

SP-091002
NEW



**SPECIAL PROVISIONS
FOR
MODULAR BLOCK WALL (HEAVY)**

Story County

STP-U-0155(666)- -70-85

Effective Date

November 17, 2009

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

PART 1 - GENERAL

1.01 Description

This work includes furnishing and installing a gravity type modular retaining wall, wall fill, and granular backfill to the lines and grades shown on the plans. Gravity type modular retaining walls are defined as system that typically uses larger precast units without requiring mesh or straps behind the block within the backfill.

1.02 Design

A. Wall Design Engineer.

The wall design shall be performed by a Professional Engineer licensed in the State of Iowa that prepares and seals the design submittals as defined in this Special Provision.

B. Minimum Design Requirements.

Retaining walls shall be designed in accordance with ASTM C 90 or ASTM C1372 and applicable recommendations of the National Concrete Masonry Association (NCMA) Design Manual for Segmental Retaining Walls. The following table summarizes the minimum design criteria and is based upon the structure being critical:

<u>External Stability</u>	<u>Minimum Factor of Safety</u>
Sliding, $F_{s_{sl}}$	1.5
Overturning, $F_{s_{ot}}$	2.0
Bearing Capacity, $F_{s_{bc}}$	2.0

<u>Local Stability</u>	<u>Minimum Factor of Safety</u>
$F_{s_{sl}}$ (Maximum Unreinforced Height)	1.5
$F_{s_{ot}}$ (Maximum Unreinforced Height)	2.0
Shear Facing Units, $F_{s_{sc}}$	1.5
Facing Connection Strength, $F_{s_{cs}}$	1.5
Global Stability	1.5

C. Submittals.

Prior to the beginning of wall construction, the Contractor shall, in accordance with [Article 1105.03](#) of the Standard Specifications, submit for review detailed design calculations including soil bearing pressure, construction drawings, and shop drawings prepared and sealed by the Wall Design Engineer.

PART 2 – MATERIALS.

The wall shall be manufactured by one of the following companies:

Redi-Rock International	Stone Strong, LLC	Allan Block Corporation (double block wall)
05481 U.S. 31 South Charlevoix, MI 49720 866-222-8400	1620 South 70 th St., Suite 105 Lincoln, NE 68506 877-501-5652	5300 Edina Ind. Blvd., Suite 100 Edina, MN 55439 952-835-5309

The supplier of all substantial material components and the Wall Design Engineer shall have demonstrated experience in gravity modular block wall systems for previous projects.

2.01 Concrete Units.

Concrete segmental units and cap blocks shall conform to the requirements of ASTM C 1372 except that they shall have a minimum 28 day compressive strength of 5500 psi (40 MPa) for any one individual unit, and 6000 psi (41 MPa) for the average of three units. The 24 hour water absorption rate shall not exceed 5%. The top surface of cap blocks shall be sloped 10:1 from front to back or from a crown at the center.

Sampling and testing of block shall conform to ASTM C 140, except that Section 6.2.4 shall be replaced with:

The specimens shall be coupons cut from a face shell of each unit and sawn to remove any face shell projections. The coupon size shall have a height to thickness ratio of 2 to 1 before capping and a length to thickness ratio of 4 to 1. The coupon shall be cut from the unit such that the coupon height dimension is in the same direction as the unit height dimension. Compressive testing of full size units shall not be permitted. The compressive strength of the coupon shall be assumed to represent the net area compressive strength of the whole unit.

Freeze-thaw durability testing will be required as described in ASTM C 1372 Sections 4.2, 4.2.1, and 7.3. Testing shall be in accordance with ASTM C 1262.

Specimens shall meet weight (mass) loss limits for testing in water as required in ASTM C 1372 Section 4.2.1.

Specimens shall also be tested in a 3% saline solution and conform with either of the following:

1. The weight (mass) loss of each of five test specimens at the conclusion of 40 cycles shall not exceed 1% of its initial weight (mass); or
2. the weight (mass) loss of four out of five specimens at the conclusion of 50 cycles shall not exceed 1.5% of its initial weight (mass).

Testing shall be continued until one of the following occurs:

1. The weight (mass) loss each of five test specimens exceeds 2% of its initial weight (mass); or
2. the weight (mass) loss of one of the five test specimens exceeds 2.5% of its initial weight (mass); or
3. the specimens have been tested for at last 100 cycles.

Complete durability test reports for water and saline conditions, including the cycle number at which failure occurred, shall be submitted to the Engineer.

All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the construction.

Modular units dimension shall not differ more than $\pm 1/16$ inch (± 1.5 mm).

2.02 Leveling Pad.

The type of materials used for the leveling pad shall be as recommended by the supplier/manufacturer. If granular material is recommended for the leveling pad, it shall be specific backfill meeting the requirements of [Section 4132](#) of the Standard Specifications. If unreinforced concrete is recommended for the leveling pad, it shall be Class C concrete meeting the requirements of the [Materials I.M. 529](#) and [Section 2403](#) of the Standard Specifications.

2.03 Unit Fill.

If required by the construction drawings, fill of concrete units in place shall be Porous Backfill meeting the requirements of [Section 4131](#) of the Standard Specifications.

2.04 Subdrains.

The subdrains shall be a minimum of 4 inches (100 mm) in diameter and meet the requirements of [Article 4143.01, B](#), of the Standard Specifications.

[Standard Road Plan RF-19F](#) Type A outlet shall be provided and fitted with a [Standard Road Plan RF-19E](#) rodent guard.

2.05 Backfill

The fill soil material behind the wall shall be Granular Backfill meeting the requirements of [Section 4133](#) of the Standard Specifications.

2.06 Certifications.

Contractor shall submit to the Engineer a notarized manufacturer's certification, at least 14 days prior to the preconstruction conference, stating that the modular units meet the requirements of this Special Provision.

PART 3 – CONSTRUCTION.

3.01 Construction Supervision.

modular units supplier shall provide a qualified and experienced representative on site at beginning of wall construction for up to 3 days at no additional cost to the Contracting Authority.

The Contractor's field construction supervisor shall have demonstrated experience and be qualified to direct all work at the site.

3.02 Excavation.

Contractor shall excavate to the lines and grades shown as the reinforced earth zone on the construction drawings. Contractor shall take precautions to minimize over-excavation. Excavation support, if required, shall be designed and at no additional cost to the Contracting Authority.

3.03 Foundation Soil Preparation.

Foundation soil shall be excavated as required for base course leveling pad dimensions and limits of reinforced earth zone as shown on the construction drawings.

Foundation soil shall be examined by the Engineer to assure that the actual foundation soil strength meets or exceeds the assumed design bearing strength. Soils not meeting required strength shall be removed and replaced with soil meeting the design criteria.

The earth foundation shall have a density equal to or greater than 90 percent Standard Proctor Density. The earth foundation shall be stepped at the required intervals to keep it a minimum 2 foot (600 mm) below the finished grade.

3.04 Leveling Pad.

The Contractor shall place the leveling pad a minimum of 9 inches (230 mm) in thickness.

The Contractor shall construct the leveling pad to insure complete contact of the retaining wall unit with the leveling pad. Gaps shall not be allowed between the retaining wall unit and the leveling pad.

3.05 Unit Installation.

Materials shall be installed at the proper elevation and orientation shown in the plans. The concrete segmental units shall be installed in general accordance with the approved submittals in [Article 1.02, C](#) above. The plans shall govern in any conflict between the two requirements.

3.06 Subdrains.

Subdrains shall be installed as shown in the construction drawings to maintain gravity flow of water to outside of the reinforced earth zone. The subdrains shall outlet into a storm sewer access or along a slope at an elevation lower than the lowest point of the pipe within the wall.

Porous backfill, in accordance with [Article 2.05](#) above shall be placed around the subdrain to a minimum cover of 3 inches (75 mm).

3.07 Backfill Placement.

The granular backfill shall be compacted in accordance with [Article 2107.03, H](#) of the Standard Specifications. The granular backfill shall be placed as shown on the construction drawings in maximum 8 inch (200 mm) lifts and compacted to a minimum 95% of standard Proctor density (ASTM D 698). The moisture limits shall be between 3% under optimum moisture to not more than the optimum moisture content.

Only hand-operated compaction equipment shall be allowed within 3 feet (1 m) of the front of the wall face.

PART 4 – MEASUREMENT AND PAYMENT

4.01 Method of Measurement

A. Modular Block Wall (Heavy)

The Engineer will measure the area of Modular Block Wall (Heavy) in square feet (square meters), from measurements of the front face of the wall in place. The height will be measured from the top of the leveling pad to the top of the wall, including coping or cap block.

B. Granular Backfill Material

The quantity of granular backfill material hauled and placed will not be measured.

C. Excavation

Excavation for preparing the reinforced earth zone for construction of the wall will be classed according to [Section 2102](#) of the Standard Specifications. The quantity will not be measured.

4.02 Basis of Payment

A. Modular Block Wall (Heavy)

For the quantity of Modular Block Wall (Heavy) constructed, the Contractor will be paid the contract unit price per square foot (square meter). This payment shall be full compensation for furnishing all materials, tools, and labor for the performance of all work necessary to construct the wall, in accordance with the contract documents, including the design, excavation, foundation preparation, leveling pad, all backfill, porous backfill, finished grade shaping, and furnishing and placing drainage pipe subdrains.

B. Granular Backfill Material.

For Contractor furnished granular backfill material for the reinforced earth zone, the Contractor will not be paid for the quantity of material furnished. This will be included in the payment for Modular Block Wall (Heavy).

C. Excavation.

For the quantity of each class of excavation for preparing the reinforced earth zone for construction of the wall, the Contractor will be not be paid for the quantity removed. This will be included in the payment for Modular Block Wall (Heavy).