GEOSYNTHETIC REINFORCED SOIL ABUTMENTS & WALLS.
(REV 03-31-15)

The following new Section is added after Section 548.

SECTION 549
GEOSYNTHETIC REINFORCED SOIL ABUTMENTS & WALLS

549-1 Description.

Construct geosynthetic reinforced soil abutments & walls (GRS) in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Contract Documents or established by the Engineer.

Ensure that each shipment of products to the job site includes a signed or stamped delivery ticket in accordance with the Materials Manual, Section 8.2 Volume II, and the required written certification statement for each product shipped. Provide these tickets and certifications to the Engineer.

Store geosynthetics in conditions above 20ºF and not greater than 140ºF. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material. Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement.

Carefully inspect all reinforcement geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

549-2 Materials.

549-2.1 Masonry Facing Blocks: When 7-5/8 inch high concrete masonry units (CMU) are shown in the Plans, provide and install normal weight CMUs of the size, textures and colors as shown in the Plans. Install textured facing blocks with textured face exposed. Install textured corner blocks in wall corners adjacent to textured blocks. When scour protection is shown in the Plans, install only solid masonry blocks below the top of scour protection elevation as shown in the Plans. Ensure all CMUs are manufactured in accordance with ASTM C90 with a minimum 28-day compressive strength of 4000 psi and a water absorption limit of 6.5% in accordance with ASTM C140.

When 8 inch high facing blocks are shown in the Plans, provide and install normal weight dry-cast segmental retaining wall units manufactured in accordance with ASTM C1372 with a minimum 28-day compressive strength of 4000 psi and a water absorption limit of 6.5% in accordance with ASTM C140. Ensure all segmental retaining wall units are nominally 8 inches high by18 inches long by 11 inches minimum depth (front to back), weigh at least 75 pounds each, and are cast with only vertical voids. The length of blocks at corners may vary in order to achieve running bond pattern or corner geometry shown in the Plans.

Unless shown otherwise in the Plans, ensure blocks at skewed corners are either solid blocks trimmed in an appropriate manner to provide the required color and texture or two blocks joined together with reinforced concrete.

549-2.2 Reinforced Soil Foundation (RSF):

549-2.2.1 RSF Geosynthetic: Provide an R-1 woven geotextile reinforcement meeting the requirements in Section 985 and the Plans.

549-2.2.2 RSF Backfill: Provide graded aggregate meeting the requirements of Section 204.

549-2.3 GRS Backfill Reinforcement: Provide an R-1 biaxial geogrid or woven geotextile reinforcement meeting the requirements in Section 985 and the Plans. Ensure all GRS backfill reinforcement materials are manufactured using the same material.

549-2.4 GRS Backfill Material.

549-2.4.1 General: Provide compacted select backfill within the GRS Backfill volume shown in the Plans.

549-2.4.2 Compacted Select Backfill: Provide graded aggregate (GAB) meeting the requirements of Section 204 and/or coarse aggregate comprised of natural stones meeting the requirements of Section 901 with a size distribution of any of the listed aggregate gradations from Size No. 57 through Size No. 89, inclusive, except as noted within this Section and the Plans. Ensure the pH, as determined by FM 5-550, is not lower than 4.5 or higher than 10.0.When uncoated polyester geosynthetics will be used, ensure the pH is not higher than 9.0. Test the backfill material for pH by a Department approved independent testing laboratory prior to placement. Provide certification to the Engineer that the results have met the requirements of this Section and are signed and sealed by a Professional Engineer, registered in the State of Florida.

549-2.5 Reinforcing Steel: Use Grade 60 rebar meeting the requirements of Section 931.

549-2.6 Concrete for Filling Facing Blocks: Use Class NS concrete meeting the requirements of Section 347.

549-2.7 Expanded Polystyrene Foam Board: Provide expanded polystyrene foam board conforming to ASTM C578, Type XI or I.

549-3 Repairs or Rejection of Masonry Facing Blocks: The Department will reject all facing blocks not meeting the quality standard of this Section and referenced Specifications. In addition, any of the following defects will be sufficient cause for rejection by the Department:

1. Defects that indicate unsatisfactory molding.
2. Defects indicating honeycombed or open texture concrete.
3. Defects in the physical characteristics such as:
   - Signs of aggregate segregation;
   - Broken or cracked corners;
   - Insufficient concrete compressive strength;
   - Exceeding thickness tolerance of plus or minus 3/16 inches;
   - Stained front face, due to excess form oil or other reasons.

Remove any stains or discolorations or apply a Department approved concrete stain to attain a uniform appearance of the portions of the structure remaining visible after construction to the satisfaction of the Engineer.

Correct cracks or spalls occurring after installation in accordance with 400-21.

549-4 Construction Requirements.

549-4.1 General: Verify all pertinent information (e.g. soil parameters, dimensions, facing alignment, utility locations, conflicting structures) prior to beginning construction. Bring any conflicts not shown in the Contract Documents to the Engineer's attention. After constructing the RSF, construct the facing blocks, compacted backfill and reinforcement in layers to produce a tight fitting and secure GRS wall. Perform all compaction operations using a

vibratory compactor (roller or plate compactor) with an operating weight of at least 600 pounds and which produces a centrifugal force of not less than 7,500 pounds.

549-4.2 Excavation: Excavate to the limits shown in the Contract Documents and in conformance with Section 125.

549-4.3 Reinforced Soil Foundation (RSF) Subsoil Preparation: Grade and compact the RSF subsoil in accordance with Section 125 for a width equal to or exceeding the limits of the RSF as shown in the Contract Documents. Remove and replace recycled asphalt pavement and any other soft or loose material from the RSF subsoil incapable of sustaining the required compaction to the Engineer's satisfaction.

In lieu of the compaction requirements of Section 125, dewater and compact the RSF subsoil with a vibratory compactor for at least five passes or as directed by the Engineer.

549-4.4 Reinforced Soil Foundation (RSF) Construction: Construct the RSF within the dewatered excavation as soon as possible in order to avoid the weakening effects of weather or seepage. Encapsulate the RSF in woven geotextile reinforcement to protect it from possible erosion. Measure and size the reinforcement sheets to fully enclose the RSF. Overlap the reinforcement sheets a minimum of 3 feet, starting with the first (outermost) layer on the upstream side of the RSF. Orient all overlapped sections of reinforcement in the area of the RSF to prevent running water from flowing between the layers of reinforcement and prevent water from eroding backfill material from within the RSF.

Place and compact graded aggregate backfill material in layers of not more than 6 inches compacted thickness. Compact graded aggregate backfill with a minimum of three passes of a vibratory compactor weighing between 600 and 1000 pounds or two passes of a vibratory compactor weighing over 1000 pounds. Use the highest vibration level that does not cause excessive fracture of the aggregate in the opinion of the Engineer. Continue compaction until there is no additional movement. Place intermediate layers of reinforcement at a vertical spacing not exceeding that shown in the Plans. Ensure each intermediate layer of reinforcement provides complete horizontal coverage of the RSF backfill material with overlaps of adjacent sheets of at least 1 foot. After all RSF backfill material is placed, compacted and leveled, tightly wrap the corners of the RSF geotextile and completely encapsulate the RSF backfill.

Ensure the position of the facing blocks on top of the RSF is firm, level and smooth. Up to 1/2 inch of GRS backfill may be placed on the RSF to assist with positioning of the blocks.

549-4.5 GRS Wall Facing: Carefully place and level GRS facing blocks tightly together along the wall alignment, one course at a time in running bond pattern unless otherwise noted in the Plans. Do not place the next course of blocks until the backfill behind the previous course is placed, compacted, and the blocks and backfill are covered with backfill reinforcement. As each layer of GRS backfill material is placed behind the GRS facing, maintain the facing blocks in the vertical position to provide a final horizontal and vertical alignment. Ensure facing blocks are separated vertically only by the reinforcement layers; sweep all soil and other materials from between the facing blocks. When reinforcement layers must be overlapped, do not overlap reinforcement on top of the facing blocks. Unless shown otherwise in the Plans, fill all but the top three courses of hollow core facing blocks with backfill material. After wall construction, trim any exposed backfill reinforcement from the wall face.

549-4.5.1 Tolerances for GRS Facing Blocks: Ensure any deviation from the horizontal alignment shown in the Plans does not exceed 1 inch when measured with a 10 foot straight edge. The maximum allowable offset in the joint between facing blocks is 1/4 inch. The final overall vertical tolerance of the completed wall (plumbness or deviation from top to bottom

batter shown in the Plans) shall not exceed 1 inch per 10 feet of wall height. GRS facing which does not meet these tolerances will not be accepted by the Department and must be removed and reconstructed at no cost to the Department.

549-4.6 GRS Backfill Placement: Use only one type of backfill in each layer. Use only coarse aggregate backfill below the 100 year flood elevation. Prior to placing each backfill layer, smooth all wrinkles and loose zones from the backfill reinforcement. Place backfill from the facing backward to prevent formation of wrinkles in reinforcement. Compact immediately behind the facing blocks then proceed backward to completely compact the layer. Allow only hand operated compaction equipment within 3 feet of the wall face. At the end of each day's operation, shape the last level of backfill to permit runoff of rainwater away from the wall face or provide a positive means of controlling run off away from the wall such as temporary pipe, etc.

549-4.6.1 Graded Aggregate (GAB) Backfill: Perform work in accordance with 204-2, 204-4, 204-5 and 204-6, except that the minimum density requirement is reduced to 95% of the maximum density.

549-4.6.2 Coarse Aggregate Backfill: Place and compact the coarse aggregate such that it will be stable, firm and unyielding. Compact coarse aggregate backfill with a minimum of three passes of a vibratory compactor weighing between 600 and 1000 pounds or two passes of a vibratory compactor weighing over 1000 pounds. Use the highest vibration level that does not cause excessive fracture of the aggregate in the opinion of the Engineer. Continue compaction until there is no additional movement.

549-4.7 GRS Backfill Reinforcement: When backfill is level with the top of each course of facing blocks, sweep all soil and other materials from the top of the facing blocks. Place the layer of reinforcement to cover the top of the blocks and the compacted backfill in one piece from the blocks to the back of the compacted backfill. In GRS abutments, position the edge of the mid-layer "bearing bed" reinforcement within the bearing bed zone shown in the Plans against the back of the facing blocks without attaching to the blocks. Place all backfill reinforcement so that all joints are normal to the face of the wall or abutment and at least 8 feet from the end of the wall or sides of the wrap-around abutment, unless otherwise shown in the Contract Documents or as directed by the Engineer. Overlapping of GRS back fill reinforcement is not necessary. Do not overlap reinforcement between facing blocks. Offset joints in adjacent layers of GRS back fill reinforcement at least 10 feet. Prior to placement of the reinforcement, compact the backfill in accordance with 549-4.6. Do not place any equipment directly on the geosynthetic reinforcement. Place a minimum 4 inch thick layer of backfill prior to operating compaction equipment or rubber tired equipment over the geosynthetic. Operate such equipment at speeds of less than five mph with no sudden breaking or turning. Do not operate track mounted equipment over the geosynthetic or reinforced backfill without mats.

549-4.8 Beam Seat Construction:

549-4.8.1 GRS Beam Seat: The GRS beam seat comprises 4 inch thick lifts of wrapped-face GRS backfill isolated from the facing blocks placed as shown in the Plans or directed by the Engineer. When wall settlement occurs during construction, increase the thickness of beam seat layers up to 2 inches each as directed by the Engineer. Place an expanded polystyrene foam board on the top layer of bearing bed reinforcement against the back of the top course of facing block as shown in the Plans before constructing the GRS beam seat. Set solid CMUs on top of the foam board immediately behind the facing blocks. Ensure the top lift of wrapped face GRS is approximately 1/2 inch above the solid CMU.

549-4.8.2 C.I.P. Concrete Beam Seat: Isolate the 4 inch thick GRS beam seat

layers directly under the concrete beam seat from the facing blocks as shown in the Plans or directed by the Engineer. When wall settlement occurs during construction, increase the thickness of the GRS beam seat layers up to 2 inches each as directed by the Engineer. Place an expanded polystyrene foam board against the back of the facing block as shown in the Plans prior to constructing the GRS beam seat layers. Ensure the top lift of wrapped face GRS is approximately level with or slightly above the polystyrene board, and the geotextile wrap extends to beyond the concrete beam seat before constructing the cast-in-place beam seat.

When concrete traffic railing junction slabs are shown in the Plans, construct isolated GRS beam seat layers as described for the concrete beam seat to support the traffic railing junction slabs. Cast the traffic railing junction slabs directly on the geotextile wrap from the GRS beam seat layer. Ensure the geotextile wrap extends to beyond the traffic railing junction slab before constructing the traffic railing junction slab.

549-4.9 Superstructure Placement: The crane used for the placement of the superstructure can be positioned on the GRS abutment at least 18 inches away from the face of the abutment wall and wing walls provided the outrigger pads are sized for less than 4000 psf. When placing precast superstructure elements onto GRS beam seats, place an additional layer of geosynthetic reinforcement between the GRS beam seat and the beams to provide additional protection to the beam seat. Set beams without dragging across the beam seat surface.

549-4.10 Integrated Approach Construction: Following placement of the cast-in-place concrete when shown in the Plans or superstructure on the GRS beam seat, construct successive wrap-face GRS layers of 6 inch maximum thickness with select backfill material or GAB as shown in the Plans until the top of the final wrap is 2 to 3 inches below the bottom of the proposed asphalt pavement. Place and compact GAB in the top three 6 inch thick layers of the integrated approach in accordance with 204-2, 204-4, 204-5 and 204- 6. Compact GAB in the integrated approach to 100% of the maximum density. Cover the geotextile wrap from the top layer of reinforcement with 2 to 3 inches of GAB to pavement grade and compact to no additional movement.

549-4.11 Guardrail Posts: When guardrail posts are shown in the Plans to be installed in the GRS backfill reinforcement material, install only steel guardrail posts. Do not attempt to pre-drill holes in the reinforcement; drive steel guardrail posts through the buried reinforcement.

549-5 Method of Measurement.

The quantity to be paid for GRS abutments and walls will be the plan quantity, in square feet, completed and accepted, of the area bounded by the top of the coping, the top of the RSF and the begin and end wall limits as shown in the Plans. Plan quantity for GRS bridge abutments includes wing walls (wrap-around abutments).

549-6 Basis of Payment.

Price and payment for GRS abutments and walls will be full compensation for all work specified in this Section, including the excavation required specifically for wall construction, masonry facing blocks, backfill reinforcement, RSF, copings, fabric material, concrete for filling facing blocks, repairs, labor, equipment, expanded polystyrene foam board, and other materials necessary to complete the wall in an acceptable manner as shown on the Contract drawings. Unless shown otherwise in the Plans, the cost of coarse aggregate and GAB backfill material as described and required in this section will be paid as gravel fill.

Payment will be made under:

Item No. 549-1 GRS Retaining Wall - per square foot.

Item No. 549-2	GRS Bridge Abutment - per square foot.
Item No. 549-3	Gravel Fill - per cubic yard.