requirements for material passing the 300 µm and/or 150 µm [No. 50 and/or No. 100] sieves may be retested and approved for use provided an approved inorganic fine material is added to correct the deficiency in grading.

The gradation requirements given above are the extreme limits to be used in determining the suitability of materials from all possible sources of supply.

The fineness modulus shall not be less than 2.3 or more than 3.1, nor vary by more than 0.20 from the value assumed in selecting proportions of the concrete. If this value is exceeded, the fine aggregate will be rejected unless suitable adjustments are made in proportions of coarse and fine aggregate. The fineness modulus of fine aggregate shall be determined by adding the cumulative percentages of material by weight retained on the following sieves: 4.75 mm, 2.36 mm, 1.18 mm, 600 µm, 300 µm and 150 µm [US Standard sieves Nos. 4, 8, 16, 30, 50, 100] and dividing by 100.

Mortar cubes containing the fine aggregates and made according to AASHTO T71 (ASTM C87) using cement conforming to AASHTO M85, Type II, shall develop compressive strength, at the age of 7 days, of not less than 90% of the strength developed by a mortar prepared in the same manner with the same cement and graded Ottawa sand having a fineness modulus of 2.40 +/- 0.10. After the initial test for each year and the fine aggregate has been accepted, the above compressive test will not be required unless the Resident deems it necessary.

Fine aggregate, from an individual source or stockpile used for blending when tested for absorption as specified in AASHTO T84 (ASTM C128), shall show a percent of absorption of not more than 2.30.

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 and of which the portion retained on the 9.5 mm [⅜ in] sieve shall contain not more than 15%, by weight of flat and elongated particles when performed in accordance with test method ASTM D4791, Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate, using a dimensional ratio of 1:5.

The coarse aggregate shall not contain more than 3%, by weight, of deleterious material from an individual or blended source or stockpile.

Deleterious material is defined as those particles of aggregate that may be crumbled in the hand and those that have an absorption greater than 3% by weight determined in accordance with AASHTO T85 modified for weight of sample. The types that are determined to be deleterious are generally highly absorptive shales, phylites, sandstones, and rotten rock of various kinds.

Coarse aggregate shall conform to the requirements of the following table for the size or sizes designated and shall be well graded between the limits specified.

PERCENTAGE BY WEIGHT PASSING A SQUARE MESH SIEVE

CLASSES	A	AA	S	LATEX
Sieve Designation				
50.0 mm [2 in]			100	
37.5 mm [1½ in]	100		95-100	
25.0 mm [1 in]	95-100	100	-	
19.0 mm [¾ in]	-	90-100	35-70	100
12.5 mm. [½ in]	25-60	-	-	90-100
9.5 mm [⅜ in]	-	20-55	10-30	40-70
4.75 mm [No. 4]	0-10	0-10	0-5	0-15
2.36 mm [No. 8]	0-5	0-5	-	0-5
1.18 mm [No. 16]	-	-	-	-
300 μm [No. 50]	-	-	-	-
75 μm [No. 200]	1.5 Max.	1.5	1.5	1.5
AGG. SIZE	25mm[1 in]	19mm[¾ in]	37.5mm[1½ in]	12.5mm[½ in]

The material passing the 75 μm [No. 200] sieve shall be determined in accordance with AASHTO T11 and AASHTO T27.

Coarse aggregate for a non-integral structural concrete wearing surface shall be hard and durable crushed ledge rock.

703.0201 Alkali Silica Reactive Aggregates. All coarse aggregates proposed for use in concrete shall be tested for Alkali Silica Reactivity (ASR) potential under AASHTO T303 (ASTM C1260), Accelerated Mortar Bar Method, prior to being accepted for use. Acceptance will be based on testing performed by the Department. Sampling will be performed by the Department from stockpiles located at the Contractor's/supplier's ready mixed concrete plants.

Aggregate approvals will be performed on a 3-year cycle, unless the source or character of the aggregate in question has changed within 3 years from the last test date.

A list of pre-approved coarse aggregate and aggregate-cement/pozzolan blends is maintained by the Department and will determine the acceptability of concrete mix designs proposed for use.

As per AASHTO T303 (ASTM C1260): Use of a particular coarse aggregate will be allowed with no restrictions when the mortar bars made with this aggregate expand less than or equal to 0.10% at 16 days; use of a particular coarse aggregate will be classified as potentially reactive when the mortar bars made with this aggregate expand greater than 0.10% at 16 days, and use of this aggregate will be allowed only with the use of cement-pozzolan blends and/or chemical admixtures that result in mortar bar expansion of less than 0.10% at 16 days.

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:

A. Class F Coal Fly Ash meeting the requirements of ASTM C618.
B. Ground Granulated Blast Furnace Slag (Grade 100 and 120) meeting the requirements of ASTM C989.
C. Densified Silica Fume (powder or slurry) meeting the requirements of AASHTO M307.
D. Lithium Hydroxide Monohydrate (LiOH-H2O).

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.

Aggregates classified as potentially reactive by the requirements of this specification may be used, provided they meet one of the following criteria:

A. A well-documented history showing that the proposed aggregate is innocuous is provided to the Department of at least 10 structures containing this aggregate. These structures must be at least 15 years of age, exposed to moisture in service, contain high alkali cement (greater than 0.80% alkali) and exhibit a lack of ASR-related distress. Cores taken from the existing structures shall be petrographically analyzed in accordance with ASTM C856; these analyses must indicate the absence of ASR gel formation, aggregate rimming and associated micro cracking. The locations and sampling of cores shall be the responsibility of the Department. All costs associated with the petrographic evaluation of cores, including transportation of the cores to the testing facility, shall be the responsibility of the Contractor.

B. Certified test results from an accredited independent laboratory utilizing the current AASHTO T303 (ASTM C1260) Accelerated Mortar Bar Method, indicating an acceptable alkali-aggregate combination, are submitted to the Department.

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 gradation shall meet the grading requirements of the following table.

Sieve Designation		Percent by Weight Passing Square Mesh Sieve
Metric	US Customary	
9.5 mm	⅜ in	85-10
75 μm	No. 200	0-5.0

703.06 Aggregate for Base and Subbase. The material shall have a minimum degradation value of 15 as determined by the Washington State Degradation Test of 1967, except that the test will be run on the portion of a sample that passes the 12.5 mm [½ in] sieve and is retained on the 2.00 mm [No. 10] sieve, minus any reclaimed asphalt pavement used.

a. Aggregate for base shall be screened 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 75 mm [3 in] sieve shall meet the grading requirements of the following table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves Aggregates		
Metric	US Customary	Type A	Type B	Type C
12.5 mm	½ in	45-70	35-75	
6.3 mm	¼ in	30-55	25-60	25-70
425 μm	No. 40	0-20	0-25	0-30
75 μm	No. 200	0-5.0	0-5.0	0-5.0

Type A aggregate for base shall only contain particles of rock that will pass the 50 mm [2 in] square mesh sieve.

Type B aggregate for base shall only contain particles of rock that will pass the 100 mm [4 in] square mesh sieve.

Type C aggregate for base shall only contain particles of rock that will pass the 150 mm [6 in] square mesh sieve.

b. 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 75 mm [3 in] sieve shall meet the grading requirements of the following table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves Aggregates			
Metric	US Customary	Type D	Type E	Type F	Type G
6.3 mm	¼ in	25-70	25-100	60-100	-
425 µm	No. 40	0-30	0-50	0-50	0-70
75 µm	No. 200	0-7.0	0-7.0	0-7.0	0-10.0

Aggregate for subbase shall not contain particles of rock which will not pass the 150 mm [6 in] square mesh sieve.

703.07 Aggregates for HMA Pavements Coarse aggregate 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 2.36 mm [No. 8] 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.

Fine aggregate, material that passes the 2.36 mm [No. 8] 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 3% by weight as determined by AASHTO T84.

The composite blend shall have a Micro-Deval value of 18.0 or less as determined by AASHTO TP58-99. In the event of a failure, the Washington State Degradation test of 1967 shall be run before rejection of the material. Material with a value of 30 or more may be accepted.

Aggregates shall also meet the following consensus properties. The Department reserves the right to sample and test the composite aggregate for any of the following properties at any time.

TABLE 3: AGGREGATE CONSENSUS PROPERTIES CRITERIA

Estimated Traffic, Million 80 kN [18 kip] ESALs	ASTM D5821 Coarse Aggregate Angularity (Minimum)	AASHTO T-304 Method A Uncompacted Void Content of Fine Aggregate (Min)	ASTM D4791 (8.4) Flat and Elongated Particles (Maximum)	AASHTO T176 Clay Content/ Sand Equivalent (Minimum)
< 0.3	60/60	40	10	45
0.3 to < 3.0	75/60			
3.0 to < 10	85/80	45		
10 to < 30	95/90			

≥ 30	100/100			50

ASTM D5821 - "85/80 denotes that 85% of the coarse aggregate has one fractured face and 80% has two fractured faces.

AASHTO TP304 - Criteria are presented as percent air voids in loosely compacted fine aggregate, (U).

ASTM 4791 - 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 Resident to change sources.

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 will meet the grading requirements of the following tables or as otherwise specified.

TABLE 1: COMPOSITION OF MIXTURES - CONTROL POINTS

SIEVE SIZE	GRADING			
	TYPE 19 mm	TYPE 12.5 mm	TYPE 9.5 mm	TYPE 4.75 mm
	PERCENT BY WEIGHT PASSING - COMBINED AGGREGATE			
37.5 mm				
25 mm	100			
19 mm	90-100	100		
12.5 mm	-90	90-100	100	100
9.5 mm	-	-90	90-100	95-100
4.75 mm	-	-	-90	80-100
2.36 mm	23-49	28-58	32-67	40 - 80
1.18 mm	-	-	-	-
600 μm	-	-	-	-
300 μm	-	-	-	-
75 μm	2-8	2-10	2-10	2-10

SIEVE SIZE	RESTRICTED ZONES			
	TYPE 19 mm [¾ in]	TYPE 12.5 mm [½ in]	*TYPE 9.5 mm [⅜ in]	TYPE 4.75 mm [#40]
	PERCENT BY WEIGHT PASSING - COMBINED			AGGREGATE
37.5 mm [1½ in]	-	-	-	-
25 mm [1 in]	-	-	-	-
19 mm [¾ in]	-	-	-	-
12.5 mm [½ in]	-	-	-	-
9.5 mm [⅜ in]	-	-	-	-
4.75 mm [No. 4]	-	-	-	-
2.36 mm [No. 8]	34.6	39.1	47.2	-

1.18 mm [No. 16]	22.3-28.3	25.6-31.6	31.6-37.6	-
600 µm [No. 30]	16.7-20.7	19.1-23.1	23.5-27.5	-
300 µm [No. 50]	13.7	15.5	18.7	-
75 µm [No. 200]	-	-	-	-

* The restricted zone is presented for information and definition of "Fine" 9.5mm mixes only.

If a Grading "D" mixture is allowed per Special Provision Section 403, it shall meet the following gradation and the aggregate requirements of Section 703.07.

Sieve Designation (Metric)	Sieve Designation (US Customary)	Percentage by Weight Passing Square Mesh Sieves
12.5 mm	½ in	100
9.5 mm	⅜ in	93-100
4.75mm	No. 4	60-80
2.36 mm	No. 8	46-65
1.18 mm	No. 16	25-55
600 µm	No. 30	16-40
300 µm	No. 50	10-30
150 µm	No. 100	6-22
75 µm	No. 200	3.0-8.0

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. The gradation of the material shall meet the grading requirements of the following table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
25.0 mm	1 in	95-100
19.0 mm	¾ in	90-100
4.75 mm	No. 4	40-65
2.00 mm	No. 10	10-45
75 µm	No. 200	0-7.0

703.11 Aggregate for Shoulder Aggregate for add shoulder gravel shall meet the grading requirements of the following table.

	*Paved or Unpaved Lifts 100 mm [4 in] or Greater Percent Passing	Paved Lifts < 100 mm [4 in] Percent Passing	Unpaved Lifts < 100 mm [4 in] Percent Passing
25 mm [1 in]	-----	90 - 100	90 - 100
6.3 mm [¼ in]	25 - 70	25 - 100	25 - 70
425µm [No. 40]	5 - 30	5 - 50	5 - 30
75µm [No. 200]	2 - 10	2 - 10	2 - 10

*Shall not contain particles larger than 150 mm [6 in] 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 meet the applicable requirements of Section 703.07(a) Coarse Aggregate. The aggregate shall meet the following gradation requirements:

Sieve Designation	Percent of Weight Passing Square Mesh Sieves
25 mm [1 in]	100
19 mm [[¾ in]	60 - 90
12.5 mm [½ in]	10 - 35
9.5 mm [⅜ in]	2 - 15
4.75 mm [No. 4]	0 - 5

Gradation tests shall conform to AASHTO Method T27.

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 M17.

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.

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 T180, 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 and other deleterious substances. The gradation of that portion passing a 75 mm [3 in] sieve shall meet the gradation requirements of the following table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves	
Metric	US Customary	Material for Underwater Backfill	Material for Embankment Construction
425 μm	No. 40	0-70	0-70
75 μm	No. 200	0-10.0	0-20.0

Granular borrow 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 150 mm [6 in] and that portion passing a 75 mm [3 in] square mesh sieve shall contain not more than 70% passing a 6.3 mm [¼ in] mesh sieve and not more than 10% passing a 75 μm [No. 200] mesh sieve.

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 900 mm [3 ft] in its greatest dimension.

703.22 Underdrain Backfill Material. Granular material for Underdrain Type B shall be free from organic matter and shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
25.0 mm [1 in]	95-100
12.5 mm [½ in]	75-100
4.75 mm [No. 4]	50-100
850 μm [No. 20]	15-80
300 μm [No. 50]	0-15
75 μm [No. 200]	0-5.0

Crushed or uncrushed material for Underdrain Type C shall conform to the following table:

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
25.0 mm	1 in	100
19.0 mm	¾ in	90-100
9.5 mm	⅜ in	0-75
4.75 mm	No. 4	0-25
2.00 mm	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
Metric	US Customary	
150 mm	6 in	90-100
37.5 mm	1½ in	0-40
4.75 mm	No. 4	0-5

Gradation test shall conform to AASHTO T27 except that the total sample shall be sieved and the minimum weight of the sample will be 55 kg [120 lb].

703.25 Stone Fill Stones for stone fill shall consist of sound durable rock that will not disintegrate by exposure to water or weather. Either field stone or rough, unhewn quarry stone may be used. Stones shall weigh from 5 kg [10 lb] to a maximum of 225 kg [500 lb] or larger if approved by the Resident. 50 percent by weight of the stones shall be approximately 100 kg [200 lb].

703.26 Plain and Hand Laid Riprap Stones shall consist of sound durable rock which will not disintegrate by exposure to water or weather. Either field stone or rough, unhewn quarry stone may be used. Exposed stones shall be angular and as nearly rectangular in cross-section as practicable. Rounded boulders or cobbles will not be permitted. Stones shall weigh from 5 kg [10 lb] to 100 kg [200 lb] except that when available suitable stones weighing more than 90 kg [200 lb] may be used. Approximately 50% of the stones by volume, shall exceed a mass of 25 kg [50 lb] each.

703.27 Stone Blanket Stones shall consist of sound durable rock that will not disintegrate by exposure to water or wind. Either field stone or rough, unhewn quarry stone may be used. Stones shall weigh from 150 kg [300 lb] to 1500 kg [3,000 lb]. Approximately 50% of the stones, by volume, shall exceed a mass of 450 kg [1,000 lb] each.

703.28 Heavy Riprap Stones shall consist of sound, durable rock, resistant to the action of air and water. Either field stone or rough, unhewn quarry stone may be used. The exposed stones shall be angular. Round or thin, flat stones will not be permitted. Stones shall have a minimum weight of 225 kg [500 lb] each and at least 50% of the stones, by volume, shall exceed 450 kg [1,000 lb] each.

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	Percentage by Weight

Designation		Passing Square Mesh Sieves
Metric	US Customary	
300 mm	12 in	90-100
100 mm	4 in	0-15

The size of any stone shall not exceed 450 mm [18 in] when measured along its longest axis.

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 in the stockpile at the source.

Sieve Designation		Percentage by Weight Passing Square Mesh Sieves
Metric	US Customary	
63 mm	2½ in	100
50 mm	2 in	95-100
25 mm	1 in	0-30
19 mm	¾ in	0-5

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 and Manhole	AASHTO M91, Grade MS or SM
Building	AASHTO M114, Grade SW

Size Number 1 brick of a nominal length of 190 mm [7 in] may be used.

704.02 Brick for Paving Brick for paving shall conform to the requirements of ASTM (C62, Grade SW) for Building brick or shale, with the following modifications:

a. The absorption limits shall be from 5% to 12% for the average of 5 bricks.
b. The compressive strength shall not be less than 41.4 MPa [6,000 psi].
c. The modulus of rupture shall not be less than 6.9 MPa [1,000 psi].
d. The bricks shall be No. 1, water struck type for paving.

The bricks shall be 57 mm by 90 mm by 190 mm [2¼ in by 3¾ in by 8 in] with permissible variations not to exceed 1.5 mm [$^{1}/_{16}$ in] in depth, 3 mm [⅛ in] in width and 6 mm [¼ in] 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.

Hollow blocks shall conform to the requirements of ASTM C90, Grade N-II, except paragraph 3.2 a. Aggregates shall meet the requirements of Sections 703.01 and 703.02 for fine aggregates and coarse aggregates respectively except that grading requirements are hereby waived.

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 M213 (ASTM D1751).

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 M85 (ASTM C150), Type II or IIA.

The sand shall meet the requirements of the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve Joints Thicker Than 13 mm [½ in]	 Joints 13 mm [½ in] or Thinner
9.5 mm [⅜ in]	100	-
6.3 mm [¼ in]	-	100
4.75 mm [No. 4]	95-100	-
2.36 mm [No. 8]	70-95	85-100
1.18 mm [No. 16]	45-80	60-90
600 µm [No. 30]	25-55	35-70
300 µm [No. 50]	10-30	15-45
150 µm [No. 100]	2-10	0-15

75 μm [No. 200]	0-5	0-5

When necessary, material retained on the 4.75 mm [No. 4] sieve may be removed.

The sand shall be subjected to the colorimetric test for organic impurities, AASHTO T21 (ASTM C40), 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 Gaskets Flexible gaskets, either rubber or plastic, shall conform to AASHTO M198 (ASTM C990).

SECTION 706 - NON-METALLIC PIPE

706.02 Reinforced Concrete Pipe This pipe shall conform to the requirements of AASHTO M170M/M170 (ASTM C76M/C76). Elliptical pipe shall conform to the requirements of AASHTO M207M/M207. 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 M206M/M206.

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.

Precast reinforced concrete special sections shall conform to the requirements of the cited specifications to the extent to which they apply.

706.06 Corrugated Polyethylene Pipe for Underdrain, Option I, and Option III Culvert Pipe This pipe and fittings shall conform to the requirements of AASHTO M252, slot-perforated for 150 mm [6 in] diameter and to AASHTO M294 for 300 mm diameters to 900 mm [12 in to 48 in]. Pipe used for Option III will meet the requirements of AASHTO M294 Type S, Dual Wall. Pipe to be used for Underdrain Type C shall be perforated in accordance with the applicable perforation requirements of AASHTO M294, Class I perforations. All polyethylene pipe shall be smooth lined and shall meet the pipe stiffness requirements shown on the Standard Details. This pipe and resins shall meet the requirements of certification under the Plastic Pipe Institute Third Party Certification Program or the American Association of State Highway Transportation Officials National Transportation Product Evaluation Program

706.08 PVC (Polyvinylchloride) Pipe This pipe and fittings shall conform to the requirements of AASHTO M278. 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 M278 or ASTM F949 for 150 mm [6 in] underdrain and AASHTO M278 for underdrain larger than 150 mm [6 in] diameter.

SECTION 707 - METALLIC PIPE

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 M36/M36M Type I, IR, II, or III for the specified sectional dimensions, sheet thickness, and coating.

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 M36/M36M, 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 M196/M196M, 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 M196/M196M. Aluminum sheet shall conform to the requirements of AASHTO M197/M197M.

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 M245/M245M, Grade 250/75 (Type I, with Type B coating) for the pipe as specified in AASHTO M246/M246M with the thinner coating on the outside.

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 M196/M196M, Type III, Class 1 perforations or Type IIIR, Class 4 perforations.

707.09 Steel Structural Plate Pipe, Pipe Arches, Box Culverts, Fasteners, and Arches Plates, bolts, nuts and other accessories shall conform to the requirements of AASHTO M167/M167M 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 Engineer on an annual basis.
c. The 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 M36/M36M using steel sheet conforming to AASHTO M274.

707.11 Zinc - Coated (Galvanized) Corrugated Steel Pipe This pipe shall conform to the requirements of AASHTO M36/M36M using steel sheet conforming to AASHTO M218.

707.14 Aluminum Alloy Structural Plate Pipe, Pipe Arches, Box Culverts, Fasteners and Arches Plates for this pipe shall conform to the requirements of AASHTO M219/M219M (ASTM B746/B746M). 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.

708.03 Pavement Marking Paint Paint for final and temporary pavement marking shall meet the requirements of AASHTO M248. Either Type N, regular dry traffic paint or Type F, fast dry traffic paint may be used.

Glass beads shall conform to the requirements of AASHTO M247, 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 M133.

SECTION 709 - REINFORCING STEEL AND WELDED STEEL WIRE FABRIC

709.01 Reinforcing Steel Reinforcing steel, both plain and epoxy coated, shall be deformed bars conforming to the requirements of AASHTO M31/M31M (ASTM A615/A615M). Bars shall be Grade 420 [Grade 60] unless otherwise specified on the plans. Epoxy coated reinforcing steel shall also conform to the requirements of AASHTO M284/M284M (ASTM A775/A775M). The requirements of AASHTO M284/M284M (ASTM A775/A775M), Sections 5.2.1, 5.3, 5.4, and 15.1 shall be mandatory.

Fabricated deformed steel bar mats shall conform to the requirements of AASHTO M54/M54M (ASTM A184/A184M).

709.02 Welded Steel Wire Fabric Welded steel wire fabric shall meet the requirements of AASHTO M55 (ASTM A185) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement or AASHTO M221 (ASTM A497) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement as specified.

709.03 Steel Strand Prestressing strand shall meet the requirements of AASHTO M203M/M203 (ASTM A416/A416M) Steel Strand, Uncoated Seven-Wire for Concrete Reinforcement.

Lateral post-tensioned strands for pre-cast/post-tensioned concrete products shall be 12mm [½ inch] AASHTO M203M/M203 (ASTM A416/A416M) 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 ASTM A121, Class 3 if zinc coated or ASTM A585, Class I if aluminum coated. The wire shall be 12½ gage, 4 point round barbs wrapped around both wires, interlocked with one barb projecting through the strand and spaced 150 mm [6 in] apart or less.

710.02 Woven Wire Wire and stays shall conform to the requirements of ASTM A116, Class 3 if zinc coated or ASTM A584, if aluminum coated.

710.03 Chain Link Fabric Chain Link fabric shall conform to the requirements of AASHTO M181, Type I, Class D, or Type II.

710.04 Metal Beam Rail The rails shall conform to the requirements of AASHTO M180, Class A, Type I, or Type IV as designated.

When metal beam rail is to be installed on a curve having a radius of curvature of 45 m [150 ft] or less, the beam sections shall be fabricated on an arc to the required radius.

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, 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 40 mm [1½ in] in taper in 2.1 m [7 ft].

The minimum diameter of heartwood in line posts at their small end shall be no less than 75 mm [3 in]. The minimum diameter of line posts at the small end shall be no less than 75 mm [3 in]. The maximum diameter of line posts at the small end shall be 150 mm [6 in]. The minimum diameter of heartwood in end, corner, gate, and barway posts shall be 110 mm [4½ in] at the small end. The minimum diameter of end, corner, gate, and barway posts at the small end shall be 110 [4½ in]. The maximum diameter of end, corner, gate, and barway posts shall be 200 mm [8 in].

That portion of wood posts to be set below ground shall be immersed to a depth of 1200 mm [4 ft] in a tank or barrel containing an approved commercial timber preservative solution for a minimum of 60 minutes. All wood posts so treated, unless otherwise specified by the Resident, shall have been peeled and air seasoned to permit thorough drying for at least 3 months before treatment. After being treated, the posts shall be piled to permit thorough drying before being set in the ground.

Braces shall be of spruce, eastern hemlock, Norway pine, pitch pine, or tamarack timbers or spruce, cedar, or tamarack round posts of sufficient length to make a diagonal brace between adjacent posts. If other than cedar, white oak, or tamarack, braces shall be treated as described above for posts except that they shall be immersed full length.

Metal posts and braces for woven wire fence shall be of new billet steel conforming to the requirements of ASTM A615M/A615 or Commercial Standard 184-51, or shall be rail steel conforming to the requirements of ASTM A616/A616M, or ASTM A499. Posts shall be galvanized according to the requirements of AASHTO M111. Steel pipe used for woven wire fence corner posts, for rails and for bracing shall conform to the requirements of ASTM A53, galvanized.

Metal posts, rails, and bracing for chain link fence shall be as specified in AASHTO M181. Expansion sleeves, turnbuckles and other fittings and hardware shall be galvanized in accordance with the applicable requirements of ASTM A153.

710.07 Guardrail Posts Posts shall be of wood or steel.

a. Wood posts shall be of cedar, tamarack, white oak, Norway pine, southern yellow pine, pitch pine, Douglas fir, maple, beech, birch, red pine, white pine, eastern hemlock, or red oak. They shall be of well seasoned, 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 25 mm [1 in] in diameter. The posts shall be free from season checks that exceed 6 mm [¼ in] in width. A tolerance of 25 mm [1 in] in length and 6 mm [¼ in] 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 38 mm [1½ in] 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 64 mm [2½ in] diameter will be permitted.

   Wood posts and offset brackets shall be preservative treated in accordance with the requirements of AASHTO M133 using pentachlorophenal or chromate copper arsenate preservative. Treatment shall be according to the Standards of AWPA C5.

   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 M183/M183M if a rolled section or ASTM A769/A769M Grade 36 if a welded section. Fabrication will be in accordance with Section 504 - Structural Steel. Galvanizing shall be in accordance with AASHTO M111.

c. Corrosion resistant steel posts shall conform to the requirements of ASTM A769/A769M, Grade 50W if a welded section. Fabrication will be in accordance with Section 504 - Structural Steel.

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, twisted end section anchors and other accessories shall be in accordance with the requirements of AASHTO M111, M232 or AASHTO M298, Class 50, Type I, whichever applies. All galvanizing shall be done after fabrication.

Hardware for corrosion resistant guardrail shall be in accordance with ASTM A325M/A325, Type 3, except the 400 mm [16 in] 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 Steel pipe piles shall conform to the requirements of ASTM A252, Grade 2 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 Welded Code - Steel.

Cast steel points and splices shall conform to the requirements of ASTM A27/A27M Grade 450-240, (Grade 65-35) or ASTM A148/A148M Grade 620-415, (Grade 90-60).

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 75 mm by 100 mm [3 in by 4 in] 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 3 mm [0.1181 in] after galvanizing. The diameter of the selvedge wire, running through all the edges (perimeter wire), shall be 3.899 mm [0.1535 in] after galvanizing. The diameter of the wire for assembling and lacing the gabion units shall be 2.2 mm [0.0866 in] 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 0.38 mm [0.015 in] 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 G23. The diameter of the steel wire mesh shall be 2.70 mm [0.1063 in] after galvanization and 3.46 mm [0.1363 in] overall, core wire plus PVC coating.

The diameter of the selvedge wire running through all the edges (perimeter wire) shall be 3.399 mm [0.1338 in] after galvanizing and 4.161 mm [0.1638 in] overall, core wire plus PVC coating. The diameter of the wire for assembling and lacing the gabion units shall be 2.2 mm [0.0866 in] after galvanizing and 2.962 mm [0.1166 in] 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 2 m [6 ft] long and of a minimum width of 1 m [3 ft], including all selvedge bindings, shall have the ends securely clamped for 1 m [3 ft] along the width of the sample. When the width of the section under test exceeds 1 m [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 0.09 m^2 [1 ft^2] 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 2720 kg [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 100 mm [4 in] in all directions and a maximum dimension of 300 mm [12 in].

Stones to fill hand filled gabions shall be of clean, hard, durable, crushed ledge or quarried rock with a minimum dimension of 100 mm [4 in] in all directions and a maximum of 300 mm [12 in].

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 504 - Structural Steel.

711.05 Protective Coating for Concrete Surfaces The coating shall be a blend of 50% by volume boiled linseed oil and 50% petroleum spirits. The linseed oil shall comply with the requirements of ASTM D260. Petroleum spirits shall meet the requirements of ASTM D235. CAUTION: This blend is flammable.

711.06 Stud Shear Connectors, Anchors and Fasteners Shear connectors shall meet the dimensional tolerances of Figure 7.1 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 7 of the D1.5 Code. Shear connectors shall meet the mechanical property requirements of Table 7.1, Type B of the D1.5 Code. Anchors and fasteners shall meet the mechanical property requirements of Table 7.1 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 63 mm by 83 mm [2½ in by 3¼ in] 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 2.2 mm [0.0866 in] after galvanizing. The diameter of the selvedge wire, running through all the edges (perimeter wire), shall be 2.7 mm [0.1063 in] after galvanizing. The diameter of the wire for assembling and lacing the units shall be 2.2 mm [0.0866 in] 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 0.38 mm [0.015 in] 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 G23. The diameter of the steel wire mesh shall be 2.2 mm [0.0866 in] after galvanization and 2.96 mm [0.1166 in] overall minimum, core wire plus PVC Coating.

The diameter of the selvedge wire running through all the edges (perimeter wire) shall be 2.67 mm [0.1050 in] after galvanizing and an overall minimum diameter of 3.43 mm [0.1350 in], core wire plus PVC coating. The diameter of the wire for assembling and lacing the units shall be 2.2 mm [0.0866 in] after galvanizing and

2.96 mm [0.1166 in] nominal 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 2 m [6 ft] long and a minimum width of 1 m [3 ft], including all selvedge bindings, shall have the ends securely clamped for 1 m [3 ft] along the width of the sample. When the width of the section under test exceeds 1 m [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 0.09 m² [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 2720 kg [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 75 mm [3 in] in all directions and a maximum dimension of 150 mm [6 in].

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 Division 2, Sections 18.2 and 18.3 of AASHTO Standard Specifications for Highway Bridges, where applicable.

711.10 H-Beam Pile Tips H-beam pile tips shall be cast steel prefabricated pointed H-shaped sections. The slope forming the point shall not be steeper than 1 ¾:1. Material for plain cast steel pile points shall conform to the requirements of ASTM A27/A27M, Grade 450-240 (Grade 65-35). Material conforming to ASTM A148/A148M Grade 620-415 (Grade 90-60) shall be used for pile points equipped with cutting teeth. 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 be 100% virgin natural rubber (polyisoprene) meeting the physical requirements of Table A, or 100% virgin neoprene (polychloroprene) meeting the physical requirements of Table B. The elastomer compound shall be classified as low-temperature Grade 3. Compounds of nominal hardness between the values shown may be used and the test requirements interpolated. When test specimens are cut from the finished product a 10% variation in “Physical Properties” will be allowed.

Flash tolerance, finish, and appearance shall meet the requirements of the latest edition of the Rubber Handbook as published by the Rubber Manufacturers Association, Inc., RMA F3 and T.063 for molded bearings at RMA F2 for extruded bearings.

TABLE A - REQUIREMENTS FOR NATURAL RUBBER

ASTM		50	60	70

STANDARD	PHYSICAL PROPERTIES	DURO	DURO	DURO
D2240	Hardness	50 +/- 5	60 +/- 5	60 +/- 5
D412	Tensile strength, minimum Mpa	15.5	15.5	15.5
	[psi]	[2250]	[2250]	[2250]
	Ultimate elongation, minimum Percent	450	400	300
	HEAT RESISTANCE			
D573	Change in durometer hardness, maximum Point	+10	+10	+10
70 Hours	Change in tensile strength, maximum Percent	-25	-25	-25
@ 70°C	Change in ultimate elongation, maximum	-25	-25	-25
[158°F]	Percent			
	COMPRESSION SET			
D395	22 Hours @ 70°C [158°F], maximum Percent	25	25	25
Method B				
	OZONE			
D1149	25 pphm ozone in air by volume,	No	No	No
	20% strain	Cracks	Cracks	Cracks
	37.7°C +/- 1°C [100°F +/- 2°F] 48 hours			
	Mounting procedure D518, Procedure A			
	ADHESION			
D429, B	Bond made during vulcanization	714	714	714
	kg/m [lb/in]	[40]	[40]	[40]
	LOW TEMPERATURE BRITTLENESS			
D746	Grade 3 - Tested @ -40°C [-40°F]	No	No	No
	Procedure B	Failure	Failure	Failure
	INSTANTANEOUS THERMAL STIFFENING			
D1043	Grade 3 - Tested @ -40°C [-40°F]			
	Stiffness at test temperature shall not exceed 4			
	Times the stiffness measured at 23°C [74°F]			
Quad Sheer	LOW TEMPERATURE CRYSTALLIZATION			
Test as				
Described in	Grade 3 - 14 days @ -26°C [-15°F]			
Annex A				

Stiffness at test time and temperature shall not exceed 4 times the stiffness measured at 23°C [74°F] with no time delay. The stiffness shall be measured with a quad shear test rig in an enclosed freezer unit. The test specimen shall be taken from a randomly selected bearing. A +/- 25% strain cycle shall be used, and a complete cycle of strain shall be applied with a period of 100 seconds. The first 0.75 cycle of strain shall be discarded and the stiffness shall be determined by the slope of the force deflection curve for the next 0.25 cycle of loading.

TABLE B - REQUIREMENTS FOR NEOPRENE

Shall meet the requirement of Table A - Requirements for Natural Rubber, except for the following:

	HEAT RESISTANCE			
D573	Change in durometer hardness, maximum Points	+15	+15	+15
70 Hour @	Change in tensile strength, maximum Percent	-15	-15	-15

100°C [212°F]	Change in ultimate elongation, maximum Percent	-40	-40	-40
D395 Method B	COMPRESSION SET 22 Hours @ 100°C [212°F], maximum Percent	35	35	35
D1149	OZONE 100 pphm ozone in air by volume, 20% strain 37.7°C +/- 1°C [100°F +/- 2°F], 100 hours Mounting procedure D518, Procedure A	No Cracks	No Cracks	No Cracks

Stiffness at test time and temperature shall not exceed 4 times the stiffness measured at 23°C [74°F] with no time delay. The stiffness shall be measured with a quad shear test rig in an enclosed freezer unit. The test specimen shall be taken from a randomly selected bearing. A +/- 25% strain cycle shall be used, and a complete cycle of strain shall be applied with a period of 100 seconds. The first 0.75 cycle of strain shall be discarded and the stiffness shall be determined by the slope of the force deflection curve for the next 0.25 cycle of loading.

711.12 Stainless Steel Stainless steel shall conform to the requirements of ASTM A167 Type 308 or ASTM A240, Type 304.

711.13 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

712.02 Calcium Chloride Calcium chloride shall conform to the requirements of AASHTO M144 (ASTM D98).

712.03 Portland Cement Concrete for Concrete Curb Portland cement concrete shall meet the applicable requirements of Section 502 - Structural Concrete, and shall meet Class A requirements with the following modifications:

a. Air content shall be 5% to 8%.
b. Portland cement shall conform to the requirements of AASHTO M85 Designation for Type I, Type II, or Type III.
c. A minimum 28-day compressive strength of 34.5 MPa [5000 psi] is required.

All curb shall be cast in steel or concrete forms which will produce a satisfactory surface requiring no further finishing, rubbing or patching after the forms are removed, except for the removal of excess material along the edges. No form joint marks shall be visible when the precast curb units are set in place. Curbs with shrinkage cracks will not be accepted.

Steel reinforcement and dowels shall conform to Section 503 - Reinforcing Steel.

Dimensions The precast curb units shall be of the dimensions indicated on the plans and shall be cast in lengths of not less than 1.2 m [4 ft] nor greater than 3 m [10 ft]. Random lengths of curb less than 1.2 m [4 ft] in length may be obtained by sawing regular precast curb, if the Resident determines it necessary to meet field conditions. All curb to be set on a radius of 20 m [50 ft] or less shall be precast to fit the curve as required.

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.

Inlets used at catch basins shall conform to the applicable requirements of Vertical Curb, Type 2 and to the shape, dimensions, and details as shown on the Standard Detail plans.

Curing The units shall be cured either by steam or water for a sufficient length of time for the concrete to obtain the minimum 28day compressive strength of 34.5 MPa [5000 psi].

a. Steam Curing Two to four hours after the concrete has been placed and attained the initial set, the first application of steam shall be made. Forms shall be removed after the units have been cured for 24 hours. The steam shall be 100% relative humidity to provide moisture for proper hydration of cement. The steam shall be directly applied onto the concrete. During application of steam, the ambient air temperature of 55°C [130°F] is required. When discontinuing the steam application, the ambient temperature shall be decreased at a rate of 22°C [40°F] per hour until a temperature of 11°C [20°F] above the atmospheric temperature has been attained. The concrete shall not be exposed to temperature below freezing for a minimum of 6 days after casting.

b. Water Curing The units may be water cured by covering with water, saturated material, or other acceptable or approved methods that will keep the units moist for a period of 5 days.

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. Natural grain size and color variations characteristic of the source deposit will be permitted. 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 20 mm [¾ in] 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 3 mm [⅛ in]. The top front arris line shall be pitched straight and true with no variations from a straight line greater than 6 mm [¼ in]. The top back arris line shall meet the same requirement except that indentations of a maximum of 9 mm [⅜ in] 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 75 mm [3 in].

The front face shall be at right angles to the top and shall be smooth split and have no projections greater than 25 mm [1 in] or depressions greater than 13 mm [½ in], measured from the vertical plane of the face through the top arris line for a distance down from the top of 200 mm [8 in]. The remainder of the face shall have no projections or depressions greater than 25 mm [1 in] 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 6 mm [¼ in] no more than 16 mm [⅝ in] 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 200 mm [8 in] from the plane of the joint.

Drill holes through the curb will be allowed providing they are at least 225 mm [9 in] 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

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 1.2 m [4 ft] nor greater than 3 m [10 ft]. Random lengths of curb less than 1.2 m [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 20 m [60 ft] or less shall be cut to fit the curve as required.

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 25 mm [1 in], 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 25 mm [1 in] 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 450 mm [18 in] from each end of the stone and spaced horizontally at a maximum of 1200 mm [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 13 mm [½ in], plus or minus 3 mm [⅛ in]. 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 25 mm [1 in] to show between a 600 mm [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 75 mm [3 in] in length and 20 mm [¾ in] 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 3 mm [⅛ in]. The arris lines at the bottom of the face shall be straight and true so that not over 25 mm [1 in] 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 40 mm [1½ in] will show in the joint for the width of the face.

When Curbing Type 5 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 performed into rolls or ribbons of various lengths, pliability, and widths suitable for use as reflecting pavement markings on Portland cement concrete or bituminous pavement.

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 retroreflectance 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.

Retroreflectance 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 15 m [50 ft] and the sample size a 600 mm by 750 mm [2 ft 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 50 mm by 150 mm [2 in by 6 in] sample bent over a 13 mm [½ in] diameter mandrel with the 50 mm [2 in] 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 15°C [60°F] and rising.

Special instructions should be supplied by the vendor for application to be made at pavement temperatures below 15°C [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 50 mm [2 in] from construction joints of portland cement concrete pavement. When directed by the Resident, opening of 150 mm [6 in] lengths shall be left at 6 m [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 ASTM C478M (ASTM C478) except as modified below.

GRACE Structural Fibers or an approved equal may be used as a replacement of 6 x 6 #10 gauge welded wire fabric when used at dosage rates of 4.5 kg/m^3 [7.5 lb/yd^3] for the construction of manholes and catch basins. The material used shall be one of the products listed on the Maine Department of Transportation’s Approved Product List.

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% air content, plus or minus 1½% tolerance. All concrete shall develop a minimum compressive strength of 20 MPa [3000 psi] in 7 days or 28 MPa [4000 psi] in 28 days.

712.061 Structural Precast Concrete Units Structural precast concrete units shall conform with the dimensions shown on the plans, the requirements of this Specification and with the approved shop drawings.

Materials Materials for concrete shall conform to the requirements of Section 502.03 - Materials. Cement shall be Type I, Type II, or Type III. Coarse aggregate gradation shall comply with Section 703.02 - Coarse Aggregate for Concrete, Class A or AA or Latex. The maximum water cement ratio shall be 0.40. The minimum air content shall be 5.5%. Concrete shall contain a minimum of 15 L/m³ [3 gal/yd^3] of calcium nitrite solution or equivalent corrosion inhibitor approved by the Resident. The minimum 28 day concrete compressive strength shall be 35 MPa [5000 psi] unless otherwise stated on the plans. Concrete shall be controlled, mixed, and handled as specified in Section 502.

Material for reinforcing shall meet the requirements of Section 709.01 - Reinforcing Steel or Section 709.02 - Welded Steel Wire Fabric.

Quality Control and Quality Assurance Quality Control (QC) is the responsibility of the Contractor. The Quality Control Inspector (QCI) shall inspect all aspects of the work. Acceptance is the prerogative of the Resident. The Department's will ensure that the Contractor's QC is performing properly, verify documentation, periodically inspect workmanship and witness testing. Testing deemed necessary by the Resident in addition to the minimum testing requirements shall be scheduled to minimize interference with the production schedule.

The Contractor shall provide a private office at the casting plant for the Inspector. The office shall have an area not less than 9.3 m² [100 ft²] and shall be conveniently located to the work. The office shall be climate controlled to maintain the temperature between 18°C [64°F] and 30°C [86°F], lighted 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 office shall be equipped with a desk or table having a minimum size of 1200 mm by 760 mm [4 ft by 2½ ft], 2 chairs, a telephone, a plan rack and a 2-drawer letter size file cabinet with a lock and 2 keys which shall be furnished to the Inspector(s).

The facilities and all furnishings shall remain the property of the Contractor upon completion of the work. Payment for the facilities, its' heating and lighting, telephone installation, basic monthly telephone charges and all furnishings shall be incidental to the contract.

Construction The Contractor shall notify the Resident at least five working days prior to production of the precast units. The precast units shall be manufactured at a facility that has had a minimum of five years experience in producing similar type products. The plant shall meet the requirements of AASHTO M-157.

Reinforcing steel shall be fabricated, handled, and placed in accordance with Section 503 - Reinforcing Steel. Reinforcing shall be as shown on the approved shop drawings. Clearance shall be 50 mm by 12 mm [2 in by ½ in]. If reinforcing steel is not noted on the plans or drawings, the minimum amount of steel required shall be the area of steel equal to a grid of #13 bars spaced at 450 mm [No. 4 bars at 18 in] in both directions, horizontally and vertically. Only one mat of steel is required for concrete thickness of 175 mm [7 in] or less; two mats, one each face is required for thickness greater than 175 mm [7 in].

All concrete shall be cast and consolidated in forms that will produce dense concrete with surfaces that are free of voids, stone pockets, or other irregularities. Forms shall be sufficiently rigid and accurate to maintain the member's dimensions.

The units shall be cured until design (28 day) strength is attained by one of the following methods:

a. Accelerated Curing Accelerated cure requires that concrete cure temperature attain a minimum of 50°C [120°F] and kept at this temperature for at least 8 hours. This may be accomplished with radiant heat or steam. The maximum heat rate gain during curing or the heat rate loss after accelerated curing is discontinued shall be 20°C/hour [36°F/hr].

Accelerated cure shall begin 2 to 4 hours after the concrete has been placed and has attained its initial set. The minimum concrete temperature before application of heat is 10°C [50°F]; the maximum enclosure temperature shall be 80°C [176°F]. Temperatures shall be monitored during cure with recording thermometers.

Steam curing shall be under an enclosure to retain the live steam to minimize moisture and heat loss. Provisions shall be made to prevent surface drying until steam application begins. Steam shall saturate the enclosure to provide moisture for proper hydration of cement. The steam shall not be applied directly onto the concrete. When radiant heat is used, provisions shall be made to ensure excess water moisture is available to prevent drying of the surfaces.

Curing shall continue, after the application of the heat ceases, until design strength is attained; preference shall be given to moist curing. The minimum curing temperature shall be 10°C [50°F]. Further curing to attain design strength will not be required if a minimum of 80% of the design strength has been attained with accelerated cure.

b. Water Curing The units may be cured by covering with a water saturated material or other acceptable method(s) that will keep the units moist for a minimum of 5 days.

c. Other methods of curing, such as “membrane curing compound” or “moisture retention without heat”, may be used if approved by the Resident and performed in accordance with manufacturer’s recommendations or agreed upon procedures.

The forms shall remain in place until the concrete attains a minimum compressive strength of 21 MPa [3000 psi] and until they can be removed without damaging the member.

When curing method b or c is used: the concrete shall not be exposed to below freezing temperatures for a minimum of six days after casting when Type I or II cement is used or a minimum of three days when Type III cement is used.

Acceptance of structural precast units, for each day's production, will be determined, based on compliance with this specification and satisfactory results of concrete testing and process control test cylinders made and tested in accordance with the following standards:

AASHTO T23 (ASTM C31/C31M) Practice for Making and Curing Concrete Test Specimens in Field

AASHTO T22 (ASTM C39) Test Method for Compressive Strength of Cylindrical Concrete Specimens

AASHTO T119 (ASTM C143) Test Method for Slump of Hydraulic Cement Concrete

AASHTO T141 (ASTM C172) Practice for Sampling Freshly Mixed Concrete

AASHTO T152 (ASTM C231) Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C1064 Test Method for Temperature of Freshly mixed Portland Cement Concrete

A minimum of 8 concrete test cylinders shall be cast to represent each continuous concrete placement. 6 of the cylinders from each test shall be cured under the same conditions as the units. Unit identification, entrained air content, water-cement ratio, slump, and temperature of the sampled concrete shall be recorded at the time of cylinder casting. All testing shall be done in the presence of the QAI. The QAI will designate the loads to be tested.

At least once a week, the Contractor shall make 4 cylinders for use by the Department. They shall be cured in accordance with AASHTO T23 (ASTM C31/C31M).

All persons performing sampling and/or testing shall hold a current certification issued by ACI or Maine Concrete Technician Certification Board or another equivalent certification.

Manufacture of the units will include all testing described within this specification and in referenced Sections.

Repairs 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. Units that are cracked or require surface repairs larger than 1250 mm^2 [2 in^2] or an accumulated repair area greater than 10% of the surface being repaired may be rejected.

Tolerances Dimensional tolerances shall be in conformance with the applicable reference specification or the established industry standards for the product being produced.

Documentation The producer of the structural precast 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 Resident when requested.

Marking The date of manufacture, the production lot number, and the type of unit shall be clearly and indelibly scribed on a rear, unexposed portion of each unit.

Handling, Storage and Shipping All units shall be handled, stored, and shipped in such 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.

SECTION 713 - STRUCTURAL STEEL AND RELATED MATERIAL

713.01 Structural Steel Highway bridge steel shall meet the requirements of AASHTO M 270M/ M 270 (ASTM A 709/ A 709M). 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/ M270, Supplementary Requirement S5, Table 9, Zone 2, for non-fracture critical steel or S6, Table 10, Zone 2 for fracture critical steel, (ASTM A 709/A 709M, S83 or S84 TABLE S1.2 or S1.3, Zone 2). Frequency of tension tests shall comply with the requirements of S1. Fracture critical material shall also comply with the supplementary requirements of S7 and S9

Impact test sampling and testing procedures shall be in accordance with AASHTO T 243M/ T 243 (ASTM A 673/A 673M).

Steel for ancillary bridge products and steel structures shall conform to AASHTO M 270M/ M 270 (ASTM A 709/A 709M) or one or more of the following:

ASTM A 36/A 36M
ASTM A 572/A 572M
ASTM A 588/A 588M
ASTM A 53
ASTM A 500
ASTM A 595 Grade C
ASTM A 786/A 786M
ASTM A 847
ASTM A 992/992M

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 AASHTO M164M/ M164 (ASTM A325M/A325), Type 1 or Type 3. Type 3 bolts shall be supplied for all structures utilizing unpainted AASHTO M270M/M270 (ASTM A709/A709M) weathering steel.

Nuts shall meet the requirements of AASHTO M291M/M291 (ASTM A563M/A563) or AASHTO M292M/M292 (ASTM A194M/A194).

Circular and beveled washers shall conform to the requirements of AASHTO M293M/M293 (ASTM F436/F436M).

Direct Tension Indicators (DTI'S) shall conform to the requirements of ASTM F959/F959M. 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 AASHTO M298 (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 AASHTO M298 (ASTM B695 Class 50, Type I).

"Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies shall meet the requirements of ASTM F1852. They shall meet the chemical and mechanical requirements of AASHTO M164M/M164 (ASTM A325/A325M).

Bolts, nuts and washers specified to be galvanized may be galvanized by either hot dip galvanizing to the requirements of AASHTO M232M/M232 (ASTM A153/A153M) Class C or mechanically galvanized to the requirements of AASHTO M298 (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/F959M.

TABLE 1 - TEST SCHEDULE*

Bolts	Tensile Strength (Wedge Test) Proof Load Hardness Coating Thickness	ASTM F606/F606M ASTM F606/F606M ASTM F606/F606M ASTM A153/A153M, ASTM B695
Nuts	Proof Load Hardness Coating Thickness	ASTM F606/F606M ASTM F606/F606M ASTM A153/A153M, ASTM B695
Washers	Hardness Coating Thickness	ASTM F606/F606M ASTM A153/A153M, ASTM B695
DTI's	Coating Thickness	ASTM B695

	Compression Load	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 3 mm [⅛ in] 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 70 MPa [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 M107 (ASTM B22), Alloy No. 911 and copper alloy bearing and expansion plates shall conform to the requirements of AASHTO M108, (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 M169 (ASTM A108). 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 shall conform to the requirements of AASHTO M105. Class Number 30 shall be furnished unless otherwise specified.

Malleable iron castings shall conform to the requirements of ASTM A47M/A47. Grade Number 22010 [Number 32510] shall be furnished unless otherwise specified.

Steel castings shall conform to Standard Specification for Steel Castings for Highway Bridges, AASHTO M192/M192M or mild-to-Medium Strength Carbon-Steel Castings for General Applications AASHTO M103/M103M (ASTM A27/A27M). The class 70 or grade 485 - 250 [70 - 36] of steel, respectively, 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 M36/M36M.

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 25°C [77 °F], 100g [3.5 oz], 5 sec.	3.5 - 4.5 mm [0.14 - .018 in]
Loss on heating at 163°C [325°F], 50g [1.75 oz], 5hrs	Not more than 1.5%
Flash point (open cup)	Not less than 226°C [440°F]
Penetration at 25°C [77 °F], 100g [3.5 oz], 5 sec., of residue after heating at 163°C [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 M20.

Whenever possible in the manufacture of the units, a minimum forming radius of 25 mm [1 in] is to be maintained. All units that are formed with less than 25 mm [1 in] 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 ASTM A153.

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 M297 (ASTM D3542).

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	-15°C [5°F] to 49°C [120°F] minimum
Film Strength (ASTM D412)	8.3 MPa [1200 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 1.5 m [5 ft] or less. Actual seal dimensions shall not differ from the nominal dimensions by more than 2 mm per 25 mm [$^1/_{16}$ inch/in] of depth or width, or a maximum of 6 mm [¼ in] whichever is less.

The material used shall be one of the products listed on the Maine Department of Transportation's Approved Product 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 1.5 m [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 Approved Product List.

SECTION 715 - LIGHTING MATERIAL

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 ASTM A153.

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 The prewired conduit shall be a unit assembly consisting of the required insulated conductors and neutrals enclosed in a medium or high-density polyethylene duct. The conduit shall be flexible enough for easy coiling or uncoiling at -10°C [15°F]. The duct shall be extruded directly over the paralleled conductors at the factory.

The percent of conduit fill shall be in accordance with the NEC and the UL.

a. Scope: Polyethylene plastic pipe in either medium density or high-density grade, in sizes 19 mm [¾ in] through 63 mm [2½ in] for direct earth burial.

b. Materials:

1. Medium density polyethylene shall meet the applicable requirements as defined in ASTM D1248-70a, Type II, Class C, Category 5 Grade P23.

2. High density polyethylene shall meet the applicable requirements as defined in ASTM D1248-70a, Type III, Class C, Category 5 Grade P34.

3. In addition, the above materials shall meet the requirements as shown below:

Property	Medium Density	High Density	Test Method
Tensile Strength, Minimum MPa [psi]	17.2[2500]	19.3[2800]	ASTM D638M
Elongation, Minimum%	400	400	ASTM D638
Melt Index, Maximum	0.4	0.4	ASTM D1238
Brittle Temperature 80% Non-failure	-76°C [-105°F]		ASTM D746
Environmental Stress Cracks Resistance, Maximum Failures Per 10 Specimens after 48 Hrs.	2	2	ASTM D1693

The duct shall have dimensions consistent with iron pipe size Schedule 40 conduit. The prewired conduit shall be shipped in continuous lengths on suitable reels.

The wires shall be stranded soft drawn coated copper conductors individually insulated with class THW insulation rated at 75°C [167°F], wet or dry. Insulation thickness shall be 600 volt rated. Phase identification shall be accomplished by numerical coding. Duct size and wire size shall be as indicated on the plans. The wire shall be UL approved.

Terminal connections, splices, and test data requirements shall be as specified in Section 715.07 - Secondary Wiring.

715.05 Metallic Junction and Fuse Box Surface-mounted junction boxes and fuse boxes shall be of either hot-dipped galvanized cast iron or cast aluminum with hinged screw down covers.

Cast iron boxes shall conform to the requirements of Gray and Malleable Iron Castings, Section 713.06. Cast aluminum boxes shall conform to ASTM B108 or ASTM B26/B26M Alloy 356.0.

All boxes shall be furnished with mounting lugs of adequate sizes and threaded bosses properly located and of sufficient thickness to provide a minimum of five full threads for all sizes of conduit used.

Fuse boxes shall be furnished with 5-ampere, cartridge type midget fuses, 10.3 mm [$^{13}/_{32}$ in] in diameter and 38 mm [1½ in] long with 600 volt fuse holder, unless indicated otherwise on the plans. Fuse boxes shall be bossed for fuse holder mounting.

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.

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 10.3 mm [$^{13}/_{32}$ in] in diameter and 38 mm [1½ in] 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.

Underground splices shall be made with cast epoxy splice kits.

715.08 Luminaire, Lamp and Ballast The luminaire shall be designed for the wattage rating and voltage indicated on the plans and for operating on a multiple circuit, using the type of lamps indicated on the plans. All luminaires shall be new and be the product of the same manufacturer.

The luminaire shall be constructed of an aluminum housing and refractor-holder, a refractor-holder latch on the street side and hinge with safety catch on the house side of the luminaire, and a detachable reflector with heat resisting gasketing between the reflector and the socket entry. Luminaires shall mount by a universal slipfitter, which shall clamp onto at least 150 mm [6 in] of a 32 mm to 57 mm [1¼ in to 2¼ in] bracket.

The refractor shall be made of aluminum and finished with prismatic acrylic. For the cutoff optics, a flat glass lens shall be standard except for a dropped clear lexan polycarbonate resin globe for improving the cutoff performance.

Light distribution shall be as shown on the plans and shall conform to ANSI or IES type as specified.

The luminaire shall be supplied with a power factor ballast, of the lag-type regulator capable of operating from a multiple circuit as indicated on the plans. The ballast shall maintain lamp wattage to 6.8% regulation with 1% change in primary voltage variation. Ballast shall provide satisfactory lamp starting and operation to -29°C [-20°F]. The ballast shall be prewired to the lamp socket and terminal board, requiring only connection of the power-supply leads to the ballast primary terminals. The minimum efficiency of the ballast shall be not less than 60%; the power factor not less than 90%.

Lamps shall be of the type and wattage rating indicated below. Lamps used shall conform to the lamp designations as listed in the latest edition of the IES Lighting Handbook.

ANSI & MFG. LAMP DESIG. ANSI	MFG.	WATTAGE	BALLAST #	LUMENS	LAMP LIFE(HR)
S68MS-50	LU50 C50S68	50	S68	4000	24000
S62ME-70	LU70 C70S62	70	S62	6000	24000
S54SB-100	LU100 C100S54	100	S54	9500	24000
S55SC-150	LU150/55 C150S55	150	S55	16000	24000
S50VA-250/S	LU250S C250S50/S	250	S50	30000	24000
S52XB-1000	LU1000 C1000S52	1000	S52	140000	24000

The Contractor shall submit shop drawings of the luminaires, lamps, and ballast data.

Underpass or under check luminaires shall be constructed such that the refractor is hinged and can be opened for maintenance. The beam angles shall be field adjustable for, but not limited to, 60° and 70° settings. The ballast shall be integrally mounted, regulator or constant wattage type and designed to operate from a 3 wire 240/480 volt circuit or voltage indicated on the plans.

Pole top luminaires shall be of colonial or traditional design, shall consist of cast aluminum and slipfitter for 75 mm [3 in] outside the diameter of the pole top, and aluminum side posts that are gasketed to the translucent white acrylic lens panels and cast aluminum top housing. The canopy shall be hinged to the lower housing, held closed with two captive screws and gasketed to the lens. In addition, the internal reflector/ refractor assembly shall be gasketed. The ballast shall be prewired to the terminal socket. The luminaire shall be factory painted black.

715.09 Luminaire, Lamp and Ballast for High Mast Lighting The luminaire and ballast shall be designed for the wattage rating and type of lamp shown on the plans.

The maximum weight of the luminaire shall be 48 kg [105 lb] and its projected area shall not exceed 0.29 m² [3.1 ft²].

The luminaire shall be open ventilated design with an optical system consisting of an aluminum reflector. The reflector shall have a smooth, non-porous inner surface and shall be readily attached to the ballast assembly by means of a captive stainless steel nut and machine screw.

The reflector with its aluminum cover shall be firmly attached to a cast ring. This ring shall have keyhole slots in its upper surface such that the reflector/refractor assembly may be readily attached to or detached from the luminaire bracket entry and lamp support assembly without completely removing the support bolts.

The luminaire ballast shall be enclosed within a Number 356 alloy cast aluminum housing which integrally attaches to the luminaire bracket entry and lamp support assembly. It shall be readily removable without removing the luminaire from the bracket arm.

The luminaire shall be attached to the bracket arm by a bracket entry and lamp support assembly. The base for this assembly shall be cast aluminum. The assembly shall include a side entry slipfitter designed for 50 mm [2 in] pipe with provision for +/- 3° adjustment for leveling the luminaire. The lamp shall be vertical burning and prevented from undue vibration and backing out by means of a stainless steel lamp clamp attached to the assembly but separate from the socket. An enclosed terminal block shall be included such that all electrical connections shall be removed from exposure to weather. A stainless steel or aluminum rolled rain shield shall be attached to the outside of this assembly.

All cast aluminum parts of the luminaire shall conform to ASTM B26/B26M or ASTM B108, Alloy 356.0.

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 20 lx [2.0 foot candles] and off at approximately 65 lx [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, EEI-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.

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 mercury solenoid 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, 16 mm [⅝ in] diameter, 2.4 m [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 115°C [239°F] rise at 40°C [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 150 mm [6 in] 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 1.5 m [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. The drive motor shall be designed to be readily attached to the pole and/or winch unit and capable of being controlled remotely from at least 6 m [20 ft] from the pole. The drive motor unit shall be equipped with a 480 to 120 volt weatherproof step-down transformer either attached to the drive motor assembly or supplied in a separate enclosure. The transformer shall be of a size compatible with the drive motor and must be adequately grounded to prevent electric shock. 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 handhole 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 B221M/B221, Alloy 6061-T6 or 6351-T5. Post and post bases shall conform to the requirements of ASTM B221M/B221), Alloy 6061-T6. Pales shall conform to the requirements of ASTM B429 Alloy 6063-T5. Washers shall conform to the requirements of ASTM B209M/B209), Alloy Alclad 2024-T4.

b. Aluminum Rivets Rivets shall conform to the requirements of ASTM B316M/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 B211M/B211, Alloy 5056 (Stabilized), 2) Pin - ASTM B211M/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/B26M or ASTM B108, Alloy A356-T6. All aluminum bars and plates shall conform to the requirements of ASTM B209M/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/A36M. Nuts embedded in concrete shall conform to the requirements of ASTM F568 Class 4.6 (ASTM A307).

Anchor bolts, exposed nuts and washers shall conform to the requirements of ASTM F568 Class 8.8 (ASTM A449 or ASTM F1554, Grade 55) and shall be hot dipped galvanized in accordance with ASTM A153 or ASTM B695, Class 50, Type 1.

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;
21% Nitrogen, of which 40% is Urea and 60% is Urea Formaldehyde Slow Release
10% Phosphorus
21% Muriate of Potash, 60% of which is Potassium oxide

(b) Slow Release Fertilizer tablets - Planting Tablets shall be a long lasting 20-10-5 plus minors 21 gram [¾ oz] tablet.

(c) Water Soluble Fertilizer shall be;
20% Nitrogen
10% Phosphorus
20% Potassium

Completely water soluble, non-corrosive, without chlorides or carbonates, and containing a color tracer dye.

717.02 Agricultural Ground Limestone Agricultural ground limestone shall have the following mechanical analysis: At least 50 percent shall pass the 150 μm [No. 100] sieve, 90 percent shall pass the 850 μm [No. 20] sieve and 100 percent shall pass the 2 mm [No. 10] sieve. The total carbonates shall not be less than 80 percent.

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 45 kg [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 a water soluble solution containing the following analysis:

Calcium Chloride - minimum 13.5%, maximum 14.5%
Ammonical Nitrogen - minimum 3.5%, maximum 4.5%
pH - minimum 10.25, maximum 10.75
Specific Gravity - minimum 1.14kg/l (9.55 lb/gal), maximum 1.15kg/l [9.65 lb/gal]

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:

A. Percent germination > 80%
B. Pure Live Seed > 85%
C. Percent Purity > 85%
D. Weed seed < 1%
E. All seed shall be from the current years 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:

A. Method #1 - Park Mixture
Creeping Red Fescue 45%

Kentucky Bluegrass	25%
Chewings Fescue	15%
Perennial Ryegrass	10%
Annual Ryegrass	5%.

B. Method #2 - Roadside Mixture #2

Red Fescue	50%
Sheep Fescue	25%
Red Top	5%
White Clover	10%
Annual Rye	10%

C. Method #3 - Roadside Mixture #3

Crown Vetch	50%
Perennial Lupine	25%
Crimson Clover	15%
Annual Rye	10%

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.

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.

(b) 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 then 30% post-consumer newsprint.

(c) 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:

1. pH between 4.0 - 8.0
2. Particle size 100% passing a 50 mm [2 inch] screen
3 Soluble salts content < 4.0 mmhos/cm

(d) 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 100 mm [4 in] in diameter and shall be a well graded material conforming to the following:

1. pH between 5.0 - 8.0
2. Particle size (by weight):
    a) 100% passing a 150 mm [6 in] screen
    b) 75 to 85% passing a 19 mm [0.75 in] screen
3. Soluble salts content < 4.0 mmhos/cm
4. Organic Matter 20 to 100%, dry weight basis

(e) 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:

1. Particle size:
    a. 100% < 19 mm [¾ in] screen
    b. 90%> 6.3 mm [¼ in] screen

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 3 kg /m^2 [0.6 lb/ ft^2]. 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 organic 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 7.57 kg/m^2 [1.55 lb/ft^2]. The blanket shall remain intact until grass is established. 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 Peat Humus Organic Humus shall be an organic substance meeting the following:

Minimum organic matter shall be 35% as determined by loss on ignition.
Particle size shall be 100% less than 25 mm [1 in].
Soluble salts shall be less than 4.0 mmhos/cm.
pH shall be between 4.5 and 8.0.
Material shall be Stable (>5) as measured by the Dewar Self Heating Test

Organic humus may be a natural peat from sedge, sphagnum or reed origin, or a compost from source separated materials that may include leaf and yard trimmings, food scrapes, food processing residues, manure and other agricultural residuals, or biosolids. Organic humus shall contain no visible admixture of refuse or other physical contaminates 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.

There shall be a round opening in the top and bottom of each head to receive 38 mm [1½ in] supporting pipe frame. All parts of the housing, including the doors and end plates shall be of die cast aluminum free from flaws, cracks, blow holes or other imperfections or polycarbonate.

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 200 mm [8 in] sections shall be 175 mm [7 in] long, hoods for 300 mm [12 in] sections shall be 240 mm [9½ in] 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 200 mm [8 in] units shall be 650-lumen minimum initial output, 120 volt, 100,000 hour rated life, clear traffic signal lamps. Lamps for the 300 mm [12 in] 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, 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 38 mm [1½ in] 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.

718.02 Pedestrian Signal Indications The pedestrian traffic control signal heads shall conform to the ITE, "Standard for Adjustable Face Pedestrian Signal Heads", latest Edition. The housing shall be dust and moisture proof and corrosion resistant and shall provide easy access to all components. All pedestrian signal heads shall have a sun visor.

All pedestrian traffic control signal heads of the incandescent type shall be as outlined in the above Standard. All new pedestrian signal faces installed at any one intersection shall be of the same make and type.

The "Don't Walk" and "Walk" indications shall be separate heads and the "Don't Walk" indication shall appear directly over the "Walk" indication. The "Walk" message shall be lunar white and the "Don't Walk" message shall be Portland orange.

Head sizes shall be standard nominal 250 mm [9 in] in minimum dimension unless otherwise specified.

LED optical assemblies for 225 mm [9 in] units shall be 650-lumen minimum initial output, 120-volt, 100,000 hour rated life.

LED optical assemblies for 300 mm [12 in] units 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 125 mm [5 in] minimum in height with a 16 mm [⅝ in] 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 38 mm [1½ in] IPS pipe to permit the signal control wires or cable to be inserted through them.

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 110 km/hr [70 mph] and at any temperature between -37°C and +74°C [-35°F 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, fuseholders, 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 230 m [750 ft] for single detection loops and for a combined lead-in length of 230 m [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 switch shall be a phenolic enclosed precision snap-acting type, switching unit, single-pole, double-throw, with screw type terminals, rated 15 amperes at 125 volts, AC and shall have the following characteristics:

a. The switching unit shall have a stainless steel plunger actuator and shall be provided with U-frame to permit recessed mounting in push button housing.

b. Where a pedestrian push button is attached to a pole, the housing shall be shaped to fit the curvature of the pole and secured to provide a rigid installation. When required, saddles shall be provided to make a neat fit.

718.07 Controllers All controllers shall be solid state menu driven keyboard units meeting NEMA standards and capable of operating in fixed time, semi-actuated and actuated modes or as designated on the plans. Controller shall have a programably "EE prom" chip with an internal real-time clock/calendar capable of daily, weekly, and yearly events time programming. The controller shall be designed to provide the number of intervals shown on the plans without any auxiliary equipment. Solid state controllers shall be provided with conflict monitors as specified in Section 718.11.

All equipment inputs, outputs, and terminals shall be identified by the phase designations shown on the plans.

The reliability of the equipment shall be demonstrated by test performance that will confirm that the controller unit, fully wired cabinet, and auxiliary equipment meet the operational and functional requirements of the plans and specifications.

The Contractor shall be responsible for providing all information describing the operation of the equipment necessary to facilitate the completion of the tests. All schematic wiring diagrams of the controllers and auxiliary equipment, all cabinet diagrams and all operation manuals shall

be submitted to the Resident at the time the controllers are delivered for testing. These diagrams shall show in detail all circuits and parts. Such parts shown thereon shall be identified by name or number and in such a manner as to be readily interpreted.

The controller shall be delivered with all documentation manuals as per Section 643.17 to the Maine Facility, US Route 2, Palmyra, Maine, mailing address RFD Box 421, Pittsfield, Maine, 04967, with all internal connections made and ready for testing. The test will be performed under simulated field loads or manufacturer's design loads, whichever are greater. Testing will be performed by the Department.

The Contractor shall allow 21 days for the testing of each controller, commencing on the day the controller is delivered to the test site, exclusive of the number of days necessary for the Contractor to respond to defect notices and the number of days the Contractor requires to correct the defective equipment.

The test shall consist of not less than five days of continuous, satisfactory operation. If unsatisfactory performance of the controller develops during the test, the Contractor shall remove the defective equipment for repair within five working days after notification, correct the deficiency and the controller shall be retested, until the 5 days of continuous satisfactory operation are obtained. If repeated failures occur, the entire controller may be rejected, requiring the Contractor to submit a new controller for testing. Delays to the contract resulting from unsatisfactory test performance due to continued equipment failure will not be considered as a valid reason to justify extension of the contract time.

The Contractor will be notified when testing of the traffic signal equipment has been completed. It shall be their responsibility to transport the equipment to the work site.

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% of the total connected load and shall meet standards of the UL and the EIA.

The type of controller, auxiliary equipment and other operational features shall be as noted on the plans.

All equipment, except pedestrian push buttons, shall be designed to operate on 120 volt, 60 hertz. Operation shall be satisfactory at voltages from 105 to 130. The voltage for pedestrian push buttons shall not exceed 18 volts.

a. Auxiliary Functions All controllers shall 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. The clock for auxiliary functions shall be a solid state time clock or module.

If noted on the plans, 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.

Actuated vehicle phases and actuated pedestrian phases shall be served in that interval of the cycle indicated on the plans. Time for an actuated interval shall be taken from the non-actuated phase(s) as noted on the plans.

Automatic transfer to or from flashing operation shall conform to the MUTCD. 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.

b. Solid State Controllers 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. Modules of unlike function shall be mechanically keyed or electrically interlocked to prevent placement in the wrong location. Each module shall be identified with the symbol shown on the plans with an embossed, color contrasting, plastic label. All components shall be marked for identification compatible with the maintenance manual for the controller unit, including components mounted on printed circuit boards.

When on manual operation, all phases shall be called regardless of vehicle detection and the controller shall be advanced upon pulse from the hand cord circuit, except yellow and red clearance intervals shall be timed for the duration programmed.

An exclusive pedestrian phase shall not extend or recycle until a vehicle phase has been serviced. When on manual operation, all phases shall be called regardless of vehicle detection and the controller shall be advanced upon pulse from the hand cord circuit except yellow and red clearance intervals shall be timed for the duration programmed. Automatic transfer from or to flashing operation shall conform to the MUTCD.

Pedestrian phases shall not be extended by actuations, during the walk or clearance interval. Actuations during the clearance intervals shall be placed in memory.

718.08 Controller Cabinet The traffic signal control equipment shall be enclosed within a dust and moisture-proof aluminum or stainless steel housing with an auxiliary door in door feature. The door hinge pins shall be made of stainless steel. The cabinet shall be installed with the back toward the nearest line of traffic unless otherwise directed by the Resident.

The controller cabinet shall be of sufficient size to 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 attached to a traffic signal post, it shall be integral with the post giving the appearance of the signal post passing directly through the cabinet. If the

controller cabinet is to be ground mounted, details of the installation will be shown on the plans. Piano type hinges on controller cabinet doors shall be fabricated of stainless steel with a stainless steel hinge pin.

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 flashing mechanism for flashing beacon installations must be enclosed within a dust and moisture proof aluminum cabinet with a hinged door.

The flasher cabinet shall be of sufficient size to accommodate a 2 circuit solid state flashing mechanism and other necessary equipment. It shall be designed to attach to the type of pole indicated in the contract plans. The flasher cabinet shall be vented to prevent excessive heat build-up.

The locks for the door of the flasher cabinet shall be the type shown on the plans. Two keys shall be furnished with each control lock.

All cabinets housing solid-state traffic signal control equipment shall be provided with a thermostatically controlled ventilating fan and throwaway glass fiber air filters. The electric fan shall have ball or roller bearings and shall have a capacity of 2.8 m^3 [100 ft^3] per minute. The ventilating system shall be designed to prevent the entrance of rain, snow, dust, and insects. 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 filter shall be firmly held in place such that cracks and openings are eliminated to ensure that all air is filtered. The fan shall be thermostatically controlled with an adjustable upper limit of 38°C to 60°C [100°F to 140°F] and a differential of not more than 5°C [10°F].

The locks for the switch compartment door of the controller cabinet shall be the type shown on the plans. The main door shall be a lock of the tumbler type. Two keys shall be furnished with each control lock.

All traffic signal controller cabinets shall be supplied with a convenience outlet, a standard 3-wire grounding duplex receptacle, 20 amp capacity and a lamp socket and 1900 lumen lamp.

A police panel shall be provided behind the auxiliary door and shall contain a switch to select "flash-automatic" function, "automatic-manual" function, "signals on-off" function and a manual control cord. Switch terminals on the rear of the main cabinet door shall be insulated so that no live posts are exposed. The "signal on-off" switch shall allow the signal indications to be de-energized, but power to all other control circuits shall not be disrupted. Switches shall be labeled and rated for load current. Traffic signal controller cabinet main doors over 0.55 m^2 [6 ft^2] in area shall be provided with a stop to limit door opening to both 90° and 180° +/- 10°. The stop shall be provided with a catch that can be operated when the door reaches these 2 positions and will hold the door open securely until released. Controller cabinets designated on the plans to be ground mounted shall 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. The bottom of the controller cabinet shall be mounted on an aluminum non-breakaway transformer base as shown on the plans.

The cabinet shall be supplied with sufficient shelf space for all control units. Receptacles for relays, shelf spaces below all removable control equipment, contactors, switches, fuses, circuit breakers and terminal blocks shall be identified with plastic labels embossed with the symbol used on the plans to indicate the related function.

718.09 Flasher The flasher shall be a two circuit solidstate 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 -35°C to +70°C [-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 -18°C to +70°C [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 2400 mm by 16 mm [8 ft by ⅝ in] 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.

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 conform to all the requirements of FHWA "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects", FP-92, Section 718.01. Engineering grade reflective sheeting shall meet the reflective intensity requirements for Type II sheeting as shown in Table 718-1, Section 718.01 - Vehicular Signal Indications, FP-92. High intensity reflective sheeting shall meet the reflective requirements for Type III sheeting as shown in Table 718-3, Section 718.01 - Vehicular Signal Indications, FP-92.

Reflective sheeting, used in sign construction, shall have been manufactured within the six 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.

For Type I Guide Signs, all reflective sheeting shall be color matched on each sign unit.

719.02 Demountable High Intensity Reflectorized Letters, Numerals, Symbols and Borders Demountable reflectorized letters, numerals, symbols and borders shall consist of cut out high intensity sheeting, conforming to FHWA, "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects", 1992, FP-92, Section 718.01(d).

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 B221M/B221, 6063-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 devise 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 to 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 2.00 mm [0.08 in] for signs of an area of 1.1 m^2 [12 ft^2] or less and shall be 3.18 mm [0.125 in] for signs over 1.0 m^2 [12 ft^2] 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 0.29 kg/m² [60 lb/1,000 ft²] surface, shall be at least 0.229 mm [0.009 in] 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 16 mm [⅝ in].

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 75 mm [3 in] 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 6 mm [¼ in] square hole for center mounting. Double and triple delineators shall have two 6 mm [¼ in] square mounting holes on the vertical centerline.

Single delineators shall be 75 mm by 75 mm [3 in by 3 in] diamonds with 19 mm [¾ in] radius corners and two 6 mm [¼ in] square mounting holes, 75 mm [3 in] on center.

Double delineators shall be 75 mm by 150 mm [3 in by 6 in] rectangles with 19 mm [¾ in] radius corners and two 6 mm [¼ in] square mounting holes 125 mm [5 in] on center.

The aluminum shall be 6061-T6, ASTM B209 or 6063-T6 or 6005-T5 1.60 mm [0.063 in] 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 W150 by 14 [W6 by 9] steel beams conforming to the requirements of ASTM A992/A992M, galvanized in accordance with AASHTO M111 (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 1.6 m [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 W150 by 14 [W6 by 9] shall not exceed approximately 1 meter [3¼ ft].

On independent sign support structures, these W150 by 14 [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 or 2. The U-bolt hardware, which includes nuts, flat washers and helical lock washers, shall be galvanized in accordance to AASHTO 232 (ASTM A153 or B695, Class 50, Type 1). 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 310 Mpa [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 con-forming to the requirements of ASTM A194/194M, 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).

719.073 Roadside Signing Aluminum signs mounted on U-channel posts shall be fastened with M8 by 38 mm [$^{5}/_{16}$ in by 1½ in] 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 M8 by 60 mm [$^{5}/_{16}$ in by 2½ in] 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 M6 by 60 mm [¼ in by 2¼ in] 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 B221M (ASTM B221) or ASTM B429, Alloy 6061-T6 or 6063-T6. Castings for use with aluminum supports shall conform to ASTM B26/B26M 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 light standards shall conform to the current edition of AWS Structural Welding Code - Aluminum D1.2.

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 12 m [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 4.78 mm [0.188 in]. A hand hole of approximately 0.016 m² [25 in²] in area, reinforced to maintain the full design strength of the shaft, shall be provided with the handhole center approximately 450 mm [18 in] 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 6 mm [¼ in]. 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 3.175 mm [0.125 in] and the minimum diameter at the base shall be 125 mm [5 in]. The length of the shaft plus the base shall be 4.34 m [14¼ ft], with a 100 mm [4 in] long by 75 mm [3 in] 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 0.016 m² [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 M20 [¾ in] anchor bolts, equally spaced on a 250 mm [10 in] 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 150 mm [6 in] and the minimum wall thickness shall be 3.175 mm [⅛ in]. The length of the pole plus the base shall be 3 m [10 ft], except that the length of poles supporting only pedestrian heads shall be 2.4 m [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 3.175 mm [⅛ in]. 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 light standards shall conform to the current edition of AWS Structural Welding Code - Aluminum D1.2.

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 A709M/A709, Grade 250 or 345 [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/A992M. 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 M111 (ASTM A123).

Chord flange splice fastener assemblies shall conform to ASTM A325M, Type 1, and galvanized in accordance with AASHTO M232 (ASTM A153 or B695, Class 50, Type 1). Other fastener assemblies shall be as specified in Section 719.07, or as approved by the 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 12 m [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 0.016 m^2 [25 in^2] in area, reinforced to maintain the full design strength of the shaft, shall be provided with the hand hole center approximately 450 mm [18 in] 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 100 mm [4 in] nominal ID, schedule 40 pipe without splices. The length of the pole plus the base shall be 3 m [10 ft], except that the length of poles supporting only pedestrian heads shall be 2.4 m [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 Engineer 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 M111 (ASTM A123). 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 A709M, Grade 345W [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 Posts shall conform to the requirements of ASTM A992/A992M. All work shall conform to the applicable provisions of Section 504 - Structural Steel. Steel shall be hot-dip galvanized in accordance with AASHTO M111 (ASTM A123). All steel hardware for use with H-beam poles shall be hot-dip galvanized in accordance with AASHTO M232 (ASTM A153 or B695, Class 50, Type 1).

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 380 Mpa [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 150 mm [6 in] minimum leg length at the lower end. The anchor bolts, nuts and hardened washers shall be hot-dip galvanized in accordance with AASHTO M232 (ASTM A153 or B695, Class 50, Type 1). The bolt shall be zinc-coated 300 mm [12 in] 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 the anchor bolts subject to approval of the Engineer.

720.08 U-Channel Posts Except as otherwise authorized, U-Channel posts for signs of less than 0.37 m^2 [4 ft^2] in area, shall be fabricated of steel weighing 3.7 kg/m [2.5 lb/ft], and shall not be doubled-up. Aluminum U-channel posts having the same strength characteristics as steel U-channel posts may be used, subject to the approval of the Engineer. The steel U-channel posts shall be galvanized in accordance with AASHTO M111 (ASTM A123).

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 Engineer.

The wood cross section shall be 250 mm by 250 mm [10 in by 10 in] minimum. The mounting height and depth of burial shall be as shown on the plans.

The following items shall be supplied, a 50 mm [2 in] 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 hot-dip galvanized in accordance with AASHTO M232 (ASTM A153 or B695, Class 50, Type 1).

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 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 100 mm [4 inches]. Tops of poles shall be beveled.

Wood Utility poles shall be pressure treated, after fabrication, with creosote, pentachlorophenol (oil borne), pentachlorophenol liquefied petroleum gas solution or copper naphthenate (oil borne), in accordance with the latest AWPA Specification C4 for pressure treated wood poles.

720.11 Mast Arms for Wood Utility Poles All mast arms for wood Utility pole attachment shall be standard 50 mm [2 in] 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 160 km/hr [100 mph] wind.

720.12 Wood Sign Posts Wood sign posts shall be rectangular, straight and sound timber, cut from live growing native spruce, hemlock, cedar or Douglas Fir trees, free from loose knots or other structurally weakening defects of importance, such as shake or holes and heart rot. A tolerance of 25 mm [1 in] in length and 6 mm [¼ in] 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 100 mm by 150 mm [4 in by 6 in] posts shall have two 38 mm [1½ in] diameter holes drilled perpendicular to traffic, one hole centered at 100 mm [4 in] above ground level and one centered at 460 mm [18 in] above ground level (posts shall be installed with the 150 mm [6 in] length parallel to the roadway); 150 mm by 150 mm [6 in by 6 in] posts shall have two 50 mm [2 in] diameter holes drilled perpendicular to traffic, one hole centered at 100 mm [4 in] above ground level and one centered at 460 mm [18 in] above ground level; 100 mm by 100 mm [4 in by 4 in] posts need not be modified.

When pressure treated wood sign posts are called for on the plans, the wood shall be Yellow Pine, Number 2 or better, .40 CCA, D4 S. The pressure treated wood shall meet AWPA Standard P-5 or Federal Standard TT-W-550. The treating process shall meet Federal Specification TT-W-571, or AWPA Commodity Standards as applicable.

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

722.01 Stabilization/Reinforcement Geotextile The geotextile shall have property values expressed as Minimum Average Roll Value (MARV) in the weakest principal direction, which meet or exceed the values stated below. Sampling and conformance testing shall be in accordance with ASTM D4354. Geotextile product acceptance shall be based on ASTM D4759. Geotextile Storage and Handling requirements shall be based on ASTM D4873.

Woven and non-woven geotextiles are acceptable and must meet the following requirements:

Mechanical Property	Test Method[1]	MARV[2]	
		Elongation[3]	
		< 50%	≥ 50%
Grab Strength - N [lb]	D4632	1400 [315]	900 [202]
Sewn Seam Strength - N [lb]	D4632	1260 [283]	810 [182]
Tear Strength - N [lb]	D4533	500 [112]	350 [79]
Puncture Strength - N [lb]	D4833	500 [112]	350 [79]
Other Properties	Test Method[1]	Requirements	
Permittivity	D4491	0.05/sec[4]	
Apparent Opening Size (AOS)	D4751	0.43 mm [0.017 in] (maximum)[5]	
Ultraviolet Stability (Retained Strength)	D4355	50% after 500 hours of exposure	
Other Requirements	Test Method[1]		
Conformance	D4759		
Sampling for Testing	D4354		
Storage and Handling	D4873		

[1]ASTM test method unless otherwise noted.
[2]Minimum Average Roll Value (MARV) unless otherwise noted.
[3]As determined in accordance with ASTM D4632.
[4]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.
[5]Maximum average roll value.

722.02 Drainage Geotextile The geotextile shall have property values expressed as Minimum Average Roll Value (MARV) in the weakest principal direction, which meet or exceed the values stated below. Sampling and conformance testing shall be in accordance with ASTM D4354. Geotextile product acceptance shall be based on ASTM D4759. Geotextile Storage and Handling requirements shall be based on ASTM D4873.

Both woven and nonwoven geotextiles are acceptable, however, no "slit-film" woven fabrics will be permitted. The geotextile must meet the following requirements:

Mechanical Property	Test Method[1]	MARV[2]	
		Elongation[3]	
		< 50%	≥ 50%
Grab Strength - N [lb]	D4632	1100 [247]	700 [157]
Sewn Seam Strength - N [lb]	D4632	990 [223]	630 [142]
Tear Strength - N [lb]	D4533	400 [90][4]	250 [56]
Puncture Strength - N [lb]	D4833	400 [90]	250 [56]

Other Properties	Test Method[1]	Requirements Percent In-Situ Soil Passing 0.075 mm[5] [0.003 in]		
		<15	15 to 50	>50
Permittivity	D4491	0.5/sec	0.2/sec	0.1/sec
Apparent Opening Size (AOS)[6] mm [in]	D4751	0.43 mm [0.017]	0.25 mm [0.010]	0.22 mm[7] [0.0087]
Ultraviolet Stability (Retained Strength)	D4355	50% after 500 hours of exposure		
Other Requirements	Test Method[1]			
Conformance	D4759			
Sampling for Testing	D4354			
Storage and Handling	D4873			

ASTM test method, unless otherwise noted.
[2]Minimum Average Roll Value (MARV) unless otherwise noted.
[3]As determined in accordance with ASTM D4632.
[4]The required MARV tear strength for woven monofilament geotextiles is 250 N [56 lb].
[5]Based on grain size analysis of in situ soil in accordance with AASHTO T88.
[6]Maximum average roll value.
[7]For cohesive soils with a plasticity index greater than 7, geotextile maximum average roll value for apparent opening size is 0.30 mm [0.012 in].

722.03 Erosion Control Geotextile The geotextile shall have property values expressed as Minimum Average Roll Value (MARV) in the weakest principal direction, which meet or exceed the values stated below. Sampling and conformance testing shall be in accordance with ASTM D4354. Geotextile product acceptance shall be based on ASTM D4759. Geotextile Storage and Handling requirements shall be based on ASTM D4873.

Both woven and non-woven geotextiles are acceptable, however, no "slit-film" woven fabrics will be permitted.

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:

a. Armor layer stone weights do not exceed 100 kg [220 lb], stone drop height is less than 1 m [3 ft], and no aggregate bedding layer is required.

b. Armor layer stone weighs more than 100 kg [220 lb], stone drop height is less than 1 m [3 ft], and the geotextile is protected by a 150 mm [6 in] 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 100 kg [220 lb], stone drop height is less than 1 m [3 ft], and the geotextile is protected by a 150 mm [6 in] thick aggregate bedding layer designed to be compatible with the armor layer.

d. Armor layer stone weights do not exceed 100 kg [220 lb] and stone is placed with a zero drop height.

The Class 2 geotextile must meet the requirements for drainage geotextile, except for the following:

Other Properties	Test Method	Requirements Percent In-Situ Soil Passing 0.075 mm [0.003 in]		
		<15	15 to 50	>50
Permittivity	D4491	0.7/sec	0.2/sec	0.1/sec

All other Erosion Control Geotextile applications that exceed the woven monofilament Erosion Control geotextile Class 2 criteria defined above require Class 1 geotextile class designation. The Class 1 geotextile must meet the requirements for Class 2 geotextile, except for the following:

Mechanical Property	Test Method	MARV	
		Elongation	
		< 50%	≥ 50%
Grab Strength - N [lb]	D4632	1400 [315]	900 [202]
Sewn Seam Strength - N [lb]	D4632	1260 [283]	810 [182]
Tear Strength - N [lb]	D4533	500 [112]	350 [79]
Puncture Strength - N [lb]	D4833	500 [112]	350 [79]

722.04 Separation Geotextile The geotextile shall have property values expressed as Minimum Average Roll Value (MARV) in the weakest principal direction, which meet or exceed the values stated below. Sampling and conformance testing shall be in accordance with ASTM D4354. Geotextile product acceptance shall be based on ASTM D4759. Geotextile Storage and Handling requirements shall be based on ASTM D4873.

Both woven and non-woven geotextiles are acceptable. The geotextile must meet the requirements of drainage geotextile, except for the following:

Other Properties	Test Method[1]	Requirements
Permittivity	D4491	0.02/sec
Apparent Opening Size (AOS)	D4751	0.60 mm [0.024 in](maximum)

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