



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0016

JOHN ELIAS BALDACCI
GOVERNOR

DAVID A. COLE
COMMISSIONER

July 10, 2007
Subject: **Bethel-Gilead**
Project No. HP-9184(300)X
Pin No. 9184.30
Amendment No. 1

Dear Sir/Ms:

Please make the following change to the Bid Documents:

In the Bid Book, ADD the attached: "Special Provision, Section 636, Mechanically Stabilized Earth Retaining Wall" dated May 14, 2007, sixteen pages total.

The following questions have been received.

Question: I was wondering about the MSE walls, is this a two stage construction where you are building the wall first and then attaching panels, or what is it?

Response: This project includes both a sole-source Geobrugg soil nail slope stabilization system with a mesh facing from Station 10+300 to 10+340 Right and Station 10+400 to 10+500 Right, and a retaining wall from Station 10+365 to 10+590 Left. The Special Provision allows a variety of wall types, including some that have not been submitted for evaluation in MeDOT's retaining wall approval process, for this project only. Acceptance of a wall system on this project will not in any way reduce the need for a manufacturer to make all submittals required for preapproval if the wall is to be used on any other MeDOT project in the future. This is a one-time deal and this form of Special Provision 636.30 will not be used for other projects.

Question: Is a Stone Strong Retaining Wall System acceptable as an equal for the SP. 635.31 Prefab Gravity Block Wall for this project?

Response: No, Stone Strong walls do not meet the requirements of SP 635.31.



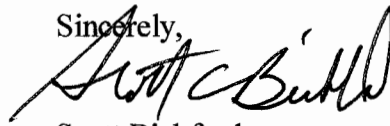
PRINTED ON RECYCLED PAPER

Question: In Special Provision 104, page 45 under the sub-section "Contractor" it states: "It is the responsibility of the contractor to layout all of the proposed utility facilities in the field prior to the start of construction". Is it the intent of this statement that the contractor needs to layout new pole locations for CMP and other utilities on the project?

Response: The intent of this spec is that the contractor will provide enough layout in an offset baseline for the utility to locate their new facilities. ie pole locations. If the pole locations are on the north side of the road the offset baseline should be on the north side of the road so that the utility can be layout in a safe manner.

Consider this change and information prior to submitting your bid on July 25, 2007.

Sincerely,

A handwritten signature in black ink, appearing to read "Scott Bickford". The signature is written in a cursive style with a large initial "S" and "B".

Scott Bickford
Contracts & Specifications Engineer

SPECIAL PROVISION
Section 636 – Mechanically Stabilized Earth Retaining Wall

Description: The work shall consist of design, fabrication, furnishing, transportation and erection of a Mechanically Stabilized Earth (MSE) retaining wall system, including miscellaneous items necessary for a complete installation.

Three general retaining wall systems will be allowed. Category one utilizes a prefabricated bin-type retaining wall, category two consists of geogrid reinforcement utilizing a concrete block facing, and category three consists of steel reinforcing mesh with a stone filled wire basket facing or welded wire facing. A gravity/friction connection between the reinforcement and the aggregate fill or facing block will not be accepted, and a geosynthetic connection or reinforcement formed into the concrete will not be accepted; either some form of solid connection is required or a positive mechanical interlock between the reinforcement and facing must be installed during construction. Use of a wall system in this project does not in any way constitute or imply pre-approval by Maine DOT for use on any other project.

Requirements for each category of wall system are specified below. The MSE retaining wall shall be constructed in accordance with these specifications and in conformity with the lines, grades, design criteria, and dimensions shown on the plans provided by MaineDOT or established by the MaineDOT Geotechnical Engineer.

GENERAL REQUIREMENTS

General Design Requirements. The MSE Retaining Wall shall be designed by a Professional Engineer registered in the State of Maine. The design to be performed by the wall system supplier shall be in accordance with AASHTO Standard Specifications for Highway Bridges, current edition, except as required herein. Thirty days prior to beginning construction of the wall, the design computations shall be submitted to the Resident for review by the Project Geotechnical Engineer. The design by the wall system supplier shall consider the stability of the wall as outlined below:

Safety Factors. The minimum factors of safety shall be as follows:

- | | |
|---|-----|
| 1. Overturning: | 2.0 |
| 2. Sliding: | 1.5 |
| 3. Stability of temporary construction slope: | 1.2 |
| 4. Ultimate bearing capacity: | 2.0 |
| 5. Reinforcement pullout | 1.5 |
| 6. Reinforcement rupture | 1.5 |
| 7. Reinforcement connection failure | 2.0 |

Submittals. The Contractor shall supply wall design computations, wall details, dimensions, quantities, and cross sections necessary to construct the wall. Spread sheet calculations alone are not acceptable. A sample hand calculation including all equations,

parameter values used, units, theory, free-body diagram, comparison to design requirements, etc. shall be provided.

Thirty days prior to beginning construction of the wall, the design computations and wall details shall be submitted to the Engineer for review. If concrete units are utilized in the wall, mix design information shall be submitted at the same time, including aggregate source, current gradation, aggregate quality information and concrete unit weight. The fully detailed plans shall be prepared in conformance with Subsection 105.02 of the Standard Specifications and shall include, but not be limited to the following items:

- I. A plan and elevation sheet or sheets for each wall, containing the following: elevations at the top of leveling pads, the distance along the face of the wall to all steps in the leveling pads, the designation as to the type of prefabricated module, the distance along the face of the wall to where changes in length of the units occur, the location of the original and final ground line.
- II. All details, including reinforcing bar bending details, shall be provided as appropriate for the type of wall. Bar bending details shall be in accordance with Department standards.
- III. All details for foundations and leveling pads, including details for steps in the leveling pads, as well as allowable and actual maximum bearing pressures shall be provided.
- IV. All prefabricated modules shall be detailed. The details shall show all dimensions necessary to construct the element, and all reinforcing steel in the element as needed for the type of wall.
- V. The wall plans shall be prepared and stamped by a Professional Engineer licensed in the State of Maine. Four sets of design drawings and detail design computations shall be submitted for review by the Project Geotechnical Engineer.
- VI. Two weeks prior to the beginning of construction, the contractor shall supply the Engineer with two copies of the design-supplier's Installation Manual. In addition, the Contractor shall have two copies of the Installation Manual on the project site.

General Construction Requirements:

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.

Foundation. The area upon which the MSE Wall structure is to rest, and within the limits shown on the submitted plans, shall be graded for a width equal to, or exceeding, the length of the module or element including reinforcement. Prior to wall and leveling pad construction, this foundation material shall be compacted to at least 95 percent of maximum laboratory dry density. Frozen soils and soils unsuitable or incapable of sustaining the required compaction, shall be removed and replaced with gravel borrow compacted to 95% of T-180.

Backfill Placement. The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T99, Method C or D. At the end of the day's operations, the Contractor shall shape the last level of backfill so as to direct runoff of rain water away from the wall face.

SPECIFIC REQUIREMENTS

CATEGORY ONE:

Description. This work shall consist of the construction of a prefabricated modular reinforced concrete gravity wall in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the plans, or established by the Engineer.

Included in the scope of the prefabricated modular gravity wall construction are: all grading necessary for wall construction, compaction of the wall foundation, backfill, construction of leveling pads, and segmental unit erection.

The prefabricated modular wall design shall follow the general dimensions of the wall envelope shown in the contract plans. The top of the leveling pad shall be located at or below the theoretical leveling pad elevation. The minimum wall embedment shall be at or below the elevation shown on the plans provided by Maine DOT. The top of the face panels shall be at or above the top of the panel elevation shown on the plans.

The Contractor shall require the design-supplier to supply an on-site, qualified experienced technical representative to advise the Contractor concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Engineer. The work done by this representative is incidental.

MATERIALS

Materials. Materials shall meet the requirements of the following subsections of Division 700 - Materials:

Gravel Borrow	703.20
Underdrain Backfill Type C	703.22
Prefomed Expansion Joint Material	705.01
Underdrain Pipe	706.06 or 706.09
Reinforcing Steel	709.01

Structural Precast Concrete Units
Drainage Geotextile

712.061

722.02

The Contractor is cautioned that all of the materials listed are not required for every prefabricated modular gravity wall. The Contractor shall furnish the Engineer a Certificate of Compliance certifying that the applicable materials comply with this section of the specifications. Materials shall meet the following additional requirements:

Concrete Units. Pre-cast units shall be manufactured by the following or approved equal: "T-Wall" as manufactured by Superior Concrete of Auburn, Maine, or "DoubleWall" as manufactured by a licensed manufacturer of DoubleWall Corp., Plainville, Connecticut.

Tolerances. In addition to meeting the requirements of 712.061, all prefabricated units shall be manufactured with the following tolerances. All units not meeting the listed tolerances will be rejected.

1. All dimensions shall be within (edge to edge of concrete) 5 mm [$\pm 3/16$ inch].
2. Squareness: The length differences between the two diagonals shall not exceed 8 mm [5/16 inch].
3. Surface Tolerances. For steel formed surfaces, and other formed surface, any surface defects in excess of 2 mm [.08 inch] in 1.2 m [4 feet] will be rejected. For textured surfaces, any surface defects in excess of 8 mm [5/16 inch] in 1.5 m [5 feet] shall be rejected.

Joint Filler (where applicable). Joints shall be filled with material approved by the Engineer and supplied by the approved prefabricated modular wall supplier. A 100 mm [4 inch] wide, by 13 mm [0.5 inch] preformed expansion joint filler shall be placed in all horizontal joints between facing units. In all vertical joints, a space of 6 mm [0.25 inch] shall be provided. All Preformed Expansion Joint Material shall meet the requirements of subsection 502.03.

Woven Drainage Geotextile. Woven drainage geotextile 300 mm [12 inch] wide shall be bonded with an approved adhesive compound to the back face, covering all joints between units, including joints abutting concrete structures. Geotextile seam laps shall be 150 mm [6 inch] minimum. The fabric shall be secured to the concrete with an adhesive satisfactory to the Engineer. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Engineer.

Concrete Shear Keys (where applicable). Shear keys shall have a thickness at least equal to the precast concrete stem.

Concrete Leveling Pad. Concrete for leveling pads shall be Fill Concrete conforming to the requirements of Section 502 Structural Concrete. Unless otherwise specified, concrete for leveling pads shall be accepted under Method "C" requirements.

Backfill and Bedding Material. Bedding and backfill material placed behind and within the reinforced concrete modules shall be gravel borrow conforming to the requirements of Subsection 703.20. The backfill materials shall conform to the following additional requirements: the plasticity index (P.I.) as determined by AASHTO T90 shall not exceed 6. Compliance with the gradation and plasticity requirements shall be the responsibility of the Contractor, who shall furnish a copy of the backfill test results prior to construction.

The backfilling of the interior of the wall units and behind the wall shall progress simultaneously. The material shall be placed in layers not over 200 mm [8 inches] in depth, loose measure, and thoroughly compacted by mechanical or vibratory compactors. Puddling for compaction will not be allowed.

Materials Certificate Letter. The Contractor, or the supplier as his agent, shall furnish the Engineer a Materials Certificate Letter for the above materials, including the backfill material, in accordance with Section 700 of the Standard Specifications. A copy of all test results performed by the Contractor or his supplier necessary to assure contract compliance shall also be furnished to the Engineer. The Engineer will base acceptance upon the materials Certificate Letter, accompanying test reports, and visual inspection.

SPECIFIC DESIGN REQUIREMENTS

- (a) Backfill and Wall Unit Soil Parameters. For overturning and sliding stability calculations, earth pressure shall be assumed acting on a vertical plane rising from the back of the lowest wall stem. For overturning, the unit weight of the backfill within the wall units shall be limited to 1602 kg/m^3 [100 pcf]. For sliding analyses, the unit weight of the backfill within the wall units can be assumed to be 1922 kg/m^3 [120 pcf]. Both analyses may assume a friction angle of 34 degrees for backfill within the wall units.

These unit weights and friction angles are based on a wall unit backfill meeting the requirements for select backfill in this specification. Backfill behind the wall units shall be assumed to have a unit weight of 1922 kg/m^3 [120 pcf] and a friction angle of 30 degrees. The friction angle of the foundation soils shall be assumed to be 30 degrees unless otherwise noted on the plans.

- (b) Internal Stability. Internal stability of the wall shall be demonstrated using accepted methods, such as Elias' Method, 1991. Shear keys shall not contribute to pullout resistance. Soil-to-soil frictional component along stem shall not contribute to pullout resistance. The failure plane used to determine pullout resistance shall be found by the Rankine theory only for vertical walls with level backfills. When walls are battered or with backslopes > 0 degrees are considered, the angle of the

failure plane shall be per Jumikus Method. For computation of pullout force, the width of the backface of each unit shall be no greater than 1.37 m [4.5 feet]. A unit weight of the soil inside the units shall be assumed no greater than 1922 kg/m^3 120 pcf when computing pullout. Coulomb may be used.

- (c) 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.
- (d) The actual applied bearing pressures under the prefabricated concrete modular block wall shall be clearly indicated on the design drawings.
- (e) Stability during Construction. The factors of safety to be used for stability during construction stages shall be the same factors used for the design of the wall.
- (f) Hydrostatic forces. Unless specified otherwise, when a design high water surface is shown on the plans at the face of the wall, the design stresses calculated from that elevation to the bottom of wall must include a 0.9 meter [3 foot] minimum differential head of saturated backfill. In addition, the buoyant weight of saturated soil shall be used in the calculation of pullout resistance.
- (g) Design Life. Design life shall be in accordance with AASHTO requirements.
- (h) Not more than two vertically consecutive units shall have the same stem length, or the same unit depth. Walls with units with extended height curbs shall be designed for the added earth pressure. A separate computation for pullout of each unit with extended height curbs, or extended height coping, shall be prepared and submitted in the design package described above.

SPECIFIC CONSTRUCTION REQUIREMENTS

Leveling Pad. A concrete leveling pad shall be constructed as indicated on the plans. The leveling pad shall be cast to the design elevations as shown on the plans, or as required by the wall supplier upon written approval of the Engineer. Allowable elevation tolerances are +3 mm [+0.01 foot] and -6 mm [-0.02 foot] from the design elevations. Leveling pads which do not meet this requirement shall be repaired or replaced as directed by the Engineer at no additional cost to the Department. Placement of wall units may begin after 24 hours curing time of the concrete leveling pad.

Method and Equipment. Prior to erection of the prefabricated modular wall, the Contractor shall furnish the Engineer with detailed information concerning the proposed

construction method and equipment to be used. The erection procedure shall be in accordance with the manufacturer's instructions. Any precast units that are damaged due to handling will be replaced at the Contractor's expense.

Installation of Wall Units. A field representative from the wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the project. Vertical and horizontal joint fillers shall be installed as shown on the plans.

The maximum offset in any unit joint shall be 20 mm [3/4 inch]. The overall vertical tolerance of the wall, plumb from top to bottom, shall not exceed 12 mm per 3 m [1/2 inch per 10 feet] of wall height. The prefabricated wall units shall be installed to a tolerance of plus or minus 20 mm in 3 m [3/4 inch in 10 feet] in vertical alignment and horizontal alignment.

Select Backfill Placement. Backfill placement shall closely follow the erection of each row of prefabricated wall units. The Contractor shall decrease the lift thickness if necessary to obtain the specified density. The maximum lift thickness shall be 200 mm [8 inches] (loose). 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. Backfill compaction shall be accomplished without disturbance or displacement of the wall units. Sheepsfoot rollers will not be allowed. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved.

CATEGORY TWO:

Description. This work shall consist of the design and construction of a prefabricated concrete block gravity wall in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the plans, or established by the Resident. Blocks shall be made of wet cast concrete made from Portland cement, water, chemical admixtures, and aggregates.

Included in the scope of the prefabricated gravity wall construction are: geotechnical design of any wall with a maximum height greater than 1.37 m [4.5 ft] or as specified on the wall detail sheet, all grading necessary for wall construction, compaction of the wall foundation soil, backfill, piped drainage, construction of leveling pads, and block wall installation.

The prefabricated gravity wall design shall follow the general dimensions of the wall envelope shown in the contract plans. The minimum wall embedment shall be at or below the elevation shown on the plans or as specified by the designer. The top of the upper row of blocks shall be at or above the top of the face elevation shown on the plans.

The Contractor shall require the design-supplier to supply an on-site, qualified experienced technical representative to advise the Contractor concerning proper

installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Resident. The work done by this representative is incidental to the construction of the wall.

MATERIALS

Materials. Materials shall meet the requirements of the following sections of Division 700:

Underdrain Backfill Type C	703.22
Gravel Borrow	703.20
Underdrain Pipe	706.06 or 706.09
Reinforcing Steel	709.01

The Contractor is cautioned that all of the materials listed are not required for every prefabricated concrete block gravity wall. The Contractor shall furnish the Resident a Certificate of Compliance certifying that the applicable materials comply with this section of the specifications. Materials shall meet the following additional requirements:

Concrete Units. Precast units shall be manufactured by the following or approved equal: "Redi-Rock" as manufactured by Superior Concrete of Auburn, Maine or Haley Concrete of Sangerville, Maine.

Materials shall conform to the requirements of Section 502 Structural Concrete Class A except that the requirements for Chloride Permeability shall not apply

- A. The minimum 28 day compressive strength requirement shall be 30 MPa [4350 psi] for any individual unit and 31.7 MPa [4600 psi] for the average of 3 units
- B. Unit Depth - 1040 mm [41 in], minimum for an unreinforced wall, or 710 mm [28 in] minimum for a geogrid reinforced wall.
- C. Unit Width - 1160 mm [46 in], minimum at the face
- D. Unit Height - 450 mm [18 in], minimum at the face for a standard block
- E. Tolerances - formed dimensions shall not vary more than 2 mm [1/16"] from the Manufacturer's published tolerances.
- F. Face Texture - formed finish on all exposed surfaces.
- G. Color - pigment shall be added during the casting process of the concrete unit to achieve a consistent shade of gray or other color as determined by the Resident.

- H. Imperfections - All units shall be sound and free of cracks or other defects that would interfere with the proper placing of each unit or significantly impair the strength or performance of the construction. Minor cracks (e.g. no greater than 0.5 mm [0.02 in] in width and no longer than 25% of the unit height) incidental to the method of manufacture or minor chipping resultant from shipment and delivery, are not grounds for rejection.

Exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 3 m [10 ft] under diffused lighting.

- I. Other Constituents – Air entraining agents, coloring pigments, integral water repellents, pozzolans, and other constituents shall be previously established as suitable for use in Class A concrete and shall conform to applicable AASHTO standards or, shall be shown by test or experience to be not detrimental to the appearance or durability of the concrete units or any material customarily used in retaining wall construction.
- J. Other Units – end blocks, steps, caps and other wall units shall be supplied by the same supplier as the block units and cast in strict accordance with manufacturer's requirements and with Sections A through I above.
- K. Quality Assurance – The supplier shall test one set of cylinders for every 50 cubic yards [38 m³] of production concrete used to cast the concrete units. The supplier shall also make one extra set of cylinders every 200 cubic yards [153 m³] for use by the Department.

The forms may be stripped after a cure time of 15 to 18 hours if the concrete units are not damaged in the stripping process. When stripped, the concrete units must be cured at a minimum of 50° F [10° C] for four days, then greater than 32° F [0° C] for three days when Type I or Type II cement is used, or a minimum of three days when Type III cement is used.

MaineDOT reserves the right to inspect the plant without notice for Quality Assurance purposes.

Geogrid Reinforcing The structural geogrid reinforcing shall meet the following requirements:

- A. The geogrids shall be a regular polymeric grid structure of select high density polyethylene (HDPE), polypropylene (PP), or polyester (PET) resin manufactured by Tensar, Huesker, Strata Systems, Mirafi, or approved equal.
- B. The geogrid shall conform to the following criteria:

- B1. PP and HDPE: Min. retained strength of 70 % after 150 hours, per ASTM D-4355.
- B2. HDPE: Grade = E-4, E-5, E-8, E-9, E-10, E-11, J-3, J-4, J-5, P-24, or P-34, per ASTM D-1248.
- B3. PET: Molecular weight (Mn) > 25,000 g/mole, Inherent Viscosity Method per ASTM D-4603, with Correlation or Determined Directly Using Gel Permeation Chromatography.
- B4. PET: Carboxyl end group (CEG) < 30 meg/kg, GRI:GG7
- B5. All polymers: Minimum Weight per Unit Area of 270 g/m², per ASTM D-5261
- B6. A default total reduction factor for creep, durability, and installation damage of 7 may be used in design, provided the criteria of B2 through B5 are satisfied and B1 is adjusted to 70% after 500 hours is satisfied.
- C. The Long Term Tensile Strength (Tal) of the geogrid shall be determined by reducing the Ultimate Strength (Tu), as determined using ASTM 4595 or GRI:GG1, by the product of the reduction factors for durability, installation damage, and creep, denoted RFD, RFID, and, RFCR, respectively. The required tests used to determine the reduction factors, minimum value to be used in design if test value is less than minimum, and maximum value to be used in design in the absence of test data are summarized below.

Reduction Factor	Test	Minimum/Maximum
Durability (RFD)	HDPE and PP: ASTM D4355 PET: GRI:GG7	1.1 / 2.0
Installation Damage(RFID)	Site installation damaged tests, similar to ASTM D-5818	1.1 / 3.0
Creep(RFCR)	ASTM D-5262	HDPE = 2.5/5.0 PP = 4.0/5.0 PET = 2.0/2.5

- D. The pullout resistance factors, F^* and F^* , used in pullout design, shall be determined for the proposed reinforcement and wall system, with soil similar to the specified backfill material of this Section. The pullout resistance factors shall be determined in accordance with Appendix A of FHWA SA-96-071 "Mechanical Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines." In the absence of test data, empirical relationships may be used to determine the pullout resistance factors, any empirical relationships used in design shall be referenced in the design calculations.
- E. Long-term connection strength between the geogrid reinforcement and the modular blocks shall be checked, per AASHTO-Standard Specifications for Highway Bridges, Section 5.8.

- F. The Contractor shall submit a Manufacturer's Certificate, which shall state that the furnished geogrid(s) meets the requirements of this Section, as evaluated by the manufacturer's quality control program. Included with the certificates, shall be the design parameters and required properties referenced in this Section. The certificates shall be attested to by a person having legal authority to bond the manufacturer. In case of dispute over validity of values, the Resident can require the Contractor to supply test data from a Department approved laboratory to support the certified values submitted.

Geogrid Connection. Reinforcing bar used in the geogrid connection shall be 13 mm [$\frac{1}{2}$ in] diameter epoxy coated reinforcing bar, coated on the ends and meeting the requirements of Section 503, Reinforcing Steel. Installation shall be in accordance with manufacturer's recommendations.

Concrete Leveling Pad. Concrete for leveling pads shall be Fill Concrete conforming to the requirements of Section 502 Structural Concrete. Unless otherwise specified, concrete for leveling pads shall be accepted under Method "C" requirements.

Reinforced and Select Backfill Material. Reinforced and select backfill material placed behind the concrete units shall be Gravel Borrow conforming to the requirements of Section 703.20. Material between blocks must be gravel borrow as above or crushed stone meeting the requirements of Section 703.12. If Gravel Borrow is used between blocks, geotextile shall be placed behind vertical joints to prevent loss of granular material between blocks. Compliance with the gradation requirements shall be the responsibility of the Contractor, who shall furnish a copy of the backfill test results prior to construction. If crushed stone is used between blocks no geotextile is required behind vertical joints.

Materials Certificate Letter. The Contractor, or the supplier as his agent, shall furnish the Resident a Materials Certificate Letter for the above materials, including the backfill material, in accordance with Section 700 of the Standard Specifications. A copy of all test results performed by the Contractor or his supplier necessary to assure contract compliance shall also be furnished to the Resident. The Resident will base acceptance upon the materials Certificate Letter, accompanying test reports, and visual inspection.

SPECIFIC DESIGN REQUIREMENTS

- (a) **Backfill Soil Parameters.** For overturning and sliding stability calculations, earth pressure shall be assumed acting on a vertical plane dropping from the back of the highest block or geogrid. Stability shall also be calculated at each level within the wall.
- (b) These unit weights and friction angles are based on a backfill meeting the requirements for select backfill in this specification. Backfill behind the concrete units and reinforced fill zone shall be assumed to

have a unit weight of 1922 kg/m^3 [120 pcf] and a friction angle of 30 degrees. The friction angle of the foundation soils shall be assumed to be 30 degrees unless otherwise noted on the plans. The friction angle of the select backfill used in the reinforced fill zone for internal stability design of the wall shall be assumed to be 34° unless noted otherwise on the plans.

- (c) External loads which affect the internal stability such as those applied through traffic, slope surcharge, hydrostatic and seismic loads shall be accounted for in the design.
- (d) The actual applied bearing pressures under the prefabricated concrete block gravity wall shall be clearly indicated on the design drawings.
- (e) Stability During Construction. The factors of safety to be used for stability during construction stages shall be the same factors used for the design of the wall.
- (f) Hydrostatic Forces. Unless specified otherwise, when a design high water surface is shown on the plans at the face of the wall, the design stresses calculated from that elevation to the bottom of wall must include a 0.9 m [3 ft] minimum differential head of saturated backfill.
- (g) Design Life. Design life shall be in accordance with AASHTO requirements.
- (h) Depth of Embedment. The depth of embedment for frost protection and stability shall be as shown on the plans supplied by the Maine DOT.
- (i) Drainage System. Piped drainage shall be designed to collect and dispose of water from the base of the reinforced soil zone and backfill soil. This shall outlet into surrounding drainage systems or ditches.
- (j) The design shall provide for end blocks, cap blocks, or other concrete units necessary to give the wall a finished appearance.

CONSTRUCTION REQUIREMENTS

A concrete leveling pad shall be constructed as indicated on the plans. Dimensions may be modified per the wall supplier's recommendations, with written approval of the Project Geotechnical Engineer. The leveling pad shall be cast to the design elevations as shown on the plans, or as required by the wall supplier upon written approval of the Project Geotechnical Engineer. Allowable elevation tolerances are +3 mm [+0.01 ft] and -6 mm [-0.02 ft] from the design elevations. Leveling pads which do not meet this requirement shall be repaired or replaced as directed by the Resident at no additional cost to the Department. Placement of wall units may begin after the strength of the concrete

leveling pad reaches 6900 kPa [1000 psi] or is adequate to support the proposed loads. Contractor may begin placement of concrete block units after 12 hours at his own risk.

Method and Equipment. Prior to erection of the prefabricated concrete block wall, the Contractor shall furnish the Resident with detailed information concerning the proposed construction method and equipment to be used. The erection procedure shall be in accordance with the manufacturer's instructions. Any units that are damaged due to handling will be replaced at the Contractor's expense.

Installation of Wall Units. A field representative from the wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the project. Horizontal joint fillers shall be installed as needed.

The maximum offset in any unit horizontal joint shall be 6.5 mm [1/4 in]. The prefabricated wall blocks shall be installed to a tolerance of plus or minus 20 mm in 3 m [3/4 inch in 10 ft] in vertical alignment and horizontal alignment.

Select Backfill Placement. Backfill placement shall closely follow the erection of each row of prefabricated wall units. The Contractor shall decrease the lift thickness if necessary to obtain the specified density. The maximum lift thickness shall be 200 mm [8 in] loose. Gravel borrow backfill shall be compacted in accordance with Section 203.12 except that the minimum required compaction shall be 95 percent of maximum density as determined by AASHTO T99 Method C or D. Backfill compaction shall be accomplished without disturbance or displacement of the wall blocks. Sheepsfoot rollers will not be allowed. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved.

CATEGORY THREE:

Description. This work shall consist of the design and construction of a proprietary MSE wall system with a welded wire or gabion face, in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the plans, or established by the Resident.

Included in the scope of the wall construction are: geotechnical design of the wall, all grading necessary for wall construction, compaction of the wall foundation soil, backfill and infill materials, construction of leveling pads, and wall installation.

The wall design shall follow the general dimensions of the wall envelope shown in the contract plans. The minimum wall embedment shall be at or below the elevation shown on the plans. The top of the upper row of facing units shall be at or above the top of the face elevation shown on the plans.

The Contractor shall require the design-supplier to supply an on-site, qualified experienced technical representative to advise the Contractor concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Resident. The work done by this representative is incidental to the construction of the wall.

MATERIALS

Materials. Materials shall meet the requirements of the following subsections of Division 700 – Materials:

Gravel Borrow	703.20
Gabions	711.02
Stones for Gabions	711.03
Erosion Control Geotextile	722.03

Electro-Chemical Limits: The gravel borrow within the reinforced zone shall conform to the following electro-chemical limits:

Chlorides	≤ 100 ppm
Sulphates	≤ 200 ppm
Resistivity	≥ 3000 ohm-cm
	$5 \leq \text{pH} \leq 10$

All materials not explicitly mentioned shall meet the manufacturer's recommendations for a 75 year design life, and meet the requirements of AASHTO Standard specification for Highway Bridges, current edition, Section 7.3.6.3. The contractor is cautioned that not all materials listed are required for each type of wall.

Modular steel units shall be manufactured by the following or approved equal: Atlantic Welded Wire Wall by Atlantic Industries Ltd of Dorchester, New Brunswick or Hilfiker Corporation of Eureka, California.

SPECIFIC DESIGN REQUIREMENTS

- (a) Backfill Soil Parameters. For overturning and sliding stability calculations, earth pressure shall be assumed acting on a vertical plane dropping from the back of the highest mesh reinforcing unit. Stability shall also be calculated at each level within the wall.
- (b) These unit weights and friction angles are based on a backfill meeting the requirements for select backfill in this specification. Backfill behind the face units and reinforced fill zone shall be assumed to have a unit weight of 1922 kg/m^3 [120 pcf] and a friction angle of 30 degrees. The friction angle of the foundation soils shall be assumed to be 30 degrees unless otherwise noted on the plans. The friction angle of the

select backfill used in the reinforced fill zone for internal stability design of the wall shall be assumed to be 34° unless noted otherwise on the plans.

- (c) The design life of all wall components shall be 75 years. Material strengths used in design shall be at the end of the design life of the wall, after all calculated corrosion loss.
- (d) The actual applied bearing pressures under the wall shall be clearly indicated on the design drawings.
- (e) Stability during Construction. The factors of safety to be used for stability during construction stages shall be the same factors used for the design of the wall.
- (f) Depth of Embedment. The depth of embedment for frost protection and stability shall be as shown on the plans supplied by the Maine DOT.

CONSTRUCTION REQUIREMENTS

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.

Method and Equipment. Prior to erection of the wall, the Contractor shall furnish the Resident with detailed information concerning the proposed construction method and equipment to be used. The erection procedure shall be in accordance with the manufacturer's instructions. Any units that are damaged due to handling will be replaced at the Contractor's expense.

Installation of Wall Units. Stones used within or behind the facing units shall meet requirements or recommendations concerning size, weight and angularity as specified by the manufacturer. A field representative from the supplier or manufacturer of the wall system being used shall be available, as needed, during the erection of the wall. The services of the representative shall be at no additional cost to the project.

Select Backfill Placement. Backfill placement shall closely follow the erection of each row of prefabricated wall modules. The Contractor shall decrease the lift thickness if necessary to obtain the specified density. The maximum lift thickness shall be 200 mm [8 in] loose. Gravel borrow backfill meeting the requirements of Section 703.20 shall be compacted in accordance with Section 203.12 except that the minimum required compaction shall be 95 percent of maximum density as determined by AASHTO T99 Method C or D. Backfill compaction shall be accomplished without disturbance or displacement of the wall units. Sheepsfoot rollers will not be allowed. Whenever a compaction test fails, no additional backfill shall be placed over the area until the lift is recompacted and a passing test achieved.

Method of Measurement. The MSE wall will be measured by the square meter of front surface not to exceed the dimensions shown on the contract plans unless authorized by the Resident. Vertical and horizontal dimensions will be from the edges of the facing units. No field measurements for computations will be made unless the Resident specifies, in writing, a change in the limits indicated on the plans.

Basis of Payment. The accepted quantity of MSE Wall will be paid for at the contract unit price per square meter complete in place. Payment shall be full compensation for furnishing geotechnical design and all labor, equipment and materials including all facing units of any type, all reinforcing made of any material, hardware, joint fillers, woven and non-woven geosynthetic, steel, drainage pipe and technical field representative.

Cost of cast-in-place concrete leveling pad will not be paid for separately, but will be considered incidental to the MSE Wall. Excavation, foundation material, stone or riprap fill or facing, and backfill material will all be incidental to the MSE Wall.

There will be no allowance for excavating and backfilling for the MSE Wall beyond the limits shown on the approved submitted plans, except for excavation required to remove unsuitable subsoil in preparation for the foundation. Payment for excavating unsuitable subsoil shall be full compensation for all costs of pumping, drainage, sheeting, bracing and incidentals for proper execution of the work, and will be paid as Common Excavation, Standard Specification 203.20.

Pay Item

Pay Unit

635.30 Mechanically Stabilized Earth Wall

Square Meter