

SECTION 32 35 00

PRECAST MODULAR BLOCK FREESTANDING WALL

PART 1 – GENERAL

1.01 SUMMARY

- A. This section includes furnishing all materials and labor required for the design and construction of a precast concrete modular block (PMB) freestanding wall (FSW) without reinforcing steel or geosynthetic reinforcement. It should be noted that precast concrete modular block and PMB are used interchangeably throughout this document and will be referenced as the abbreviation PMB going forward. Systems specified under this section shall be self-supporting barrier wall systems constructed for the purposes of security, noise reduction and/or privacy. Full-height precast panel wall systems are excluded from this section. Precast modular block freestanding wall blocks under this section shall be cast utilizing a wet-cast concrete mix and exhibit a final handling weight in excess of 450 LB (2.0 kN) per unit.
- B. Scope of Work: The work shall consist of furnishing materials, labor, equipment and supervision for the construction of a precast modular block (PMB) freestanding wall (FSW) structure in accordance with the requirements of this section and in acceptable conformity with the lines, grades, design and dimensions shown in the project site plans.
- C. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 31, Division 32 and Division 33 also apply to this Section.

1.02 PRICE AND PAYMENT PROCEDURES

- A. Allowances. No allowance shall be made in the price of the wall for excavation beyond the limits shown on the project plans. The cost of excavation for the purposes of site access shall be the responsibility of the General Contractor. Removal of unsuitable soils and replacement with select fill shall be as directed and approved in writing by the Owner or Owner's representative and shall be paid under separate pay items.
- B. Unit Prices. In addition to a lump sum price pursuant to completion of the scope of work described in Part 1.01 of this Section, the General Contractor shall provide a unit price per sq ft of vertical wall face that shall be the basis of compensation for up to a ten (10) percent increase or reduction in the overall scope of the wall work.
- C. Measurement and Payment.
 - 1. The unit of measurement for furnishing the PMB-FSW system shall be the vertical area of the wall face surface as measured from the top of the leveling pad to the top of the wall including coping. The final measured quantity shall include supply of all material components and the installation of the PMB-FSW system.
 - 2. The final accepted quantities of the PMB-FSW system will be compensated per the vertical face area as described above. The quantities of the precast modular block as shown on the plans and as approved by the Owner shall be the basis for determination of the final payment quantity. Payment shall be made per sq ft of vertical wall face.

1.03 REFERENCES

- A. Where the specification and reference documents conflict, the Owner's designated representative will make the final determination of the applicable document.
- B. Definitions:
1. Precast Modular Block Freestanding Wall (PMB-FSW) Unit – machine-placed, “wet cast” concrete modular block wall unit.
 2. Leveling Pad – hard, flat surface upon which the bottom course of precast modular blocks are placed. The leveling pad may be constructed with crushed stone or cast-in-place concrete. A leveling pad is not a structural footing.
 3. Foundation Zone – soil zone immediately beneath the leveling pad.
- C. Reference Standards
1. Design
 - a. Minimum Design Loads for Buildings and Other Structures – ASCE/SEI 7-16.
 - b. International Building Code, 2024 Edition.
 - c. American Concrete Institute Building Code Requirements for Structural Concrete – ACI 318-19.
 - d. Precast Modular Block Design Manual Volume I: Gravity Walls, Aster Brands, 2022.
 2. Precast Modular Block Units
 - a. ACI 201 – Guide to Durable Concrete
 - b. ACI 318 – Building Code Requirements for Structural Concrete
 - c. ASTM C33 – Standard Specification for Concrete Aggregates
 - d. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - e. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
 - f. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - g. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - h. ASTM C150 – Standard Specification for Portland Cement
 - i. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - j. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
 - k. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
 - l. ASTM C595 – Standard Specification for Blended Hydraulic Cements.
 - m. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - n. ASTM C666 – Standard Test Method for Concrete Resistance to Rapid Freezing and Thawing.
 - o. ASTM C845 – Standard Specification for Expansive Hydraulic Cement.
 - p. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
 - q. ASTM C989 – Standard Specification for Slag Cement for Use in Concrete and Mortars.
 - r. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.
 - s. ASTM C1157 – Standard Performance Specification for Hydraulic Cement.
 - t. ASTM C1218 – Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
 - u. ASTM C1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures.
 - v. ASTM C1611 – Standard Test Method for Slump Flow of Self-Consolidating Concrete.
 - w. ASTM C1776 – Standard Specification for Wet-Cast Precast Modular Retaining Wall Units.

- x. ASTM D6916 – Standard Test Method for Determining Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks).
3. Soils
- a. AASHTO M 145 – AASHTO Soil Classification System.
 - b. AASHTO T 104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
 - c. AASHTO T 267 – Standard Method of Test for Determination of Organic Content in Soils by Loss of Ignition.
 - d. ASTM C33 – Standard Specification for Concrete Aggregates.
 - e. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.
 - f. ASTM D448 – Standard Classification for Sizes of Aggregates for Road and Bridge Construction.
 - a. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - g. ASTM D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base and Surface Courses.
 - h. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
 - b. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - i. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - j. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
 - k. ASTM D3080 – Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.
 - l. ASTM D4254 – Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - m. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - n. ASTM D4767- Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils.
 - o. ASTM D4972 – Standard Test Method for pH of Soils.
 - p. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
 - q. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Aggregate by Nuclear Methods (Shallow Depth).
 - r. ASTM G51 – Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing.
 - s. ASTM G57 – Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preconstruction Meeting. As directed by the Owner, the General Contractor shall schedule a preconstruction meeting at the project site prior to commencement of wall construction. Participation in the preconstruction meeting shall be required of the General Contractor, the Retaining Wall Design Engineer (RWDE), the Retaining Wall Installation Contractor (RWIC), the Earthwork/Grading Contractor, and the Qualified Inspection Engineer. The General Contractor shall provide notification to all parties at least 10 calendar days prior to the meeting.
1. Preconstruction Meeting Agenda:
 - a. The RWDE shall be provided the opportunity to explain all aspects of the freestanding wall construction drawings.
 - b. The RWDE shall communicate the required bearing capacity of the soil below the freestanding wall structure.
 - c. The RWIC shall explain all excavation needs, site access and material staging area requirements to the General Contractor and Earthwork/Grading Contractor.
- B. The General Contractor may choose to self-perform any or all the work, and the Earthwork and Grading Contractor may or may not also be the RWIC. Also, the project Civil Engineer or the project Geotechnical Engineer may or may not also be the RWDE.

1.05 SUBMITTALS

- A. Product Data. At least 14 days prior to construction, the General Contractor shall submit a minimum of six (6) copies of the wall product submittal package to the Owner's Representative for review and approval. The submittal package shall include technical specifications and product data from the manufacturer for the following:
1. PMB-FSW System brochure
 2. Precast Modular Block concrete test results specified in paragraph 2.01, subparagraph C of this section as follows:
 - a. 28-day Compressive Strength
 - a. Air Content
 - b. Slump or Slump Flow
 - c. Water-Cement Ratio
- B. Installer Qualification Data. At least 14 days prior to construction, the General Contractor shall submit the qualifications of the business entity responsible for installation of the freestanding wall, the RWIC, per Part 1.07, Paragraph A of this section.
- C. Freestanding Wall Design Calculations and Construction Shop Drawings. Prior to construction, the General Contractor shall furnish construction shop drawings and the supporting structural calculations report to the Owner for review and approval. Unless specifically requested by the Owner, the submittal may be in electronic format. This submittal shall include the following:
1. Signed, sealed, and dated drawings and engineering calculations prepared in accordance with these specifications.
 2. Qualifications Statement of Experience of the RWDE as specified in Part 1.07, Paragraph B of this section.
 3. Certificate of Insurance of the RWDE as specified in Part 1.06, Paragraph B of this section.

1.06 CONSTRUCTION SHOP DRAWING PREPARATION

- A. The Wall Installation Contractor shall coordinate the construction shop drawing preparation with the project Civil Engineer, project Geotechnical Engineer and Owner's Representatives. For PMB-FSW systems with a total exposed height (above grade) of 42 in (1.07 m) or more, the Wall Installation Contractor shall engage the services of a Professional Engineer to prepare sealed, site-specific, construction shop drawings with supporting structural calculations. The construction shop drawings and structural calculations shall be prepared in accordance with all applicable building codes and in general accordance with the manufacturer's written installation recommendations. The Professional Engineer retained to prepare the construction shop drawings and structural calculations shall be a licensed professional engineer in the jurisdiction of the project location. This information shall include, but is not limited to, the following:
1. Current versions of the site, grading, drainage, utility, erosion control, landscape, and irrigation plans.
 2. Electronic CAD file of the civil site plans listed in (1).
 3. Report of geotechnical investigation and all addenda and supplemental reports.
 4. Information pertaining to the magnitude, location, and nature of surcharge loadings acting on or near the proposed wall.
- B. The RWDE shall provide the Owner with a certificate of professional liability insurance verifying the minimum coverage limits are adequate for the size and scale of the freestanding wall design for the project.
- C. Design of the PMB-FSW system shall satisfy the requirements of this section. Where local design or building code requirements exceed these specifications, the local requirements shall also be satisfied.
- D. The RWDE shall note any exceptions to the requirements of this section by listing them at the bottom right corner of the first page of the construction shop drawings.
- E. Approval or rejection of the exceptions taken by the Retaining Wall Engineer will be made in writing as directed by the Owner.
- F. The RWDE shall determine the appropriate standard(s) to be utilized, and to which the PMB-FSW design shall be based upon, except as noted herein. Refer to Part 1.03, Paragraph C, Part 1. Some project Owners may also specify which standard shall be used.
- G. In the event that a conflict is discovered between these specifications and a reasonable interpretation of the design specifications and methods referenced in Paragraph F above, these specifications shall prevail. If a reasonable interpretation is not possible, the conflict shall be resolved per the requirements in Part 1.03, Paragraph A of this section.
- I. Allowable bearing pressure requirements for each freestanding wall shall be clearly shown on the construction drawings.
- K. Seismic Stability. Seismic loading shall be evaluated in accordance with AASHTO Load and Resistance Factor Design (LRFD) methodology, or NCMA Allowable Stress Design (ASD) methodology as determined by the RWDE as referenced in Section 1.06, Part F.

1.07 QUALITY ASSURANCE

- A. RWIC Qualifications. In order to demonstrate basic competence in the construction of PMB-FSW walls, the RWIC shall document compliance with the following:
1. Experience.
 - a. The contractor shall demonstrate competency and experience in constructing retaining walls and provide the Owner with experience documentation as explained in item 2 below.
 2. RWIC experience documentation for each qualifying project shall include:
 - a. Project name and location.
 - b. Date (month and year) of construction completion.
 - c. Contact information of Owner or General Contractor.
 - d. Type (trade name) of PMB-FSW system used.
 - e. Maximum height of the wall constructed.
 - f. Face area of the wall constructed.
 3. In lieu of the requirements set forth in items 1 and 2 above, the RWIC must submit documentation demonstrating competency in PMB-FSW retaining wall construction through a training program that is deemed acceptable by the Owner.
- B. The General Contractor shall retain the services of an Inspection Engineer who is experienced with the construction of PMB-FSW structures to perform inspection and testing. The cost of inspection shall be the responsibility of the General Contractor.
- C. The Inspection Engineer shall perform the following duties:
1. Inspect the construction of the PMB-FSW structure for conformance with construction shop drawings and the requirements of this specification.
 2. Verify that the foundation soils will adequately support the PMB-FSW system without settlement based upon the allowable bearing pressure required in 1.06 C above.
 3. Notify the Wall Installation Contractor of any deficiencies in the wall construction and provide the Wall Installation Contractor a reasonable opportunity to correct the deficiency.
 4. Notify the General Contractor of any construction deficiencies that have not been corrected in a timely manner.
 5. Document all inspection activities on site.
- D. The General Contractor or Owner's engagement of the Inspection Engineer does not relieve the Wall Installation Contractor of responsibility to construct the proposed PMB-FSW system in accordance with the approved construction shop drawings and these specifications.
- E. The Wall Installation Contractor shall inspect the on-site grades and excavations prior to construction and notify the General Contractor if on-site conditions differ from the elevations and grading conditions depicted in the wall construction shop drawings.

1.08 DELIVERY, STORAGE AND HANDLING

- A. The Wall Installation Contractor shall inspect the materials upon delivery to ensure that the proper type, grade and color of materials have been delivered.

- B. The Wall Installation Contractor shall store and handle all materials in accordance with the manufacturer's recommendations as specified herein and in a manner that prevents deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, UV exposure or other causes. Damaged materials shall not be incorporated into the work.
- C. Precast Modular Blocks
- Block units shall be stored in an area with positive drainage away from the blocks and shall be protected from mud and excessive chipping and breakage. Block units shall not be stacked more than three (3) units high in the storage area.

PART 2 – MATERIALS

2.01 PRECAST MODULAR BLOCK FREE-STANDING WALL UNITS

- A. All units shall be wet cast PMB-FSW units conforming to ASTM C1776.
- B. All units for the project shall be obtained from the same manufacturer. The manufacturer shall be licensed and authorized to produce the wall units by the precast modular block system patent holder/licensor and shall document compliance with the published quality control standards of the proprietary precast modular block system licensor for the previous three (3) years, or the total time the manufacturer has been licensed, whichever is less.
- B. Concrete used in the production of the precast modular block units shall be first-purpose, fresh concrete. It shall not consist of returned, reconstituted, surplus or waste concrete. It shall be an original production mix meeting the requirements of ASTM C94 and exhibit the following:

Concrete Mix Properties

Freeze Thaw Exposure Class ⁽¹⁾	Minimum 28-Day Compressive Strength ⁽²⁾	Maximum Water Cement Ratio	Nominal Maximum Aggregate Size	Aggregate Class Designation ⁽³⁾	Air Content ⁽⁴⁾
Moderate	4,000 psi (27.6 MPa)	0.45	1 in (25 mm)	3M	4.5% +/- 1.5%
Severe	4,000 psi (27.6 MPa)	0.45	1 in (25 mm)	3S	6.0% +/- 1.5%
Very Severe	4,500 psi (30.0 MPa)	0.40	1 in (25 mm)	4S	6.0% +/- 1.5%
Maximum Water-Soluble Chloride Ion (Cl ⁻) Content in Concrete, Percent by Weight of Cement ^(5,6)					0.15
Maximum Chloride as Cl ⁻ Concentration in Mixing Water, Parts Per Million					1000
Maximum Percentage of Total Cementitious Materials By Weight ^(7,9) (Very Severe Exposure Class Only):					
Fly Ash or Other Pozzolans Conforming to ASTM C618					25
Slag Conforming to ASTM C989					50
Silica Fume Conforming to ASTM C1240					10
Total of Fly Ash or Other Pozzolans, Slag, and Silica Fume ⁽⁸⁾					50
Total of Fly Ash or Other Pozzolans and Silica Fume ⁽⁸⁾					35
Alkali-Aggregate Reactivity Mitigation per ACI 201					
Slump (Conventional Concrete) per ASTM C143 ⁽¹⁰⁾				5 inches +/- 1½ inches (125 mm +/- 40 mm)	
Slump Flow (Self-Consolidating Concrete) per ASTM C1611				18 inches – 32 inches (450 mm – 800 mm)	

(1) Exposure class is as described in ACI 318. "Moderate" describes concrete that is exposed to freezing and thawing cycles and occasional exposure to moisture. "Severe" describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture. "Very Severe" describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture and exposed to deicing chemicals. Exposure class should be specified by owner/purchaser prior to order placement.

(2) Test method ASTM C39.

(3) Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregates for Concrete*.

(4) Test method ASTM C231.

(5) Test method ASTM C1218 at age between 28 and 42 days.

(6) Where used in high sulfate environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents.)

(7) The total cementitious material also includes ASTM C150, C595, C845, C1157 cement. The maximum percentages shall include:

(a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.

(b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.

(c) Silica fume, ASTM C1240, present in a blended cement.

(8) Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

(9) Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze/thaw durability in a detailed and current testing program.

(10) Slump may be increased by a high-range water-reducing admixture.

C. Each concrete block shall be cast in a single continuous pour without cold joints. With the exception of half-block units, corner units and other special application units, the precast modular block units shall conform to the nominal dimensions listed in the table below and be produced to the dimensional tolerances shown.

Block Type	Dimension	Nominal Value	Tolerance
FSW Unit	Height	18 in (457 mm)	+/- 3/16 in (5 mm)
	Length	46-1/8 in (1172 mm)	+/- 1/2 in (13 mm)
	Width	24 in (610 mm)	+/- 1/2 in (13 mm)

*Block tolerance measurements shall exclude variable face texture

D. With the exception of cap and coping units, all individual block units shall have a nominal height of 18 in (457 mm). Full-height wall panels shall not be permitted.

E. With the exception of half-block units, top units, corner units and other special application units, the precast modular block units shall have two (2), circular dome shear knobs that are 10 in (254 mm) maximum in diameter and 4 in (102 mm) maximum in height. The shear knobs shall fully index into a continuous shear channel in the bottom of the block course above. Peak interlock shear between any two (2) vertically stacked precast modular block units measured in accordance with ASTM D6916 shall exceed 6,500 lbs/ft (94.9 kN/m) at a minimum normal load of 500 lbs/ft (7.30 kN/m) as well as an ultimate peak interface shear capacity in excess of 11,000 lbs/ft (160.5 kN/m) Test specimen blocks tested under ASTM D6916 shall be actual, full-scale production blocks of known compressive strength. The interface shear capacity reported shall be corrected for a 4,000 psi (27.6 MPa) concrete compressive strength.

- F. The precast modular block units shall be manufactured with an integrally cast shear key, lip or knob(s) that establishes a vertical wall face (zero standard horizontal set-back for subsequent block courses).
- G. The precast modular block unit face texture shall be selected by the owner from the available range of textures available from the precast modular block manufacturer. Each textured block facing unit shall be a minimum of 5.76 sq ft (0.54 sq m) with a unique texture pattern that repeats with a maximum frequency of once in any 15 sq ft (1.39 sq m) of wall face.
- H. The block color shall be selected by the owner from the available range of colors available from the precast modular block manufacturer.
- I. All precast modular block units shall be sound and free of cracks or other defects that would interfere with the proper installation of the unit, impair the strength or performance of the constructed wall. PMB-FSW units to be used in exposed wall construction shall not exhibit chips or cracks in the exposed face or faces of the unit that are not otherwise permitted. Chips smaller than 1.5 in (38 mm) in its largest dimension and cracks not wider than 0.012 in (0.30 mm) and not longer than 25% of the nominal height of the PMB-FSW unit shall be permitted. PMB-FSW units with bug holes in the exposed architectural face larger than 0.75 in (19 mm) in its largest dimension shall be rejected. PMB-FSW units that exhibit cracks that are continuous through any solid element of the PMB-FSW unit shall not be incorporated in the work regardless of the width or length of the crack.
- J. Preapproved Manufacturers.
 - 1. Manufacturers of Redi-Rock Retaining Wall Systems as licensed by Redi-Rock International, LLC, 3890 Charlevoix Avenue, Suite 310, Petoskey, MI 49770 USA; telephone (866) 222-8400; website: www.redi-rock.com.
- K. Substitutions. Technical information demonstrating conformance with the requirements of this specification for an alternative PMB-FSW system must be submitted for preapproval at least 14 calendar days prior to the bid date. Acceptable alternative PMB-FSW systems, otherwise found to be in conformance with this specification, shall be approved in writing by the owner 7 days prior to the bid date. The Owner's Representative reserves the right to provide no response to submissions made out of the time requirements of this section or to submissions of wall systems that are determined to be unacceptable to the owner.
- L. Value Engineering Alternatives. The owner may evaluate and accept systems that meet the requirements of this specification after the bid date that provide a minimum cost savings of 20% to the Owner. Construction expediency will not be considered as a contributing portion of the cost savings total.

2.02 LEVELING PAD

- A. The PMB-FSW units shall be placed on a leveling pad constructed from crushed stone or unreinforced concrete. The leveling pad shall be constructed to the dimensions and limits shown on the construction shop drawings.
- B. Crushed stone used for construction of a granular leveling pad shall be a durable crushed stone conforming to No. 57 (or equivalent) size per ASTM C33 with the following particle-size distribution requirements per ASTM D422:

<u>U.S. Standard Sieve Size</u>	<u>% Passing</u>
1-1/2 in (38 mm)	100
1 in (25 mm)	95-100
1/2 in (13 mm)	25-60
No. 4 (4.76 mm)	0-10
No. 8 (2.38 mm)	0-5

- C. Concrete used for construction of an unreinforced concrete leveling pad shall satisfy the criteria for AASHTO Class B. The concrete should be cured a minimum of 12 hours prior to placement of the PMB-FSW units and exhibit a minimum 28-day compressive strength of 2,500 psi (17.2 MPa).

PART 3 – EXECUTION

3.01 GENERAL

- A. All work shall be performed in accordance with OSHA safety standards, state and local building codes and manufacturer's requirements.
- B. The General Contractor is responsible for the location and protection of all existing underground utilities. Any new utilities proposed for installation in the vicinity of the freestanding wall, shall be installed concurrent with the wall construction. The General Contractor shall coordinate the work of subcontractors affected by this requirement.
- C. New utilities installed below the wall shall be backfilled and compacted to a minimum of 98% maximum dry density per ASTM D698 standard proctor.
- D. The General Contractor is responsible to ensure that safe excavations and embankments are maintained throughout the course of the project.
- E. All work shall be inspected by the Inspection Engineer as directed by the General Contractor.

3.02 EXAMINATION

- A. Prior to construction, the General Contractor, Wall Installation Contractor and Inspection Engineer shall examine the areas in which the wall will be constructed to evaluate compliance with the requirements for installation tolerances, worker safety and any site conditions affecting performance of the completed structure. Installation shall proceed only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

- A. Fill Soil.

1. The Inspection Engineer shall verify that any fill soil installed in the foundation zone beneath the wall leveling pad satisfies the requirements of the construction shop drawings.
- B. Excavation.
1. The Grading Contractor shall excavate to the lines and grades required for construction of the wall as shown on the construction shop drawings. The Grading Contractor shall minimize over-excavation.
 2. Over-excavated soil shall be replaced with compacted fill in conformance with the specifications of the Wall Design Engineer and "Division 31, Section 31 20 00 – Earthmoving" of these project specifications.
 3. Embankment excavations shall be bench cut as directed by the project Geotechnical Engineer and inspected by the Inspection Engineer for compliance.
- C. Foundation Preparation.
1. Prior to construction of the PMB-FSW wall, the leveling pad area and undercut zone (if applicable) shall be cleared and grubbed. All topsoil, brush, frozen soil and organic material shall be removed. Additional foundation soils found to be unsatisfactory beyond the specified undercut limits shall be removed and replaced with approved fill as directed by the project Geotechnical Engineer. The Inspection Engineer shall ensure that the undercut limits are consistent with the requirements of the project Geotechnical Engineer and that all soil fill material is properly compacted according to the project specifications. The Inspection Engineer shall document the volume of undercut and replacement.
 2. Following excavation for the leveling pad and undercut zone (if applicable), the Inspection Engineer shall evaluate the in-situ soil in the foundation and retained soil zones.
 - a. The Inspection Engineer shall verify that the foundation soil exhibits sufficient ultimate bearing capacity to satisfy the requirements indicated on the freestanding wall construction shop drawings per paragraph 1.06 I of this section.
- D. Leveling Pad.
1. The leveling pad shall be constructed to provide a level, hard surface on which to place the first course of PMB-FSW units. The leveling pad shall be placed in the dimensions shown on the construction shop drawings and extend to the limits indicated.
 2. Crushed Stone Leveling Pad. Crushed stone shall be placed in uniform maximum lifts of 6 in (152 mm). The crushed stone shall be compacted by a minimum of 3 passes of a vibratory compactor capable of exerting 2,000 lbs (8.9 kN). of centrifugal force and to the satisfaction of the Inspection Engineer.
 3. Unreinforced Concrete Leveling Pad. The concrete shall be placed in the same dimensions as those required for the crushed stone leveling pad. The Wall Installation Contractor shall erect proper forms as required to ensure the accurate placement of the concrete leveling pad according to the construction shop drawings.

3.04 PRECAST MODULAR BLOCK FREE-STANDING WALL SYSTEM INSTALLATION

- A. The PMB-FSW structure shall be constructed in accordance with the construction shop drawings, these specifications and the recommendations of the wall system component manufacturers. Where conflicts exist between the manufacturer's recommendations and these specifications, these specifications shall prevail.
- B. Precast Modular Block Installation
 - 1. The first course of block units shall be placed with the front face edges tightly abutted together on the prepared leveling pad at the locations and elevations shown on the construction shop drawings. The Wall Installation Contractor shall take special care to ensure that the bottom course of block units are in full contact with the leveling pad, are set level and true and are properly aligned according to the locations shown on the construction shop drawings.
 - 2. Subsequent courses of block units shall be installed with a running bond (half block horizontal course-to-course offset). With the exception of 90 degree corner units, the shear channel of the upper block shall be fully engaged with the shear knobs of the block course below. The upper block course shall be pushed forward to fully engage the interface shear key between the blocks and to ensure consistent face batter and wall alignment.
 - 3. If included as part of the PMB-FSW design, cap units shall be secured with an adhesive in accordance with the precast modular block manufacturer's recommendation.
- C. Construction Tolerance. Allowable construction tolerance of the retaining wall shall be as follows:
 - 1. Deviation from the horizontal alignment of the wall face shall not exceed a 1/200 ratio when measured along straight wall section and shall not exceed 2 in (50 mm) from staked location.
 - 2. The maximum allowable offset (horizontal bulge) of the face in any precast modular block joint shall be 1/2 in (13 mm).
 - 3. The base of the precast modular block wall excavation shall be within 2 in (50 mm) of the staked elevations, unless otherwise approved by the Inspection Engineer.
 - 4. Differential vertical settlement of the face shall not exceed a 1/100 ratio of wall length and shall not exceed 3 in (75 mm).
 - 5. The maximum allowable vertical displacement of the face in any precast modular block joint shall be 1/2 in (13 mm).
 - 6. Deviation from the overall design batter shall not exceed 1° from vertical.
 - 7. Refer to local project requirements for additional allowable construction tolerances.

3.05 COMPLETION

- A. The General Contractor shall confirm that the as-built PMB-FSW system geometries conform to the requirements of this section. The General Contractor shall notify the Owner of any deviations.

END OF SECTION 32 35 00