SPECIAL PROVISIONS
City Job Numbers: 1303 & 1308
1720 New Street & 2305 W. 4th Street Retaining Walls
May 22, 2015

Addendum #2
May 22, 2015

S-13 (2411) PREFABRICATED MODULAR BLOCK WALL (PMBW) WITH AND WITHOUT SOIL REINFORCEMENT

This work consists of furnishing certified design calculations, shop drawings, fabrication, furnishing and installing a non-structural leveling pad, prefabricated modular block wall, wall construction, excavation and backfill (not included in MnDOT 2451 and 2105) and other services necessary for construction of the wall.

The work shall be performed in accordance with the applicable provisions of MnDOT Specifications 3126, 3137, 3149, these Special Provisions, and in close conformity with the lines, grades, standards, design, details, and dimensions shown on the Plans or as otherwise established.

Prefabricated modular block wall systems shall be selected from the MnDOT pre-qualified wall system list at the following web site:

http://www.dot.state.mn.us/products/index.html

S-1.1 DEFINITIONS AND DESIGN REQUIREMENTS

I. DEFINITIONS

A. Gravity PMBW: A retaining wall system consisting of wet cast concrete blocks that resists earth pressures and other loads solely by the weight of the blocks, and block infill (if applicable).

B. Backfill Soil (for gravity walls only): Soil placed in the backfill zone meeting the requirements of MnDOT 3149 and the “Materials” section of this specification.

C. Backfill Zone (for gravity walls only): Practical limit for placement of backfill soil. Limit begins at the bottom corner of the aggregate portion of the leveling pad and extends at a slope determined by OSHA regulations and the in-situ soils. Refer to sheet C8.0 of each wall for typical section for backfill zone pay limit. Soil in this zone shall meet the requirements of MnDOT 3149 and the “Materials” section of this specification.

D. Retained Soil: Soil retained by the PMBW wall behind the backfill zone for gravity walls.

E. Foundation Soil: Soil below the leveling pad.

F. Prefabricated Modular Blocks (PMB): Wet cast precast concrete modules used to contain the soil in position at the face of a wall. For gravity walls blocks are used to resist horizontal earth forces.

G. Block Depth: The block "depth" is measured from the front face of the block to the back face of the block. The maximum block depth shall be 60", exclusive of face relief.

H. Coping: Attachment placed or cast on top of the wall to tie together the facing blocks and provide an aesthetic finish to the top of the wall.

I. Geotextile Filter: Material placed behind blocks, which prevents migration of fines though the joints, yet still allows for drainage of water through joints.

J. Temporary Shims: Temporary supports used to position the blocks during construction. For permanent shim requirements see Section S-1.4E.

K. Impervious Layer (Geomembrane): A layer of puncture-free and flexible, roughened sheet HDPE, LLDPE or PVC at least 30 mils (0.75 mm) thick placed below the roadway surface to prevent surface water from entering into the wall system. The Impervious Layer (Geomembrane) shall meet the requirements of the materials section of this specification.

L. PMBW System Supplier: The vendor who's name appears on the MnDOT pre-qualified wall system list and is responsible for supplying the PMBW system including blocks and connections. The PMBW System Supplier designs the components of the PMBW system, designs the system for internal stability and prepares the shop drawings.

M. Prequalified PMBW System: A PMBW wall system which has been prequalified by the MnDOT Structural Wall Committee. A list of prequalified PMBW systems can be found at http://www.dot.state.mn.us/products/index.html

N. Gravity PMBW Design Height (GH): For walls with level fill, the wall design height is from the top of block or coping to the bottom of the aggregate portion of the leveling pad. For walls with sloping fills or complex geometries see the AASHTO LRFD Bridge Design Specifications Chapter 11 for design height.

O. Supporting Roadway: See Design Section Item F.

P. Exposed Height: The distance from the finished ground line at the top of the wall to the finished ground line at the base of the wall. See Design Section B.

Q. Engineer: The consulting engineer. (Northland Consulting Engineers)

II. DESIGN REQUIREMENTS

The wall designer shall be an engineer licensed by the State of Minnesota and shall prepare, sign, and date the design calculations, shop drawings, and the "PMBW Design Certification Letter" provided herein for each PMBW in the contract. The wall designer shall have experience in the design and construction of a minimum of five PMBW projects of similar size and scope as the project currently under design. This experience shall include PMBWs of equivalent complexity and similar height to the walls being designed as part of this contract. A letter certifying the wall designer's previous design experience shall be submitted to the Engineer.

The design shall consider the internal and external stability of the wall mass including eccentricity (overturning), sliding, and bearing pressure including temporary construction slopes or stockpiles. The design shall be in accordance with any restrictions for the chosen PMBW system, the plans, specifications and the PMBW design and construction provisions of the AASHTO LRFD Bridge Design Specifications, latest with all interim revisions.

The design shall meet the following requirements:

A. Only PMBW systems listed on the MnDOT pre-qualified supplier list at the letting date will be allowed. The Contractor shall include in the shop drawing and calculation submittal a copy of the MnDOT pre-qualification letter for the PMBW system, and any deviations of details from the previously submitted pre-qualification shall also be specifically outlined in the letter, including MnDOT approval of the deviations.

B. The exposed height is the distance from finished ground line at the top of the wall to the finished ground line at the base of the wall. The exposed wall height shall be less than 8' for gravity walls. All walls shall have a minimum of 6" of block below the finished ground line at the base.

C. For gravity PMBW's if backfill soil is placed behind the wall at a 1 V: 1 H from the bottom corner of the aggregate portion of the leveling pad, a unit weight of 0.120 kcf and friction angle of 34 degrees may be used for

design if adequate right of way (ROW) is available and there are no utility conflicts. If backfill soil is placed behind the wall at less than a 1 V: 1 H from the bottom corner of the concrete of the leveling pad or for retained soil (outside of the backfill zone) properties are defined in the Geotechnical Report, but not to exceed a friction angle of 30 degrees. Shop drawings shall show backfill limits consistent with the design assumptions.

D. The contribution from passive resistance in front of the wall shall not be allowed from the finished ground line to a distance of 2' below the finished ground line.

E. The design life for the wall system other than soil reinforcement and connections shall be 75 years.

F. Gravity PMBW's shall be designed to support traffic. A vehicular roadway or parking lot shall not be situated within a 1V: 1H horizontal distance measured from the front face bottom corner of the bottom block. The horizontal distance shall be determined for each wall measured at the highest portion of the wall. A vehicular live load shall be applied, and a surcharge must be applied to account for snow loads, future maintenance operations, or future regrading. The surcharge shall be 120 psf with a maximum load factor of 1.35 and a minimum load factor of 1.0.

G. Differential settlement shall be less than 1/200 along the length of the wall and normal to the wall alignment. Adequate joint width/or slip joints shall be provided to accommodate movements without block cracking.

The wall shall be designed and detailed to accommodate differential movements and loads from adjacent structures or structures intercepting the blocks.

All PMBW's shall have 1 foot coarse aggregate per MnDOT Spec 3137 CA-3 behind the block and geotextile fabric per MnDOT Spec 3733.

H. Minimum radius requirements can be found on the MnDOT Approved Products web site.

I. Lateral Earth Pressure for gravity PMBW's shall be calculated according to the Coloumb method in AASHTO LRFD Bridge Design Specifications, Article 3.11.5.3. The magnitude and resultant loads and resisting forces shall be calculated according to AASHTO LRFD Bridge Design Specifications, Article 3.11.5.9.

J. All ends of the wall shall have corner or radius treatments when they do not abut up to a fixed feature on the project (bridge abutment, other wall, building, etc.). This is to prevent erosion around the end of wall, unsightly exposed ends of blocks and ease of matching in with the existing and fill slopes. The ends are then turned back inward and buried into the soil.

Gravity PMBW's shall be set on an aggregate leveling pad (meeting the minimum requirements above).

K. No drainage systems other than what is required for the wall and highway drainage shall be placed within the backfill soil zone. The wall design shall include necessary details or design modifications to accommodate the drainage system. The placement of the drainage system shall occur only during construction backfilling of the wall.

L. The drainage system shall consist of perforated pipe per MnDOT 3245 wrapped with a type I geotextile per MnDOT 3733. The pipe shall be placed such that water drains freely from the pipe, typically a 1% grade and 3 foot minimum radius bends. Provide outlets as required due to expected flow rate with a minimum spacing of 16 feet. Outlet the drainage system as shown in the typical wall section. The designer shall take into account the location of wall drainage systems in the layout and step locations of wall leveling pads and to ensure the wall drainage system is compatible with the leveling pad step locations. The shop drawings for each wall shall denote the location of the drainage system components, including the station of each outlet penetration through the wall and whether the flow is outletted through the slope in front of the wall or into a drainage structure.

M. The ground on the exposed side of the wall shall slope away from the wall. The surface water on the backfill side shall be drained away from the wall to prevent runoff next to the facing blocks and ponding above the backfill zone. Surface run-off shall not be designed to pass over the top of the wall. A wall coping, drainage system, or a properly designed ditch shall be used to carry run-off water along the wall to be properly deposited.

N. Coping details shall include joints no more than every 20 feet along the length of the wall. Locate coping joints to align with the joints between the blocks.

O. Stability Analysis shall be conducted. All appurtenances behind, in front of, under, mounted on, or passing through the wall such as drainage

structures, utilities, noise wall, barrier and moment slab, footings, traffic, slope surcharge or other appurtenances shown on the plans shall be accounted for in the stability analysis. For more detailed stability analysis requirements see Section S-1.2.I.8

P. For walls that include pedestrian railings or barriers, the Contractor shall coordinate all design and detailing, including the connection between the railing and the wall, and all construction procedures, with the wall system supplier. All of the necessary details shall be included in the shop drawings. It is also the responsibility of the Contractor to ensure that all railings Including connection details, are constructible and compatible with the specific PMBW system and meet the plans, design requirements and specifications for the project. No payment shall be made for additional rail quantities or work.

Pedestrian railings and connections attached to units shall be designed to resist loads per AASHTO LRFD Bridge Design Specifications, Article 13.8. The units shall be designed to fully resist the pedestrian live load.

S. Gravity PMBW's with open core "bin" type units shall be designed according to AASHTO LRFD Bridge Design Specifications, Articles 11.11.4.3 and 11.11.4.4 with 100% of the soil-fill inside the units for applied bearing and a maximum of 80% of the soil-fill inside the units as effective in resisting overturning. The soil-fill inside the units shall meet the requirements of MnDOT Spec 3137 CA-3 with Class A aggregates (crushed quarry aggregates) and a friction angle of 36 degree's shall be assumed for design.

T. Stacking blocks front to back to achieve a greater wall depth is not permitted.

U. Traffic barriers and moment slabs shall meet the requirements of Test Level 4 (TL-4) There are three possible methods for approval of traffic barriers:

a. Test Method: The barrier, connection, wall, and backfill, shall be crash tested as a system per NCHRP Report 350 or MASH (08) requirements.

b. Analytical Method: The FHWA allows the use of bridge barrier designs that are similar to a crash tested design based on an analytic comparison using the methodology outlined in Section 13 of the AASHTO

LRFD Bridge Design Specifications. The FHWA policy and an example comparison can be obtained at:

http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/ctrmeasures/bridge_railings/

For either method (a) or (b), FHWA acceptance is necessary and shall include a cross section detail of the barrier and slab, including all dimensions.Calculations validating the AASHTO LRFD Bridge Design Specifications Article 13 provisions must be included. No variation in the details will be allowed without written approval of the FHWA.

c. Test and Analytical Method: The barrier shall be crash tested per NCHRP Report 350 or MASH (08) requirements and connection, moment slab, wall, and reinforced soil shall be designed analytically per NCHRP Report 663 "Design of Roadside Barrier Systems Placed on MSE Retaining Walls" and this specification.

Regardless of what barrier approval method is used, traffic barriers and moment slabs shall be detailed to allow at least 2 inches of horizontal movement prior to making contact with PMBW block. The traffic barrier shall also meet the following requirements:

S-1.2 SUBMITTAL REQUIREMENTS AND MnDOT QUALITY ASSURANCE (QA) REVIEW

Shop Drawing and Calculation Submittal:

The Contractor shall be responsible to review all available geotechnical investigation reports, and the Contractor's signature on the proposal shall certify that this review has been performed and that any relevant geotechnical information has been provided to the designer and PMBW System Supplier of the PMBWs.

For each wall the PMBW system supplier shall submit two sets of complete, certified and independently checked design computations, five sets of certified shop drawings, and one "PMBW Design Certification Letter" to the Engineer for quality assurance (QA) review allowing at least 30 calendar days for review before beginning the fabrication and construction of the wall system. The shop drawings shall comply with the design plans, and include all details, dimensions, quantities and any information required to lay out and construct the wall.

The submitted information shall include, but not be limited to, the following:

A. Plan shop drawing for the full length of EACH wall containing the following:

1. Beginning and ending stations of wall relative to roadway centerline and any changes in wall alignment.
2. Locations of bridges, piles, existing and other proposed retaining walls, slopes or other objects.
3. Locations of all drainage structures, pipes, signs, light poles and other conflicting existing and planned structures or obstructions as provided in the contract documents. Additional typical sections shall be provided whenever changes happen to the wall such as the addition or change in moment slab or coping, transition to approach span of bridge, etc.

4. Location of existing and planned utilities as provided in the contract documents.
5. Existing and proposed ground elevations.
6. Limits for any construction constraints such as right-of-way, easements, staged construction, etc.
7. Horizontal and vertical curve data for curved walls.
8. Limits of bottom of wall and top of wall, for wall system submitted.

B. Cross section drawing for EACH wall and design change identifying:

1. Location and batter of the wall face.
2. Wall treatment, including impervious geomembrane, traffic barrier(s), cast-in-place moment slab, runoff collection, subsurface and surface drainage pipes & structures.
3. Elevation of leveling pad.
4. Depth of wall embedment below finished grade.
5. Limits of excavation and backfill.
6. Block joint cover (geotextile filter fabric) location and generic material type.

C. Elevation view in equal horizontal and vertical scale for the full length of EACH wall showing:

1. Top and bottom wall elevations, in-place ground line, and finished grade elevation at top and bottom of wall.
2. Details and dimensions for foundation and leveling pad, including steps and setbacks in the leveling pad.
3. Location of drainage structures and construction details around these structures. Locations and details of any penetrations in the facing blocks.

4. Manufacturer name, block type and "depth" dimension for each block.
5. Block configuration for standard and special cut blocks.
6. Summary of quantities for each wall.
7. Block dimensions.

D. Connection details and dimensions between facing blocks, and embedded devices.

E. Details for construction, including but not limited to:

1. Termination at cast-in-place structures and any adjacent slope construction.
2. Connection detail requirements around all obstructions including light and sign supports.
3. Details for constructing blocks lock.
4. ALL internal drainage pipes, systems, and facilities.
5. Other details such as coping or barrier, guardrail, fencing, or noise wall.
6. Impervious geomembrane to block connection detail, and construction sequencing notes.
7. Location of ALL subdrains and outlets of the internal drainage system.
8. Locations and details of any required penetrations in the blocks.
9. Locations and placement details including minimum overlap(s) dimension(s), for geotextile filters.

F. Name of PMBW System Supplier and their QA/QC documents.

G. Test wall construction and details, when specified.

H. General notes required for constructing the wall:

1. Design properties and assumptions regarding material properties, material qualities and construction method.
2. Wall layout information.
3. Materials used in construction.
4. Geotextile filter fabric locations
5. Angle of internal friction used for the design.

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I. Copy of calculations showing:

1. Table of contents page for design computations.
2. List of all assumptions used for all calculations and rationale for each assumption.
3. Design notes page with explanation of symbols and details of any computer programs used. Summary table of design parameter inputs for computer program. Tabulate all calculated capacity to demand ratios to ensure internal, external and compound stability.
4. Block design.
5. Computed applied bearing pressure and factored bearing resistance beneath the wall assuming an estimated total settlement of 1 inch. The computed applied bearing pressure shall be compared explicitly to the owner specified factored bearing resistance.
6. Barrier/slab detail above wall, when applicable.
7. Stability analysis shall include internal and external stability. External stability consists of evaluating sliding, limiting eccentricity (overturning), and bearing resistance. All appurtenances behind, in front of, under, mounted on, or passing through the wall such as drainage structures, utilities, noise wall, barrier and moment slab, footings, traffic, slope surcharge or other appurtenances shown on the plans shall be accounted for in the stability analysis.

Global stability checks and calculations shall be conducted by the design build Contractor's geotechnical engineer.

The Contractor's wall system supplier is required to perform a compound stability check and submit supporting calculations and drawings.

8. Provide a copy of calculations showing magnitude, direction, and location of the forces from any external loads such as traffic surcharge, traffic barrier, moment slab and attachments including impact loading, lighting, signs, bridges, slope surcharge, etc. The design and detailing of the wall system shall take into account these external loads. Walls supporting traffic barriers shall provide complete details and calculations showing conformance with the requirements listed above for Extreme Event II traffic impacts.
9. A set of project-typical hand calculations verifying computer generated output.
10. Verification of the design properties/parameters including results from creep, durability, construction induced damage, junction

strength tests, and any other applicable tests from MnDOT pre-approval documentation. Indicate the appropriate standardized test designation followed for each test.

All design calculations shall be based on assumed conditions at the end of the design life.

J. Indicate the following performance requirements:
1. Anticipated and tolerable movement of the wall for both horizontal and vertical settlements or movements both along and perpendicular to wall.
2. Tolerable block movement.
3. Monitoring and measurement requirements, if any.

All other appropriate design computations.

Shop Drawing and Calculation Submittal Review:

The above information shall be submitted to the Engineer for QA review. The Engineer's QA review of the computations and shop drawings shall not relieve the Contractor of sole responsibility for the wall design, details, computations, and the submission of complete shop drawings for the accurate construction and performance of the wall. The Contractor shall be solely responsible for ensuring that the information submitted by the wall designer and the PMBW System Supplier is in accordance with all contract plans and shall contain all material, fabrication and construction requirements for erecting the wall system complete in place. (For more information about routing and review of submittals see Technical Memorandum No.: 08-11-MRR-02)

S-1.3 MATERIALS

All Materials for the wall system shall conform to requirements of these Special Provisions.

A. Acceptance of Materials:

Unless stated otherwise, at least 3 weeks prior to construction of the PMBW the Contractor shall furnish the Engineer Certificates of Compliance for each material listed below, certifying that all materials comply with the applicable contract specifications, including a copy of all test results. All tests shall be performed by an independent testing laboratory. A Certificate of Compliance shall be provided by the Contractor for each material source. A new Certificate of Compliance shall be provided any time the Contractor changes the source of materials.

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Acceptance will be based on the Certificate of Compliance, accompanying test reports, visual inspection, and/or tests ordered or performed independently by the Engineer. The Engineer retains the right to order or perform independent tests to verify information.

B. **Backfill Soil**: Soil used in the backfill zones shall comply with MnDOT 3149.

C. **Prefabricated Modular Blocks:** The precast concrete blocks shall be wet cast and conform to the following requirements:

1. Concrete reinforcement (if any) shall conform to MnDOT 2472 and shall be galvanized per MnDOT 3394, or epoxy coated per MnDOT 3301. All reinforcing and attachment devices shall be carefully inspected by the Contractor to insure they are true to size and free from defects that may impair their strength and durability.

2. Steel connection elements, tie strip guides or other galvanized devices shall not contact or be attached to the facing block reinforcement steel, unless the block reinforcement is also galvanized.

3. The minimum rebar cover requirement is 1.5 inches.

4. The manufacturer's name, plant identification (if manufacturer has multiple plants) and date of manufacture shall be stenciled with waterproof ink or clearly scribed on the back face of each block.

5. Block colors shall be consistent and free of stains, and blocks should be free of defects, cracks or chips. Blocks that contain visible defects such as, but not limited to, vertical or horizontal seams, conspicuous stains, form marks or color streaks shall be repaired to the satisfaction of the Engineer or removed and replaced at the Contractor's expense.

6. All units used shall be manufactured within the following tolerances:

   a. Height: +/- 3/16 inch
   b. Width: +/- 1/2 inch unless field cut for fitting purposes
   c. Depth: No less than the unit design depth (i.e. 24", 26", 48")
   d. Squareness shall be determined by measuring diagonally across the face; the difference between the two diagonals shall not exceed ½ inch.
   e. Formed patterns or textures designed to be oriented horizontally or vertically shall be aligned with both the horizontal and vertical edges of the block, and the pattern/texture shall cover the entire face of the block.

f. If required, allowance shall be made for texture relief up to 2 inches in depth measured from the front face of the block.

7. The block shall be cast on a level surface and shall be fully supported until a compressive strength of 2500 psi has been attained. A random sample of the concrete shall be taken in accordance with AASHTO T141.

8. Concrete shall be mix number 3Y43 or an air-entrained mix with a minimum compressive strength of 4300 psi, using an approved design meeting the requirements of 2461. Coarse aggregate shall meet the requirements of 3137.2D1. If the system requires a higher strength concrete, the mix design shall meet the requirements of MnDOT 2461 for that higher strength.

9. All units shall be handled, stored, and shipped in a manner to eliminate the risk of chipping, discoloration, cracks, fracture, and excessive bending stresses. Blocks shall be stored on firm blocking or on a paved or otherwise compacted surface so as to protect any block connection devices and the exterior finish. Blocks shall reach 100% of design strength before shipment, as demonstrated by control cylinders kept with the product.

D. **Block Rejection:** Blocks may be rejected because of failure to meet any of the requirements specified above. In addition, any or all of the following defects shall be sufficient cause for rejection:

1. Defects that indicate imperfect molding, including imperfections of the form liner, if there is one.

2. Bending or misalignment of connections.

3. Defects indicating honeycombing or open texture concrete.

4. Any defect on the visible face larger than 1 square inch, cracks on any face, severe chips or other defects caused by defective materials or workmanship.

5. Color variation on front face of block due to excess form oil or other reasons.

6. Tie strips, connecting pins, PVC pipe, or lifting devices set to improper dimensions or tolerances shown on the plans and specified above.

7. Any damage that would prevent making a satisfactory joint.

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S-1.4 CONSTRUCTION REQUIREMENTS

A. **General Requirements**: A Preconstruction Meeting shall be held prior to wall construction beginning and after the Engineer has completed the QA review of the shop drawings and design calculations. At a minimum this meeting shall be attended by the Engineer, Contractor, the Contractor who will erect the wall, and a technical representative from the PMBW system supplier. The Contractor shall provide a complete written sequence of PMBW construction at the meeting and review the sequence, any construction issues, the specifications and the PMBW system requirements and determine any issues that need to be resolved prior to construction.

The Contractor shall be solely responsible to coordinate construction of PMBWs with bridge, roadway, and other construction and ensure that resulting or existing obstructions shall not impact the construction or performance of the wall.

All PMBW system blocks shall be constructed in accordance with the QA reviewed shop drawings, including the architectural features specified.

B. **Foundation Preparation:** The following statements shall apply to MnDOT 2451: The foundation for the structure shall be graded level for a width equal to the length of the PMBW width or as shown on the plans. The entire graded area shall be compacted according to MnDOT 2451 before wall construction begins.

Prior to wall construction and subsequent to clearing and grubbing any unsuitable foundation material shall be excavated and replaced with granular fill per these specifications, and compacted with a smooth wheel steel vibratory drum roller.

The Contractor shall develop and implement a plan to protect the open excavation from surface drainage during construction and until the wall is placed. The Contractor shall protect the excavation against collapse.

C. **Backfill Soil Placement:** Soil placement shall closely follow erection of each row of blocks. Soil shall be placed in a way that does not cause damage or disturbance to the wall.

Compaction beyond 3 feet of the back face of the prefabricated modular blocks shall be compacted to a density of not less than 100 percent of maximum density using the specified density method in accordance to MnDOT 2105.3.F.1. or the granular penetration index method in accordance with MnDOT 2105.3.F.3. The maximum lift size shall be 12 inches loose.

Compaction within 3 feet of the back face of the concrete blocks shall be achieved by means of a minimum of 3 passes with a lightweight mechanical tamper, roller or

vibratory system. The number of passes needed for the compaction within the 3 foot zone shall be determined using a test strip with the proposed compactor and lift height(s) for this zone. The maximum lift size within 3' shall be 8 inches loose and it shall be compacted to a density of not less than 95 percent of maximum density using the specific density method in accordance to MnDOT 2105.3.F.1.

The PMBW system supplier may require the Contractor to perform quality control density tests. The contractor shall perform the PMBW system suppliers required tests and submit the test results to the Engineer at no additional cost.

The area in front of the wall and around the leveling pad should be backfilled as soon as practically possible.

D. **Leveling Pad:**

Gravity PMBW's shall be set a granular leveling pad.

A wider leveling pad shall be used for walls with curves or corners to ensure blocks fully bear on the leveling pad. The bottom of pad elevation shall be a minimum of 1 foot below finished ground line. Construct the leveling pad so that the surface does not vary more than ¼ inch in 10 feet along the length of the wall nor more than 1/8" across the width of the leveling pad from plan dimensions. The leveling pad shall have a compressive strength of at least 1500 psi. During erection blocks shall not extend more than 6 inches beyond the end of the leveling pad at steps.

E. **Wall Erection:** Storage, handling and transportation shall avoid damage or discoloration of the blocks. If water has ponded in front of the wall; pump the water out prior to constructing the wall. All PMBW's shall be constructed in accordance with approved shop drawings and in conformance with this specification, including the architectural features specified. PMB's shall be placed so that their final position is vertical or battered as shown on the plans. Construction should always begin from existing structures toward the open end of the wall. For erection, blocks which are handled by means of lifting devices inset in the top surface of the block. After placing the blocks, the depressions for lifting devices in the top course of blocks shall be completely filled with MnDOT Spec 2506.2B mortar. Depressions do not need to be filled if the lifting device is stainless steel. Place the initial row of blocks on the centerline of the leveling pad and level the block. Permanent bearing pads to level the blocks (between the leveling pad and bottom course of blocks) are prohibited.

Permanent shims may be used to level or position successive courses of blocks provided:

a. The shim is made of a plastic material that will not rust, stain, rot or leach onto the concrete;

b. The shim has a minimum compressive strength of 4300 psi;

c. The shim shall not exceed 3/16" in thickness;

d. No shim shall be used between the aggregate leveling pad and the base course of the block wall, regardless if such wall is a Gravity PMBW or a PMBW with Soil Reinforcement;

e. Shims shall be limited to no more than 3 percent of the blocks in a wall.

If blocks overhang the leveling pad transversely reconstruct the leveling pad. After setting the batter of the blocks, horizontal and vertical alignments shall be checked by the Contractor with surveying methods, using suitable measuring points. The maximum vertical joint spacing between blocks of the constructed wall shall be 3/16 inch. Placement of a block on top of a block not completely backfilled shall not be permitted.

Concrete block vertical and horizontal alignment tolerances shall not exceed ¾ inch per 10 feet. Do not construct any block more than ½ inch out of vertical or horizontal alignment from the adjacent blocks. The completed wall shall have (cap or top of wall) overall horizontal and vertical tolerance not to exceed ½ inch per 10 feet of the planned location.

F. **Cap Block, Coping and Barrier Construction:** This final construction sequence shall be undertaken after the final wall blocks have been placed. Pedestrian rail anchors shall be placed at least 5 inches from a top block edge or coping joint (measured from the center on the anchor to the edge of the block).

G. **Method of Measurement**: PMBW's shall be measured by the square foot of face on a vertical plane from bottom of wall to the top of the wall or coping as shown on the plans. The city will not adjust pay quantities for variations in aggregate leveling pad elevations required to accommodate actual block placement.

H. **Payment Method**: Payment for PMBW's constructed at the Contract price per square foot of completed wall surface will be compensation in full for all costs of design and construction including blocks, connection devices, joint materials, leveling pad, technical representatives, and other items which do not have separate pay items but are necessary to complete the PMBW. The pay item for PMBW's is 2411.618 PREFABRICATED MODULAR BLOCK WALL, SQ FT.

Excavation and backfill shall be paid for as specified in 2451. Drainage systems shall be paid for as specified in 2502. Coping, traffic barriers and moments slabs (if applicable) shall be paid for separately.

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PMBW Certification Letter

State Project No. (S.P. or S.A.P.)	
Wall No.	
Name of Pre-Qualified PMBW System	

Design Data	
The design life for the wall system other than soil reinforcement and connections.	75 years
Angle of Internal Friction - Backfill	____ Degrees
Maximum Applied Bearing Pressure at Base	
Factored Bearing Resistance at base (located in Geotechnical or foundation report)	
Compound stability check satisfied (if required by these special provisions)	

I hereby certify that the design calculations for the internal stability of the mechanically stabilized earth retaining structure and the detail drawings included in this construction submission are in complete conformance with the AASHTO LRFD Bridge Design Specifications, the project special provisions and meet the foundation report recommended global stability soil reinforcement length. I further certify that the design data provided above and data assumed for the design calculation submitted herein is accurate for the above referenced wall.

Engineer of Record I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly licensed professional engineer under the laws of the State of Minnesota.
Signature:
Date:
Registration Number:

Engineer Performing Design Check I hereby certify that this plan was checked by me and that I am a duly licensed professional engineer under the laws of the State of Minnesota.
Signature:
Date:
Registration Number: