

SP596B (~~11-18-1001-13-11~~)

(This Section requires SP440, SP2030, and SP2630. Requires SP2320 when drainage geotextile or riprap geotextile are used.)

(Delete the following heading if Section 0A596 (Mechanically Stabilized Earth Retaining Walls) is included in the project.)

## SECTION 00596 - RETAINING WALLS

(Follow all instructions. If there are no instructions above a subsection, paragraph, sentence, or bullet, then include them in the project.)

(Use one of the following lead-in paragraphs as instructed below. Delete the one that does not apply. Delete both if Section 0A596 (Mechanically Stabilized Earth Retaining Walls) is included in the project.)

[ Use this lead-in paragraph when only Section 0B596 (Prefabricated Modular Retaining Walls) is included in the project. ]

Replace Section 00596 of the Standard Specifications with the following Section 0B596:

[ Use this lead-in paragraph when Section 0A596 (Mechanically Stabilized Earth Retaining Walls) is not included but when Sections 0B596 (Prefabricated Modular Retaining Walls) and 0C596 (Cast-in-Place Concrete Retaining Walls) are included in the project. Keep the sections in alphabetical order. Do not realphabetize. ]

Replace Section 00596 of the Standard Specifications with the following Section 0B596 and Section 0C596:

## SECTION 0B596 - PREFABRICATED MODULAR RETAINING WALLS

### Description

**0B596.00 Scope** - This work consists of furnishing and constructing prefabricated modular gravity retaining walls as shown and specified.

(Use the following subsection .01 and bullets when the contractor will be required to select a proprietary Prefabricated Modular wall system. List at least three walls. For "Bridge" retaining walls and "Highway" retaining walls, fill in the blank with the structure number. If the retaining wall does not have a structure number, delete the phrase ", structure no. \_\_\_\_ ,".)

**0B596.01 Proprietary Prefabricated Modular Walls** - Select one of the following preapproved Prefabricated Modular proprietary retaining wall systems for the wall, structure no. \_\_\_\_ , as shown:

(Fill in the blanks with the proprietary retaining wall system name (including the "™" symbol), company name and telephone number from the ODOT Geotechnical Design Manual, appendix 15-D.)

- \_\_\_\_\_ Retaining Wall System, provided by \_\_\_\_\_, telephone: \_\_\_\_\_.
- \_\_\_\_\_ Retaining Wall System, provided by \_\_\_\_\_, telephone: \_\_\_\_\_.
- \_\_\_\_\_ Retaining Wall System, provided by \_\_\_\_\_, telephone: \_\_\_\_\_.

**0B596.02 Cost Reduction Proposals** - According to 00140.70, cost reduction proposals will be considered for proprietary retaining wall systems that are preapproved by the Agency before advertisement of the Project.

**0B596.03 Definitions:**

**Appurtenances** - Traffic barriers, guardrail, fences, non-standard coping, drainage structures, sign supports, lighting supports, sound barriers, foundations, and utilities that are not part of the retaining wall system but are connected to, resting on, or passing through the retaining wall system.

**Alternate Gabion Basket Joint Fasteners** - Spiral binders or high tensile locking spring steel clip or clamp-on ring type fasteners specified as an alternate to tie wire for assembling and joining gabion units.

**Batter** - The slope of the wall facing from vertical that is expressed as degrees or as a ratio of the horizontal change in inches for each 12 inches of vertical change. A vertical face has a zero batter.

**Bin Wall** - A prefabricated modular gravity retaining wall system type composed of metal or precast concrete modules backfilled with granular structure backfill material.

**Crib Wall** - A prefabricated modular gravity retaining wall system type composed of interlocking longitudinal and transverse beams made of precast reinforced concrete and backfilled with granular structure backfill material.

**Dry Cast Concrete Block Gravity Wall** - A prefabricated modular gravity retaining wall system type composed of dry cast concrete blocks without soil reinforcements.

**Gabion Gravity Wall** - A prefabricated modular gravity retaining wall system type composed of assembled wire baskets that are connected together, filled with specified rock.

**Manufacturer** - The fabricator having exclusive production rights for a proprietary retaining wall system.

**Nonproprietary Retaining Wall System** - A retaining wall system that is not patented or trademarked and is shown on the plans.

**Piecemark** - An alpha-numeric marking that identifies a specific type of retaining wall component. All components with the same piecemark are considered identical. Piecemarks shown on the working drawings identify placement of the component.

**Preapproved Proprietary Retaining Wall System** - A wall system that is listed in Appendix 15-D of the Geotechnical Design Manual (GDM).

**Preapproved Proprietary Retaining Wall System Options** - Acceptable preapproved proprietary retaining walls listed in 0B596.01 when proprietary retaining wall systems are required.

**Preapproved Proprietary Retaining Wall System Alternates** - Acceptable preapproved proprietary retaining walls listed in 0B596.01 when non-proprietary retaining wall systems are shown.

**Prefabricated Modular Retaining Wall System** - A basic gravity retaining wall system type composed of solid or hollow prefabricated concrete or steel modules. Hollow modules are typically backfilled with granular structure backfill material. Prefabricated modular retaining walls include metal and precast concrete bin, precast concrete crib, gabion, dry cast concrete block, and wet cast concrete block gravity retaining walls.

**Proprietary Retaining Wall System** - A retaining wall system that is protected by trademark, patent, or copyright and is produced or distributed by a manufacturer having exclusive rights.

**Retained Backfill** - Unreinforced backfill within a distance of  $H/2$  behind the back of the wall, where  $H$  is the total height of the wall excluding the leveling pad or footing.

**Retaining Wall System** - An engineered system of structural and geotechnical components that restrains a mass of earth. The terms "retaining wall system", "retaining structure", and "retaining wall" are used interchangeably.

**Wet Cast Concrete Block Gravity Wall** - A gravity retaining wall system type composed of wet cast concrete blocks without soil reinforcements.

**0B596.04 Proprietary Retaining Walls** - Submit the following at least 30 Calendar Days before beginning construction of proprietary retaining walls:

- Complete stamped working drawings and design calculations prepared by the Manufacturer according to 00150.35.
- Manufacturer's field construction manual.
- Manufacturer's field representative name and qualifications.

Field verify existing ground elevations and bottom of wall elevations before preparing and submitting working drawings.

Obtain the Engineer's written approval before beginning construction of the wall system.

**(a) Working Drawings** - Working drawings according to 00150.35 are drawings that meet the requirements of the project documents, the AASHTO LRFD Bridge Design Specifications, as modified by the ODOT GDM, and are consistent with the preapproved retaining wall system.

Include the following items in the working drawings, as applicable:

- **General Notes** - Information for design and construction of the retaining wall.
- **Plan View:**
  - Construction centerline and related horizontal curve data.
  - Centerline station and offset to the wall control line or face of wall including the beginning and end points of the retaining wall.
  - Location, type and size of all appurtenances.
  - Location of right-of-way and easement boundaries, staged construction, designated wetlands, and all other highway structures, features, or facilities or other construction constraints.
- **Elevation View:**
  - Wall vertical curve data and wall elevations at a sufficient number of points along the top of wall that defines the top of wall alignment.
  - Field verified elevations of original and final ground lines and foundation bearing elevation along face of the wall.
  - Vertical dimensions of steps along the wall base (foundation bearing elevation).
  - Centerline stations and elevations at the beginning and end of the wall.
  - Horizontal offsets.
  - Changes in the top of wall slope.
  - Layout of prefabricated modular units.
  - Architectural treatment.
- **Typical Sections:**
  - Typical sections at intervals of 50 feet or less along the wall.
  - Wall construction limits.
  - Original and final ground lines across typical sections, including roadways, highway structures, and other facilities.
  - Construction centerline stationing at each typical section.
- **Structural and Geometric Details:**
  - Leveling pad details, showing depths and limits of proposed excavation beyond the neat lines of the wall.
  - Prefabricate modular unit details.
  - Final front face batter.
  - Reinforcing bar bend details.
  - Surface and subsurface drainage details for the wall.
  - Prefabricated modular unit construction details at utility and drainage facilities, overhead sign support footings, guardrails, traffic barriers, piles, shafts, or other structures.

- Maximum inclinations of wall backslope and foreslope.
- Elevation, slope, and width of wall bench in front of wall.
- Locations of anticipated shoring.
- **Appurtenances:**
  - Wall appurtenance details needed to construct the wall.
  - Wall appurtenance details that are required but not fully detailed on the plans.
- **Wall Construction Methods and Construction Sequence:**
  - Wall construction methods.
  - Construction sequence.
  - Locations of all shoring.
- **Materials and Quantity Summary List** - All items of each wall.

**(b) Design Calculations** - Design calculations are calculations that meet the requirements of the project documents, AASHTO LRFD Bridge Design Specifications, as modified by the ODOT GDM, and are consistent with the preapproved retaining wall system, and according to 00150.35.

Include the following items in the design calculations, as applicable:

- **Design Limits:**
  - Structural and geotechnical design input parameters and design assumptions.
  - Wall design loads, load combinations, load factors, and resistance factors for each limit state.
- **Methodology:**
  - Design steps with a detailed design narrative explaining the design and demonstrating how the design meets all applicable design requirements.
  - Explanation of all symbols and variables used in the calculations.
  - A set of hand calculations verifying typical computer generated output.
- **External Stability Calculations** - Calculations showing that the retaining wall system meets external stability requirements, including overturning, sliding, and bearing capacity.
- **Internal Stability Calculations:**
  - Calculations showing that the retaining wall meets internal stability requirements at each level of the wall.
  - Calculations showing adequate structural resistance of prefabricated modular units.

- **Compound Stability** - Calculations showing that the retaining wall meets compound stability requirements.
- **Appurtenances:**
  - Design calculations for wall appurtenances that are required but not fully detailed on the plans.
  - Calculations for all appurtenance load effects on the wall.

*(Use the following lead-in paragraph and bullets to list proprietary wall design parameters. Obtain information from the designer. Delete what does not apply. Copy and paste the structure number and bullets for each separate retaining wall.)*

The following retaining wall design parameters have been established for this Project:

**Structure Number** \_\_\_\_\_

- Foundation soil unit density ..... \_\_\_\_\_ kips/cu. ft.
- Foundation soil angle of internal friction ..... \_\_\_\_\_ degrees
- Foundation soil nominal (unfactored) bearing resistance..... \_\_\_\_\_ kips/sq. ft.
- Retained soil unit density ..... \_\_\_\_\_ kips/cu. ft.
- Retained soil angle of internal friction ..... \_\_\_\_\_ degrees
- Peak ground acceleration coefficient (PGA) .....
- Long period spectral acceleration coefficient ( $S_1$ ).....
- Site class .....

*(Use the following two bullets when the Mononabe-Okabe method is required.)*

- Peak seismic ground acceleration coefficient modified by short period site factor ( $A_s$ ) ..... \_\_\_\_\_
- Horizontal seismic acceleration coefficient ( $K_h$ ) ..... \_\_\_\_\_

*Use the following bullet and ~~two sub-bullets~~ when the Mononabe-Okabe method is not required to list  $P_{AE}$  and  $P_{IR}$  (GLE method). Repeat as necessary for variations in wall height and backslope along the wall.)*

- Between Station \_\_\_\_\_ and Station \_\_\_\_\_ (Lt.) (Rt.):
  - Total (static plus seismic) external seismic thrust ( $P_{AE}$ ) ..... \_\_\_\_\_ kip/ft.
  - Seismic inertial horizontal force ( $P_{IR}$ ) ..... \_\_\_\_\_ kip/ft.

**(c) Manufacturer's Field Construction Manual** - A field construction manual according to 00150.37, is prepared by the manufacturer and includes detailed instructions for constructing the retaining wall.

**0B596.05 Nonproprietary Retaining Wall Submittals** - Submit complete unstamped working drawings according to 00150.35 at least 30 Calendar Days before beginning construction of nonproprietary retaining walls. Field verify existing ground elevations and

bottom of wall elevations before preparing and submitting working drawings. Obtain the Engineer's written approval before beginning construction of the wall system.

## **Materials**

### **0B596.10 General:**

**(a) Proprietary Retaining Wall Systems** - Provide all proprietary retaining wall system components from the same wall manufacturer. If there are conflicts between the Manufacturer's requirements and the Agency's requirements, the Agency's requirements prevail.

**(b) Nonproprietary Retaining Wall Systems** - Provide materials according to the applicable material Specifications.

**(c) Quality Control** - Provide quality control according to Section 00165.

### **0B596.11 Backfill:**

**(a) Gravel Leveling Pads Backfill** - Furnish dense graded 1" - 0 or the 3/4" - 0 aggregate base material for leveling pads meeting the requirements of 02630.10.

**(b) Modular Block Core and Drainage Backfill** - Furnish 3/4" - No. 4 PCC aggregate material meeting the requirements of 02690.20 (a) through (f).

**(c) Gabion Basket Fill** - Furnish a durable well graded 4 to 8 inch size rock material meeting the requirements of 00390.11(b).

**(d) Granular Structure Backfill** - Furnish dense graded 1" - 0 or 3/4" - 0 aggregate base material meeting the requirements of 02630.10 and the following:

**(1) Material Passing No. 200 Sieve** - The amount of material passing the No. 200 sieve shall not exceed 15 percent by weight. Test according to AASHTO T 27 and AASHTO T 11.

**(2) Plasticity Index** - The plasticity index of the material passing the No. 40 sieve shall not exceed 6. Test according to AASHTO T 90.

**(e) Pipe Drain Backfill** - Furnish granular drain backfill material for drainage pipes meeting the requirements of 00430.11.

### **0B596.12 Concrete:**

**(a) Cast-in-Place Concrete for Leveling Pads** - Furnish commercial grade concrete for leveling pads meeting the requirements of Section 00440.

**(b) Precast Concrete Bin Units** - Furnish precast concrete bin units with the following properties:

**(1) Portland Cement Concrete** - Class 4000 - 3/4 structural concrete meeting the requirements of Section 00540.

**(2) Casting** - Place concrete in each bin unit without interruption and consolidate with an approved vibrator. Use a release agent throughout the casting operation.

**(3) Supporting and Curing** - Maintain full support, cure the units, and do not strip or remove the forms from the units until the concrete has obtained a minimum compressive strength of at least 1,000 psi.

**(4) Finish** - Finish the bin unit front face with a general surface finish according to 00540.53(a).

**(5) Tolerances** - Manufacture units within the following tolerances:

**a. Unit Dimensions** - Within  $\pm 1/2$  inch between diagonals. Within  $\pm 3/16$  inch for all other unit dimensions.

**b. Unit Face** - Smooth formed surfaces within  $\pm 3/32$  inch when measured with a 3 foot straight edge. Textured-finished surfaces within  $\pm 3/16$  inch when measured with a 3 foot straight edge.

**(6) Acceptance of Bin Unit Concrete Strength** - Acceptance will be according to 00540.17, except acceptance of concrete strength will be determined based on production sublots. A production subplot will consist of either 10 units or a single day's production, whichever is less. Cast one set of cylinders for each production subplot. The concrete strength of a production subplot will be represented by a single compressive strength test on a cylinder.

**(7) Marking** - On the rear face of each unit scribe the date of manufacture, the production subplot number, and the piecemark.

**(8) Handling, Storage, and Shipping** - Do not allow chipping, discoloration, cracks, fractures and connecting device damage during handling, storing, and shipping. Support stored units on firm blocking.

**(9) Rejection** - Units not meeting the requirements of this subsection will be rejected.

**(c) Dry Cast Concrete Blocks** - Furnish dry cast concrete blocks with the following properties:

**(1) Aggregate, Strength, Freeze-Thaw Durability, Unit Weight, and Water Absorption:**

- Aggregate meeting the requirements of ASTM C 33.
- Blocks meeting the requirements of ASTM C 1372.
- The average of three coupons or cores have minimum compressive strength of 4,000 psi as tested according to ASTM C 140.
- Individual coupons or cores have a minimum compressive strength of 3,500 psi as tested according to ASTM C 140.
- A minimum oven-dry unit weight of 125 pcf as tested according to ASTM C 140.

- Test, no longer than 18 months before delivery, freeze-thaw durability of five test specimens made with the same materials, concrete mix design, manufacturing process, and curing method that will be used on the project. At least four of the five test specimens shall have a weight loss of not more than 1 percent of the block's initial weight after 150 freeze-thaw cycles as tested according to ASTM C 1262.
- A maximum water absorption of 1 percent above the water absorption of the subplot of blocks that were produced and passed the freeze thaw test. For the water absorption testing, do not use the same blocks used for the freeze-thaw test.

**(2) Portland Cement** - Portland cement meeting the requirements of 02010.10.

**(3) Blended Hydraulic Cement** - Blended hydraulic cement meeting the requirements of 02010.20.

**(4) Tolerances** - Manufacture within the following geometric tolerances:

- Molded length and width dimensions within  $\pm 1/8$  inch of the block manufacturer's nominal length and width dimensions.
- Molded height dimension within  $\pm 1/16$  inch of the block manufacturer's nominal height dimension.
- Rear height does not exceed the front height.
- Top and bottom face groove dimensions within the tolerances specified by the manufacturer.

**(5) Color** - Consistent natural color of dry cast concrete.

**(6) Finish** - Split-face units that when viewed from a distance of 10 feet under diffused light, chips, cracks, and other imperfections are not detectable.

**(7) Acceptance of Blocks** - Acceptance will be determined on tolerances, visual inspection, compressive strength, water absorption, freeze-thaw durability, and unit weight. Acceptance of compressive strength, water absorption, and unit weight will be based on production sublots. The maximum number of blocks per production subplot is 2,000 blocks. Test blocks at the frequency of one set for each production subplot. Acceptance of freeze-thaw durability will be based on the freeze-thaw testing requirements of 0B596.12(c-1).

**(8) Marking** - Indicate the date of manufacture and the production subplot number on each subplot of dry cast concrete blocks.

**(9) Handling, Storage, and Shipping** - Do not allow chipping, discoloration, cracks, or fractures during handling, storing and shipping.

**(10) Rejection** - Blocks not meeting the requirements of this subsection will be rejected.

**(d) Wet Cast Concrete Blocks** - Furnish wet cast concrete blocks with the following properties:

**(1) Concrete** - Commercial grade concrete meeting the requirements of Section 00440.

**(2) Marking** - The rear face of each block is scribed with the date of manufacture, the production subplot number, and the piecemark.

**(3) Color** - Consistent natural color of wet cast concrete.

**(4) Finish** - Smooth face blocks that, when viewed from a distance of 10 feet under diffused light, chips, cracks, and other imperfections are not detectable.

**(5) Tolerances** - Molded length and width dimensions within 1/4 inch from the manufacturer's dimensions. Molded height dimension within 1/8 inch of the manufacturer's dimension.

**(6) Handling, Storing, and Shipping** - Do not allow chipping, discoloration, cracks, or fractures during handling, storing, and shipping.

**(7) Acceptance of Blocks** - Acceptability will be determined by tolerances, visual inspection, and concrete strength. Concrete strength will be based on production sublots. A production subplot is 20 blocks or a single day's production, whichever is less. The production subplot will be represented by a single compressive strength sample of one set of cylinders.

**(8) Rejection** - Blocks not meeting the requirements of this subsection, or any of the following defects will be rejected:

- Honeycombed or open texture concrete.
- Extreme color variation on front face of block.

**(e) Precast Concrete Crib Walls** - Furnish precast concrete crib walls with the following properties:

**(1) Portland Cement Concrete** - Furnish Class 4000 - 3/4 structural concrete meeting the requirements of Section 00540.

**(2) Color** - Consistent natural color of wet cast concrete.

**(3) Finish** - Smooth crib wall members that, when viewed from a distance of 10 feet under diffused light, chips, cracks, and other imperfections are not detectable.

**(4) Tolerances** - Manufactured within  $\pm 1/8$  inch of the Manufacturer's nominal dimensions.

**(5) Handling, Storing, and Shipping** - Do not allow chipping, discoloration, cracks, or fractures during handling, storing, and shipping.

**(6) Acceptance of Concrete Strength** - Acceptance of concrete strength will be determined based on production sublots. A production subplot will consist of either 100 crib wall members or a single day's production, whichever is less. Cast one set of cylinders for each production subplot. The concrete strength of a production subplot will be represented by a single compressive strength test on a cylinder.

**(7) Rejection** - Crib units not meeting the requirements of this subsection will be rejected.

**0B596.13 Steel:**

**(a) Steel Reinforcement for Concrete** - Furnish steel reinforcement for concrete meeting the requirements of Section 00530.

**(b) Metal Bin Gravity Walls** - Furnish metal bin walls meeting the requirements of Section 02350.

**(c) Gabion Baskets** - Furnish gabion baskets meeting the requirements of Section 02340.

**0B596.14 Geosynthetics:**

**(a) Geotextile Filter Layer for Subsurface Drainage Systems** - Furnish Type 1, Level B, drainage geotextile according to Section 02320.

**(b) Geotextile Filter Layer Between Backfill and Gabion Walls** - Furnish Type 2, Level B, riprap geotextile according to Section 02320.

**(c) Geotextile Filter Layer Between Backfill and Other Prefabricated Modular Walls** - Furnish Type 1 or Type 2, Level B, drainage geotextile according to Section 02320.

**(d) Modular Block Drainage Fill Geotextile Filter** - Furnish Type 1, Level B, drainage geotextile according to Section 02320.

**Labor**

**0B596.30 Quality Control Personnel** - Provide technicians with CAgT and CDT certifications.

**0B596.31 Manufacturer's Field Representative Qualifications and Duties** - Provide a Manufacturer's field representative with the following minimum qualifications:

- Is a licensed professional engineer in the State of Oregon.
- Has been trained and certified by the Manufacturer in the construction, installation, and inspection of the selected proprietary retaining wall system.

The times that the Manufacturer's field representative are required to be present or available and the duties of the Manufacturer's field representative are:

- **Preconstruction Conference** - Meet with the Engineer and all contractor supervisory personnel and subcontractors involved in construction of the proprietary retaining wall at the preconstruction conference to discuss methods of accomplishing all phases of work required to construct the proprietary retaining wall.
- **Initial Wall Construction** - Be present at the retaining wall construction site and provide technical assistance to the Contractor and Engineer during all wall construction activities from the beginning of wall construction until at least 10 percent of the total wall length is successfully installed and backfilled to a height of at least 10 feet, or the actual wall height, whichever is less.

Submit daily field observation reports no later than noon of the next working day. Include the following information in the daily field observation reports:

- Date of observation.
  - Description all work observed and whether or not the work was acceptable.
  - Documentation of all communications with the Contractor and Engineer.
  - Name and signature.
- **Remaining Wall Construction** - Be available by phone or in person as needed throughout the remaining construction of the proprietary retaining wall to provide technical assistance to the Contractor and Engineer.
  - **Final Field Observations** - Conduct a final field observation of the completed retaining wall construction with the Engineer and Contractor. Submit a final field observation report that includes the following information one Calendar Day after the final field observation:
    - Date of observation.
    - Documentation of all retaining wall deficiencies.
    - Recommendation to accept or reject the retaining wall construction.

Provide a stamped final report to the Engineer no later than 10 Calendar Days after the final field observation of the retaining wall. Include the following information in the final report:

- Preconstruction meeting minutes.
- All daily field observation reports.
- Transcripts of all communications with the Contractor and the Engineer during the remaining wall construction phase.
- Final field observation report.

## **Construction**

### **0B596.40 General:**

**(a) Proprietary Retaining Walls** - Construct proprietary retaining walls according to Agency requirements, Manufacturer's working drawings, and the Manufacturer's Field Construction Manual. If the Manufacturer's working drawings or the Manufacturer's Field

Construction Manual conflict with Agency requirements, Agency requirements shall take precedence.

Follow instructions and recommendations of the representative if approved by the Engineer.

**(b) Nonproprietary Retaining Walls** - Construct nonproprietary retaining walls as shown.

**0B596.41 Excavation and Foundation Preparation** - Perform excavation and prepare and backfill wall foundations according to Section 00510 and the following:

- Grade the foundation level for a width equal to the width of the wall base plus 1.0 feet on each side. Do not reinforce backfill for over-excavated foundations without prior approval.
- Place backfill material in nearly horizontal layers not more than 8 inches thick. Compact the entire surface of each layer with at least three coverages, using equipment made specifically for compaction. Routing hauling and grading equipment over the surface is not acceptable as adequate compaction.
- Do not construct backfill when the backfill, the foundation, or the embankment on which it would be placed is frozen, or unstable.

**0B596.42 Leveling Pads:**

**(a) Cast-in-Place Leveling Pads** - Construct cast in place leveling pads with:

- Unreinforced concrete.
- A width of at least the block front face to block back face plus 12 inches (6 inches on each side of the facing units).
- A thickness of 6 inches  $\pm$  1/4 inch.
- A location tolerance of  $\pm$  1 inch of the design location.
- A top pad tolerance of  $\pm$  1/8 inch of the design elevation.

Cure cast-in-place leveling pads at least 12 hours before placing the wall units.

**(b) Gravel Leveling Pads** - Construct gravel leveling pads with:

- A width of at least the width of the wall facing plus 12 inches (6 inches on each side of the facing units).
- A thickness of at least 6 inches.
- A location tolerance of  $\pm$  1 inch of the design location.
- A top pad tolerance of  $\pm$  1/8 inch of the design elevation.

Compact gravel leveling pads in 3 to 4 inch lifts using a minimum of three passes of a walk behind vibratory plate compactor with a gross static weight of not less than 125 pounds and a total compaction static plus dynamic force of not less than 2,000 pounds.

**0B596.43 Subsurface Drainage** - Install subsurface drainage before constructing walls.

**0B596.44 Erecting Walls:**

**(a) Dry Cast Concrete Block Walls:**

**(1) Placement** - Begin placing the first course of blocks on top of and in full contact with the lowest foundation level of the leveling pad. Level and align all blocks. Lay blocks as close together as possible and parallel to the straight or curved line of the wall face. Place blocks in vertical or battered positions as shown. Level each course block-to-block and front-to-back. Set each block on the blocks below without rocking. Correct high areas by grinding or shimming with approved shims. Do not use shims within 1 inch of the front face. Do not exceed a shim stack thickness of 1/16 inch. Stack all blocks in a running bond pattern with each block spanning the joint below.

Place granular structure backfill with each course of blocks. When shown, place modular block core backfill and drainage fill backfill, and install drainage fill geotextile and shear pins with each course of blocks. Remove all backfill that is on top of the blocks before installing the next course of blocks or soil reinforcements. Attach the top row of dry cast concrete blocks or cap blocks to the underlying blocks with an adhesive from the QPL. Clean the finished exposed wall face of all foreign material deposits.

**(2) Tolerances:**

- First course of wall blocks located within  $\pm 1/4$  inch of the design horizontal alignment.
- Final out of plane concavity or convexity of the front face within  $\pm 3/4$  inch in 10 feet.
- Final deviation from the design batter within  $\pm 1 1/4$  inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Each course of blocks within  $\pm 1/16$  inch of level when checked with a 4 foot straight edge level.
- Out of plane offset between consecutive rows within  $3/4$  inch of the planned offset.
- Finished top of wall elevation within  $\pm 1$  inch of the design elevation.

**(b) Wet Cast Concrete Block Walls:**

**(1) Placement** - Begin placing the first course of blocks on top of and in full contact with the lowest foundation level of the leveling pad. Level and align all blocks. Lay blocks as close together as possible and parallel to the straight or curved line of the wall face. Place blocks in vertical or battered positions as shown. Level and set each block on the blocks below without rocking. Correct high areas by grinding or shimming with approved shims. Do not use shims within 1 inch of the front face. Do not exceed a shim stack thickness of 1/8 inch. Stack all blocks in a running bond pattern with each block spanning the joint below.

Place granular structure backfill with each course of blocks. When shown, place modular block core backfill and drainage fill backfill, and install drainage fill geotextile and shear pins with each course of blocks. Remove all backfill that is on top of the blocks before installing the next course of blocks or soil reinforcements. Clean the finished exposed wall face of all foreign material deposits.

**(2) Tolerances:**

- First course of wall blocks located within  $\pm 1/4$  inch of the design horizontal alignment.
- Final out of plane concavity or convexity of the front face within  $\pm 3/4$  inch in 10 feet.
- Final deviation from the design batter within  $\pm 1 1/4$  inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Each course of blocks within  $\pm 1/8$  inch of level when checked with a 4 foot straight edge level.
- Front-to-back tilting within  $\pm 1/4$  inch of the design batter when measured with a straight edge level long enough to span the entire front-to-back distance of the block.
- Out of plane offset between consecutive rows within  $\pm 3/4$  inch from the planned offset.
- Finished top of wall elevation within  $\pm 1$  inch of design elevation.

**(c) Gabion Walls:**

**(1) General** - Select and use:

- The same style of mesh for the gabion panel bases, ends, sides, diaphragms, and lids.
- The same method of joining the edges of a single gabion unit.
- The same method of tying successive gabion units together throughout each structure.

Place riprap geotextile according to Section 00350 and the following:

- Minimum overlap shall be 12 inches.
- Against the back of the gabion wall before placing backfill material.

**(2) Assembly** - Assemble each style of gabion by rotating the panels into position and joining the vertical edges with tie wire or alternate fasteners.

If twisted wire panels are tied with tie wire, join the selvage vertical edges with alternating single and double loops at 4 inch nominal spacing.

If welded wire panels are tied with tie wire, pass the tie wire through each mesh opening along the vertical edges joint and secure with a half hitch locked loop.

Leave no openings greater than 4 3/4 inches (line dimension) along the edges or at corners of tied or spiral bound gabions of either mesh style. Crimp the edges of spiral binding wire to secure the spiral in place.

If high tensile fasteners are used instead of tie wire, install one fastener in each mesh opening according to the manufacturer's recommendations.

**(3) Placement** - Set the empty gabions in place and connect each gabion to the adjacent gabion along the top and vertical edges with tie wire or spiral binders. Connect each layer of gabions to the underlying layer along the front, back and sides with tie wire or spiral binders in the same manner as specified for assembly of baskets. Common wall construction will not be allowed.

Before filling each gabion with rock, remove all kinks and folds in the wire fabric and properly align all baskets. Remove all temporary clips and fasteners. The assembled gabion baskets may be placed in tension before filling.

Concurrently with the filling of the baskets, place granular structure backfill around the assembled baskets to the limits shown. Maintain the outside backfill approximately level with the inside fill.

**(4) Basket Filling** - Place rock by hand or machine. Maintain basket alignment, avoiding bulges, and fill with minimum voids. Provide an exposed rock surface that is smooth, neat appearing, and has no sharp edges projecting through the wire mesh.

Place the rock in layers to allow placement of internal connecting wires in each outside cell of the structure or when directed at the following intervals:

- None required for 1 foot high baskets.
- At the one half point for 1 1/2 foot high baskets.
- At one third points for 3 foot high baskets.

Fill the basket so the lid will bear on the rock when it is closed. Secure the lid to the sides, ends, and diaphragms with tie wire or spiral binders in the same manner as assembling the baskets.

**(5) Repairs** - During construction, repair and secure all breakage of the wire mesh that results in mesh or joint openings larger than 4 3/4 inches (line dimension). Make repairs using 13 1/2 gauge galvanized tie wire as directed.

Repair damaged PVC coated wire in a manner that provides the same degree of corrosion resistance as the undamaged wire, according to the manufacturer's recommended repair procedures and as approved.

**(6) Tolerances:**

- First course of gabion units within  $\pm 1/4$  inch of the design horizontal alignment.
- Final out of plane concavity or convexity within  $\pm 2$  inches in 10 feet.

- Final deviation from the design batter within  $\pm 1$  inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Out of plane offset between consecutive rows within  $\pm 1$  inch from the planned offset.

**(d) Metal Bin and Precast Concrete Bin Walls:**

**(1) Placement** - Begin placing the first course of bin wall units on top of and in full contact with the prepared leveling pad surface. Concurrently with the assembly of the bins, place granular structure backfill within and around the bins of the assembled wall to the limits shown. Maintain the outside backfill approximately level with the inside backfill.

**(2) Tolerances:**

- First course of units within  $\pm 1/4$  inch of the design horizontal alignment.
- Final out of plane concavity or convexity within  $\pm 1 1/4$  inches in 10 feet.
- Final deviation from the design batter within  $\pm 1$  inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Out of plane offset between consecutive rows within  $\pm 1$  inch from the planned offset.

**(e) Precast Concrete Crib Walls:**

**(1) Placement** - Begin placing the first course of crib wall units on top of and in full contact with the prepared leveling pad surface. Concurrently with the assembly of the cribs, place granular structure backfill within and around the cribs of the assembled wall to the limits shown. Maintain the outside backfill approximately level with the inside backfill. Fill depressions of stringers and spacers and compact without displacing them from line and batter.

**(2) Tolerances:**

- First course of units within  $\pm 1/4$  inch of the design horizontal alignment.
- Final out of plane concavity or convexity within  $\pm 1 1/4$  inches in 10 feet.
- Final deviation from the design batter within  $\pm 1$  inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Out of plane offset between consecutive rows within  $\pm 1$  inch from the planned offset.

**0B596.45 Geotextile Placement** - Install geotextiles according to Section 00350 and as shown.

**0B596.47 Backfill Placement:**

**(a) General** - Do not misalign wall units or damage wall components when placing backfill material. Remove and replace all misaligned or damaged wall materials at no additional cost to the Agency.

**(b) Compaction** - Meet the following requirements:

**(1) Equipment** - Provide the following compaction equipment:

**a. Backfill In and Within 3 Feet Behind Wall Units** - Walk behind vibratory roller compactor with a single smooth drum, vibratory plate compactor, or rammer/tamper plate compactor; each with a gross static weight of not more than 1,000 pounds and a total compaction static plus dynamic force of not more than 5,000 pounds.

**b. Backfill More Than 3 Feet Behind Wall Units** - Vibratory roller compactor with a single smooth drum, vibratory plate compactor, or rammer/tamper plate compactor.

**(2) Maximum Density and Optimum Moisture Content** - Determine maximum density and optimum moisture content of the MSE granular backfill material according to AASHTO T 99 Standard Proctor Method A, with coarse particle correction according to AASHTO T 224.

**(3) Moisture Content** - Prepare backfill material to within minus 4% to plus 2% of optimum moisture content at the time of compacting. Add water to material that does not contain sufficient moisture and thoroughly mix. Remove excess moisture by manipulation, aeration, drainage, or other means before compacting.

**(4) Density:**

**a. Backfill In and Within 3 Feet Behind Wall Units** - Compact to 95% of maximum density using the required number of passes determined according to 0B596.47(b-5-a).

**b. Backfill More Than 3 Feet Behind Wall Units** - Compact to 95% of maximum density determined according to 0B596.47(b-5-b).

**(5) Testing Methods and Frequency:**

**a. Test Pad Method** - Before placing the wall backfill, determine the number of passes necessary to achieve the specified density by constructing a test pad that is at least 5 feet wide, 15 feet long, and 3 feet in final depth. Construct test pad fill in layers no more than 8 inches thick using the same equipment and methods that will be used to compact the wall backfill. Perform at least one density test according to AASHTO T 310 on each test pad layer. Construct and test a new test pad when changes in material occur or different equipment is used during the construction of the wall backfill, except a new test pad is not required for modular block drainage backfill.

**b. Nuclear Gauge Method** - Test in-place field density according to AASHTO T 310. Test at the frequency required in the ODOT Manual of Field Procedures.

**(6) Deflection Requirement** - Conduct at least one deflection test, witnessed by the Engineer on each compacted layer of backfill according to ODOT TM 158. If the tested layer exhibits yielding, deflection, reaction, or pumping, rework the area to provide acceptable test results before placing the next layer.

**Maintenance**

**0B596.60 Protecting Work** - Protect and repair work as follows:

- Do not allow runoff from adjacent areas to enter the wall construction site during construction operations.
- At the end of each day's operation, direct potential runoff away from the wall by sloping the last lift of backfill away from the wall.
- Rework and repair all damaged subgrade areas to the depth where undamaged work is encountered.

**Measurement**

**0B596.80 Measurement** - No measurement of quantities will be made for retaining walls.

The estimated quantity of retaining walls are:

*(Provide wall area below. Copy as necessary.)*

| Station Limits                       | Area                                 |
|--------------------------------------|--------------------------------------|
| Sta. _____ to Sta. _____ (Lt.) (Rt.) | _____ (Wall area here) _____ sq. ft. |

*(Use the following paragraph to list estimated quantities for nonproprietary retaining wall systems only. Ensure that the Wall (Bridge) Designer addresses quantities for excavation, shoring (if needed), and leveling pad concrete and rebar, and backfill. Copy and paste more lines to address the estimated quantities for nonproprietary retaining wall systems.)*

The estimated quantities, for estimating purposes only, of excavation, shoring, leveling pads, and specified backfill for nonproprietary retaining wall systems are:

| Structure Number | Material | Estimated Quantities |
|------------------|----------|----------------------|
| #_               | _____    | _____ cu. yd.        |
| #_               | _____    | _____ foot           |
| #_               | _____    | _____ lb.            |

*(Use the following paragraph when Type "F" traffic barrier coping is required.)*

The quantities of Type "F" traffic barrier coping with moment slab will be measured on the length basis, from end to end of coping.

*(Use the following paragraph when sidewalk coping is required.)*

The quantities of sidewalk coping will be measured on the area basis, from end to end and from top of curb to exterior edge of coping.

Excavation below elevations shown will be measured according to 00510.80(b).

### Payment

**0B596.90 Payment** - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

| Pay Item | Unit of Measurement |
|----------|---------------------|
|----------|---------------------|

*(Modify this list of pay items to only include project specific pay items. Delete those that are not required on the project. Re-alphabetize the list if necessary.)*

- |   |             |
|---|-------------|
| (a) Retaining Wall, Prefabricated Modular Gravity .....               | Lump Sum    |
| (b) _____ inch Type "F" Traffic Barrier Coping with Moment Slab ..... | Foot        |
| (c) Sidewalk Coping .....   | Square Foot |

*(Use the following paragraph when Type "F" traffic barrier coping is required.)*

In item (b), the height of barrier will be inserted in the blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Excavation below elevations shown will be paid for according to 00510.90(c).

No separate or additional payment will be made for:

- manufacturer's representative
- excavation, shoring, leveling pads, and specified backfill
- wall drainage and filter systems
- cast-in-place and precast standard coping