Florida Department of Transportation

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SECRETARY

August 27, 2026

Daniel Holt, PE, PTOE
Director, Project Delivery
Director, Technical Services
FHWA
400 West Washington Street, Suite 4200
Orlando, FL 32801

Re: State Specifications Office
Section: 548
Proposed Specification: **5480100 Retaining Wall Systems**
Associated Specification: **9360000 Components for Retaining Wall Systems**

Dear Mr. Holt:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

The changes are proposed by Rodrigo Herrera to clarify the requirements that address the contractor versus those that address the manufacturers of wall components.

Please review and transmit your comments, if any, within two weeks (10 business days). Comments should be sent via email daniel.strickland@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at (850) 414-4130.

Sincerely,

Signature on File

Daniel Strickland, P.E.
State Specifications Engineer

DS/am
Attachment
cc: Florida Transportation Builders' Assoc.
State Construction Engineer

RETAINING WALL SYSTEMS
(REV 6-9-26)

ARTICLE 548-1 is deleted and the following substituted:

548-1 Description.

Construct permanent and temporary retaining wall systems in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Contract or established by the Engineer. Sheet pile walls and cast-in-place walls are not included in this Section. Construct all walls of a specific type such as ~~(~~mechanically stabilized earth (MSE), counterfort, segmental block wall (SBW), etc.~~)~~, using the same wall system and supplier. If different types of wall systems must be used in such a manner that causes one wall to interact with or influence another wall, coordinate the detailing of these areas of interaction/influence with the assistance of the Contractor's Engineer of Record.

~~Obtain each reinforced concrete precast concrete retaining wall system from a plant that is currently on the Department's Production Facility Listing. Producers seeking inclusion on the list shall meet the requirements of Section 105.~~

~~Ensure that each wall system component is marked in accordance with 548-5.3.~~

~~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. Submit these tickets and certifications to the Engineer.~~

When shown in the Plans or approved by the Engineer, a ~~segmental block~~SBW MSE ~~retaining wall (SBW)~~ system may be provided as a substitute for a reinforced concrete panel MSE wall system. All SBW systems must ~~comprise:~~meet the requirements of Section 936 and herein.

~~1. Unreinforced dry-cast masonry facing blocks in a running bond pattern meeting the requirements of 548-5.~~

~~2. Structural backfill reinforcement:~~

~~a. Type R-3 geosynthetic backfill reinforcement placed in sheets full length without splices normal to the facing blocks and laterally without horizontal gaps, and with a vertical spacing of not more than every other course of blocks or 30 inches, whichever is less.~~

~~b. Metallic reinforcement placed full length without splices normal to the facing blocks and spaced laterally and vertically not more than every other block or 30 inches, whichever is less, with a positive mechanical or shear connection to the facing blocks.~~

~~3. A mechanical shear connection to lock adjacent blocks together horizontally or vertically.~~

ARTICLE 548-2 is deleted and the following substituted:

548-2 Materials.

Meet the following requirements:

Structural Portland Cement Concrete	Section 346
Portland Cement Concrete – Class NS	Section 347
Reinforcing Steel	Section 931

Fiber Reinforced Polymer (FRP) .....Section 932
Horizontal Joint Pads .....Section 936
Structural Geosynthetic Type R-3* ..... Section 985-5
Joint Cover Geotextile Type D-2 or D-3* ..... Section 985-3
Geotextile Separator Type D-4* ..... Section 985-3
*Use products listed on the Department's APL.

Provide a wall system listed on the Department's Approved Product List (APL) based on the wall type shown in the Plans. Purchase components, soil reinforcement, attachment devices, joint filler, geotextile, and all necessary incidentals for each wall from the same wall supplier.

548-2.1 Concrete: Ensure that concrete utilized for all wall components is consistent with the concrete class, environmental classification and admixture requirements for durability as stated in the Contract Documents. ~~Produce and supply concrete for all reinforced concrete wall components meeting the requirements of Section 346.~~

Produce and supply concrete for the leveling pad meeting the requirements of Section 347~~. Use~~ using Department approved mix designs.

~~**548-2.2 Reinforcing Steel:** Meet the requirements of Section 931 for steel reinforcing and Section 932 for FRP reinforcing, as identified in the Contract Documents and APL drawings.~~

548-2.3~~2~~ Backfill Reinforcement: For walls utilizing backfill reinforcement, use reinforcement ~~consisting of steel wire mesh, metal strips or structural geosynthetics~~meeting the requirements of Section 936 as required for the wall system chosen. ~~Use~~Ensure backfill reinforcement is of the same length from top to bottom of wall at any section. For tiered walls, ~~use~~ensure backfill reinforcement is of the same length within the height of each tier at any section.

~~Use plain steel wire mesh and embedded loops shop fabricated from cold drawn steel wire and weld into the finished mesh fabric meeting the requirements of ASTM A1064. Use longitudinal and transverse wires of equal and constant diameter within a given piece of mesh reinforcement. Use steel strips hot rolled from bars to the required shape and dimensions with physical and mechanical properties meeting ASTM A572 Grade 65 or as shown in the Contract.~~ Use shop-fabricated hot rolled steel tie straps meeting the minimum requirements of ASTM A1011/A1011 M, Grade 50, or as shown in the Contract.

~~Ensure that steel reinforcing strips, tie strips, reinforcing mesh and connectors used in permanent walls are galvanized in accordance with ASTM A123 or ASTM A153, as applicable. For typical applications, punch or drill holes in metal items before galvanizing.~~ Field drilled holes for bin walls are permitted. Repair field drilled holes; field cut ends and other damage to galvanized surfaces in accordance with Section 562.

For walls utilizing geosynthetic reinforcement, ~~Use~~ensure the reinforcement is Type R-3 structural geosynthetic~~s~~ and approved for use with the wall system. ~~made of polypropylene, select high density polyethylene or high-tenacity polyester fibers having cross-sections sufficient to permit significant mechanical interlock with the backfill. Use geosynthetics having a high tensile modulus in relation to the backfill. Use geosynthetics having high resistance to deformation under sustained long term design load while in service and resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced. Do not use~~For walls utilizing uncoated polyester (PET) reinforcements or reinforcements weakened or damaged by high pH environments, do not place reinforcement within any portion of ~~the~~ flowable fill, below the flood elevation, or other controlling water elevation shown in the Plans.

~~Store the 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 in the wall system.~~

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

548-2.43 Attachment Devices: Use backfill reinforcement attachment devices as required by the wall system chosen.

548-2.54 Joint Materials and Geotextiles:

548-2.54.1 Horizontal Joint Pads: Use ~~elastomeric or polymeric~~joint pads in all horizontal joints between precast components as recommended by the wall ~~manufacturer~~supplier and meeting the requirements of Section 936. ~~Ensure that the pads are of sufficient size and hardness to limit vertical stresses on the pad and concrete surface and to prevent concrete to concrete contact at the joints.~~

548-2.54.2 Joint Covers for Non-SBW Walls: For walls supporting bridge abutments on spread footings, cover joints and other wall openings with Type D-2 geotextile within a horizontal distance equal to the larger of:

1. the length of the reinforcement under the footing plus 25 feet, or
2. twice the maximum height of the footing above the leveling pad,

measured from the nearest edge of the footing, surrounding the reinforced backfill for the abutment ~~with Type D-2 geotextile meeting the requirements of Section 514~~.

For all other walls, ~~C~~cover all joints and wall openings ~~in portions of the wall backfilled with coarse aggregate~~ with Type D-2 or D-3 geotextile ~~meeting the requirements of Section 514. Cover all other joints and wall openings with~~In portions of the wall backfilled with coarse aggregate, use Type D-2 ~~or D-3~~ geotextile ~~with a maximum apparent opening size (AOS) equal to US Sieve No. 70 meeting the requirements of Section 514~~.

Apply an adhesive approved by the Engineer to the back of the precast component for attachment of the geotextile material.

548-2.54.3 Alignment Pins: Ensure that pins used to align the precast components during construction are of the size, shape, and material required for the wall system chosen.

548-2.54.4 Separation Geotextile: Provide a Type D-2(a) or D-3(a) separation geotextile ~~meeting the requirements of Section 514~~ between ~~the~~ coarse aggregate and the select backfill/embankment at the bottom, top, and sides of the coarse aggregate.

548-2.4.5 Compressible Free Draining Seal: Provide compressible free draining material (open cell) to prevent plant growth from seeds or spores that may be in the joints or transported to the joints by wind or rain. Provide a sample of the free draining material to the Engineer ten days prior to wall construction.

548-2.65 Backfill Material:

548-2.65.1 General: Provide compacted select backfill or coarse aggregate backfill within the retaining wall volume as shown in the Plans. For permanent walls, provide coarse aggregate backfill to the elevation shown in the Plans. Provide flowable fill within the retaining wall volume in lieu of compacted select backfill or coarse aggregate backfill only when the option for flowable fill is shown in the Plans. The retaining wall volume is defined to extend from the top of the leveling pad or footing, or bottom of walls which do not have footing or

leveling pads, to the finish grade line and from the face of the wall to a vertical plane passing through the end of the extreme wall component (straps, counterforts, etc.) plus one foot.

548-2.65.2 Compacted Select Backfill: Meet the requirements of Sections 105 and 120 except as noted within this Section. Have all backfill material tested for electro-chemical properties as specified in Table 548-1 and 548-2. All electro-chemical testing shall be performed by a Department approved qualified laboratory. Submit a certification, signed and sealed by a Professional Engineer registered in the State of Florida, that the results have met the requirements of this Section.

Table 548-1 Electro-Chemical Requirements for Metallic Reinforcement	
Test Method	Criteria
FM 5-550	$5 \leq pH \leq 10$
	*$4.5 \leq pH \leq 10$
FM 5-551	Resistivity $\geq$ 3000 Ohm-cm
FM 5-552	Soluble Chlorides $\leq$ 100 PPM
FM 5-553	Soluble Sulfates $\leq$ 200 PPM
*Meet the following wall panel requirements: (1) Interior face of the MSE wall panels have three inches of concrete cover over the reinforcement (2) Concrete used in the panels contain either a highly reactive pozzolan or the ternary mix design meeting the requirements of Table 346-2 with a surface resistivity $\geq$ 29 kOhm-cm and there are no steel piles and metallic elements/pipes other than metallic reinforcement placed within the backfill.	

Table 548-2 Electro-Chemical Requirements for Geosynthetic Reinforcement		
Test Method	Base Polymer	Criteria
FM 5-550	Polypropylene (PP) & High Density Polyethylene (HDPE)	$5 \leq pH \leq 10$
		*$3 \leq pH \leq 10$
	Polyester (PET)	$5 \leq pH \leq 9$
		*$3 \leq pH \leq 9$
*See Table 548-1 for wall panel requirements		

For constructing the retaining wall volume, do not use backfill material containing more than 2.0% by weight of organic material, as determined by FM 1-T 267, ~~and~~ by averaging the test results for three randomly selected samples from each stratum or stockpile of a particular material. If an individual test value of the three samples exceeds 3%, the stratum or stockpile will not be suitable for constructing the retaining wall volume.

Ensure that the material is non-plastic as determined by AASHTO T 90 and the liquid limit as determined by AASHTO T 89 is less than 15.

For walls using soil reinforcement, use backfill that meets the following gradation limits determined in accordance with AASHTO T 27 and FM 1-T 011:

Table 548-3 Gradation Limits	
Sieve Size	Percent Passing
3-1/2 inches	100
3/4 inch	70-100
No. 4	30-100
No. 40	15-100
No. 100	0-65
No. 200	0-12

For walls not ~~using~~utilizing soil reinforcement, use backfill that meets the following gradation limits determined in accordance with AASHTO T 27 and FM 1-T 011:

Table 548-4 Gradation Limits Not Using Soil Reinforcement	
Sieve Size	Percent Passing
3-1/2 inches	100
No. 200	0-12

548-2.6~~5~~.3 Flowable Fill: Meet the requirements of Section 121 except as noted within this Section and the Plans.

548-2.6~~5~~.4 Coarse Aggregate Backfill ~~and Drainage Aggregate~~: Provide 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 on the Plans. Have all coarse aggregate backfill material tested for electro-chemical properties as specified in Table 548-1 and 548-2 prior to placement, except replace FM 5-550 with ASTM D8262. All electro-chemical testing shall be performed by a Department qualified laboratory. Submit a certification, signed and sealed by a Professional Engineer registered in the State of Florida, that the results of these tests meet the requirements of 548-2.6~~5~~.2.

~~548-2.5.5 Drainage Aggregate:~~ For SBW systems, provide drainage aggregate comprised of coarse aggregate backfill and a drainage geotextile to separate the drainage aggregate from the reinforced backfill as specified for each approved wall system.

ARTICLE 548-3 is deleted and the following substituted:

~~**548-3 Approved Product List (APL).**~~

~~All proprietary retaining wall systems shall be listed on the APL. Manufacturers seeking evaluation of products for inclusion on the APL shall submit an application in accordance with Section 6, independently certified test reports, and calculations and drawings in accordance with the latest edition of the AASHTO LRFD Bridge Design Specifications and the Department's Structures Design Guidelines (SDG) signed and sealed by a Professional Engineer registered in the State of Florida. Submit calculations and drawings showing details, notes, materials, dimensions, sizes, and other information as described below for a complete description of the retaining wall system.~~

~~1. Soil reinforcement durability and/or corrosion data;~~

~~2. Differential settlement the wall system can tolerate without exceeding normal stress range of the soil reinforcement and wall facing, or the construction tolerances in this Section;~~

~~3. The effects of water flow;~~

~~4. Applicable environmental classifications as outlined in the SDG;~~

~~5. Signed and sealed design calculations. Design calculations may be either by hand or by a wall company program with hand calculations verifying the program output. It is only necessary to include sample hand calculations for a 20 foot height for each soil condition.~~

~~6. Corrosion and durability design procedures for soil reinforcement elements;~~

~~7. Provide 11 inch x17 inch drawings showing:~~

~~a. Notes specific to the wall system;~~

~~b. Panel sizes and reinforcing;~~

~~c. Soil reinforcement connection to wall facings;~~

~~d. Wall panel abutment interfacing;~~

~~e. Slip joints;~~

~~f. Steps in leveling pad;~~

~~g. Soil reinforcing details around all vertical obstructions;~~

~~h. Geotextile placement at panel joints and around all obstructions;~~

~~i. Details for skewing soil reinforcement (15 degrees maximum) without cutting;~~

~~j. Corner elements (required at all angle breaks greater than 5 degrees);~~

~~k. Bin wall details for acute corners (required at all acute corners where interior corner angle is less than 70 degrees);~~

~~l. Details showing how to accommodate long term (post construction) wall settlement in excess of four inches without attaching soil reinforcement to the abutment; and,~~

~~m. Details of how to ground the wall system.~~

~~8. Pull-out test data for the proposed wall/reinforcement connection, and size and type of soil reinforcement for the wall system. Testing shall be done by an independent soil testing laboratory or testing agency certified by the Department. Ensure test data includes all sizes and types of soil reinforcement to be utilized on Department projects. Default AASHTO values may be used for conventional soil reinforcement. For soil reinforcement grids, include all various configurations and combinations of longitudinal and transverse wires.~~

~~9. Other information pertinent to the design and performance of the wall system as necessary.~~

~~10. A field construction manual describing construction requirements and sequencing for the wall system. Submit manual in 8-1/2 inch x 11 inch format in either pdf or MS Word format.~~

548-3 General Requirements

Ensure that each shipment of products to the job site meets the requirements of 936-4.

ARTICLE 548-4 is deleted and the following substituted:

548-4 Shop Drawings.

Procure shop drawings meeting the requirements of Section 936.~~Submit shop drawings and calculations in accordance with Section 5. Provide calculations and drawings showing details, notes, materials, dimensions, sizes and other information necessary for the complete fabrication and erection of the retaining wall system. As a minimum, provide the following:~~

~~1. Elevation view showing the finished graded surface and elevations of the top and bottom of wall at the begin and end of wall, all breaks in vertical alignment and all whole stations and 25 foot station increments.~~

~~2. Sections showing the length, size and designation of soil reinforcement.~~

~~3. Plan view showing the horizontal alignment and offsets from the horizontal control line to the exterior face of the wall; the location of utilities, drainage structures and other items that impact the wall; the limits of the reinforced soil volume; and, the location of piles within the reinforced earth volume.~~

~~4. Details for construction around utilities, drainage structures and other items that impact the wall; for placement of soil reinforcement at acute corners; for addressing conflicts between soil reinforcement and obstructions in the reinforced soil volume; for addressing different wall types intersecting and impacting each other.~~

~~5. General notes and design parameters including design soil characteristics; factored bearing resistance and factored bearing pressure for each wall height increment and other notes required for construction of the walls.~~

~~6. Design calculations for each wall height increment detailed in the shop drawings.~~

~~7.~~ When the backfill friction angle depicted in the shop drawings exceeds 30 degrees for sand backfill or 34 degrees for limerock backfill, provide laboratory test results in accordance with 548-9.5 verifying the backfill to be used for the wall meets the design soil characteristics specified ~~for~~ in the shop drawings.

~~8. For SBW systems, include details for the placement of drainage aggregate, drainage pipes and separation geotextile. Drawings should be similar to details for Type II or Type III underdrains in Standard Plans, Index 440-001. Do not directly cover perforated drainage pipes with a geotextile (such as a filter sock).~~

~~9. When SBW systems use friction or semi-friction connections between geosynthetic reinforcement and the facing blocks, include the results of connection capacity testing. Tests must be performed using the materials to be used on the project and tested in accordance with ASTM D6638 to justify the short-term ultimate connection strength reduction factor (CR_u) used to determine the long-term connection strength reduction factor (CR_{cr}) value in the design calculations for each wall height increment detailed in the shop drawings.~~

ARTICLE 548-5 is deleted and the following substituted:

~~548-5 Concrete Component Construction.~~

~~Construct reinforced concrete components in accordance with Section 400. Precast wall components are produced using certification acceptance; therefore, assume responsibility for performance of all quality control testing and inspections required by Sections 346 and 400 for~~

~~the precast component construction. Perform all quality control (QC) inspection and testing using Construction Training and Qualification Program (CTQP) qualified personnel. Perform compressive strength testing in a laboratory meeting and maintaining at all times the qualification requirements listed in Section 105. The minimum time for form removal is 12 hours. Unless otherwise indicated in the Contract, apply a Class 3 finish to the concrete surface for the front face, and roughly screed the rear face to eliminate open pockets of aggregate and surface distortions in excess of 1/4 inch.~~

~~Construct unreinforced concrete SBW components (facing blocks) with a minimum compressive strength of 4,000 psi at 28 days and a maximum absorption of 6.5% in accordance with ASTM C140. Units must have a normal weight density classification meeting the requirements of ASTM C1372, except as modified in this Section.~~

~~**548-5.1 Curing:** Cure reinforced concrete components in accordance with Section 400.~~

~~**548-5.2 Tolerances:** Meet the following manufactured tolerances:~~

~~**548-5.2.1 Reinforced Concrete Components:**~~

~~1. Precast component dimensions: lateral position of soil reinforcement attachment devices - within 1 inch. All other dimensions - within 3/16 inch.~~

~~2. Precast component squareness: angular distortion of the component must not exceed 0.2 inches in 5 feet.~~

~~3. Precast component surface finish: surface defects on smooth formed surfaces measured on a length of 5 feet must not exceed more than 0.1 inches. Surface defects on textured finished surfaces measured on a length of 5 feet must not exceed 5/16 inch.~~

~~**548-5.2.2 Unreinforced Concrete SBW Components:**~~

~~1. Length, width and height of each individual block must be within 1/16 inch of the specified dimension. Hollow units must have a minimum wall thickness of 1-1/4 inches.~~

~~2. All units must be free of defects that would interfere with proper placing of the unit or impair the integrity of the wall construction. Minor cracks with a width less than 1/32 inch and a length less than 25% of the unit height may be acceptable.~~

~~3. Exposed facing blocks must be split face texture with a uniform wheat or tan color, unless shown otherwise in the Plans.~~ **548-5.~~3~~ Marking of Precast Components:**

Ensure precast components are marked in accordance with Section 936.~~ **548-5.3.1 Reinforced Concrete Components:** Permanently and legibly mark the following information on the back of each reinforced precast wall panel by etching: the panel number or type, piece mark, project number (if applicable), date cast and precast manufacturer's name or symbol with the approved producer's QC stamp affixed.~~

~~**548-5.3.2 Unreinforced Concrete SBW Components:** Label each pallet of dry-cast unreinforced concrete SBW facing blocks with the component identification number or type, project number (if applicable), LOT number, date cast, and the manufacturer's name or symbol. Labels must be clearly legible until the component is installed.~~

SUBARTICLE 548-6.1 is deleted and the following substituted:

548-6.1 Reinforced Concrete Components: For precast concrete wall components that have not been installed, evaluate for cracks, spalls, and other deficiencies in accordance with 450-12. Repair deficiencies in accordance with 450-13 or the plant's approved repair methods that are included as part of the Producer Quality Control Plan. The original performance and

durability of repaired wall components must be maintained. Use materials for concrete repair that meet or exceed the strength requirement for the class of concrete used. Materials meeting the requirements of Section 930 may be substituted for non--shrink grout when required by 450-13.

For precast concrete wall components that have been installed, the disposition of concrete cracks will be determined in accordance with 400-21.

The Department will reject all precast concrete wall components 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:
    a. Signs of aggregate segregation
    b. Broken or cracked corners
    c. Soil reinforcement attachment devices improperly installed/damaged
    d. Lifting inserts not useable
    e. Exposed reinforcing steel
    f. Insufficient cover over reinforcing steel
    g. Cracks at the alignment pipe or pin
    h. Insufficient concrete compressive strength
    i. Precast component thickness in excess of plus or minus 3/16 inch from that shown in the Contract Documents
    j. Stained front face, due to excess form oil or other reasons. If the face of the precast component is stained or discolored to the point of rejection, the stain or discoloration may be removed, or a Department approved stain or a Class 5 finish may be applied to attain a uniform appearance for the entire structure, to the satisfaction of the Engineer.

ARTICLE 548-7 is deleted and the following substituted:

548-7 Handling and Storage ~~and Shipping~~.

Handle and~~,~~ store ~~and ship~~ all concrete wall components in a manner that prevents chipping, cracks, fractures, excessive bending stresses, mud, dirt and debris. Support precast panels ~~wall~~ and counterfort components in storage on firm blocking located immediately adjacent to the attachment device.

~~Do not ship precast concrete wall components to the project site prior to the completion of the 72 hour curing period and attainment of the required 28 day strength.~~

The Contractor is permitted to verify the shipping strength test, before 28 days, by testing compressive strength cylinders that are cured under the conditions similar to the product or by testing temperature match cured cylinders. ~~The shipping strength test is the average compressive strength of two test cylinders. Do not ship reinforced concrete products until accepted and stamped by the QC Manager or the inspectors under the direct observation of the QC Manager.~~

Store the geosynthetics at temperatures above 20ºF and below 140ºF. Prevent mud, wet cement, epoxy, and similar 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 in the wall system.

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

SUBARTICLE 548-8.1 is deleted and the following is substituted:

548-8.1 General: Due to the unique nature of the structure and concept, procure from the wall supplier fully detailed shop drawings, technical instructions, guidance in preconstruction activities, and on-site technical assistance during construction. Closely follow any instructions from the wall supplier, unless otherwise directed by the Engineer. Submit any instructions from the wall supplier to the Engineer. Verify all pertinent retaining wall information (soil parameters, wall alignment, utility locations, conflicting structures) prior to the wall supplier finalizing shop drawings. Bring any conflicts not shown in the Contract to the Engineer's attention.

SUBARTICLE 548-8.3 is deleted and the following substituted:

548-8.3 Foundation Preparation: Grade the foundation for the structure level for a width equal to or exceeding the limits of the retaining wall volume or as shown in the Contract. Prepare the foundation in conformance with Section 125.

In addition to the compaction requirements of Section 125, compact the graded area with an appropriate vibratory roller weighing a minimum of eight tons for at least five passes or as directed by the Department's District Geotechnical Engineer. Remove and replace any soft or loose foundation subsoils incapable of sustaining the required compaction to the Engineer's satisfaction.

For permanent MSE wall systems, provide an unreinforced concrete leveling pad as shown in the Contract Documents. Cure the leveling pad a minimum of 12 hours before placement of precast wall components.

For SBW MSE wall systems, a geogrid reinforced, geotextile wrapped, compacted aggregate leveling pad may be used in lieu of the unreinforced concrete leveling pad. The compacted aggregate leveling pad must be at least 24 inches wide and at least 8 inches thick after compacting, and the geogrid must be at least 6 inches below the top of the leveling pad. Wrap the aggregate leveling pad with a Type D-2 or D-3 separation geotextile. The geotextile may run up the front and back of the first block course or between the aggregate leveling pad and the first block course.

SUBARTICLE 548-8.4 is deleted and the following substituted:

548-8.4 Wall Erection: Assemble, connect, and support wall components as recommended by the wall supplier. As backfill material is placed behind the wall face of MSE wall systems utilizing reinforced concrete panels, maintain the wall in the vertical position or slightly battered into the backfill to provide a final vertical alignment (by means of bracing, temporary wooden wedges placed in the joint at the junction of the two adjacent precast components on the external side of the wall or other alignment aids). Remove wooden wedges as soon as the precast component above the wedged precast component is completely erected and backfilled. External bracing is required for the initial lift of MSE systems.

For SBW systems, carefully place the first course of concrete block units on the leveling pad. Up to 1/2 inch of sand may be placed between the concrete leveling pad and the buried first course of blocks to provide a level and stable base. A one-inch gap between the first course of facing units is allowed, provided a suitable geotextile is placed behind the foundation units as specified for each approved wall system. Each unit must be in full contact with the base and checked for level and horizontal alignment. Voids must be kept to a minimum to prevent point loading and cracking, unless otherwise indicated in the shop drawings. Place units side by side for the full length of wall alignment. Fill the hollow cores or cells and the space within blocks with drainage aggregate. Sweep away excess material from top of units and install the next course.

Place soil reinforcement normal to the face of the wall, unless otherwise shown in the Contract or as directed by the Engineer. Do not cut or kink soil reinforcement. Do not connect soil reinforcement to piles or allow soil reinforcement to bear against piles. Field cut soil reinforcement only at locations as shown in the approved shop drawings. Prior to placement of the reinforcement, compact the backfill in accordance with 548-8.5.

For SBW systems, shims made of non-degradable materials may be used as specified for each approved wall system. The shim thickness per course of block must not exceed 1/8 inch and must not be installed on reinforcement elevations when the reinforcement connection relies on any friction.

548-8.4.1 Tolerances for Permanent Walls: Walls that do not meet the following tolerances will not be accepted by the Department and must be removed and reconstructed at no cost to the Department.

548-8.4.1.1 Reinforced Concrete MSE Wall Systems: Vertical tolerances (plumbness) and horizontal alignment tolerances must not exceed 3/4 inch when measured with a 10-foot straightedge. The maximum allowable offset in the joint between precast components is 3/4 inch. The final overall vertical tolerance of the completed wall (plumbness from top to bottom) must not exceed 1/2 inch per 10 feet of wall height. Horizontal and vertical joints between precast components must not be less than 1/2 inch or more than 1-1/4 inches.

548-8.4.1.2 SBW Systems: Horizontal alignment tolerances must not exceed 3/4 inch per10 feet of wall length. The maximum allowable gap between segmental retaining wall blocks above the first course must not exceed 1/16 inch. The final overall vertical tolerance of the completed wall (deviation from plumbness from top to bottom or batter shown in the Plans) must not exceed 1/2 inch per 10 feet of wall height.

548-8.4.2 Tolerances for Temporary Walls: Vertical tolerances (plumbness) and horizontal alignment tolerances must not exceed three inches when measured with a 10 foot straightedge. The final overall vertical tolerance of the completed wall (plumbness from top to bottom) must not exceed one inch per three feet of wall height, not to exceed a total of six inches.

SUBARTICLE 548-8.5.1 is deleted and the following substituted:

548-8.5.1 Compacted Select and Coarse Aggregate Backfill: A LOT is defined as a single lift of finished embankment not to exceed 500 feet in length of continuous or interconnected walls. Backfill within 3 feet from the panels and backfill beyond 3 feet from the panels are separate LOTs. Overlapping retaining wall volumes may be considered one LOT,

excluding the 3-foot width behind the panels. Strips up to 8 feet wide between two retaining wall volumes constructed with the same material in a single operation may be considered as one LOT with the retaining wall volumes. Isolated compaction operations will be considered as separate LOTs. For multiple phase construction, a LOT will not extend beyond the limits of the phase. When bridge abutments on spread footings are shown in the Plans, the material within 3 feet behind the wall face and within the limits defined in 548-9.4.2 are considered as separate LOTs.

Remove wrinkles in geosynthetic reinforcement prior to covering with backfill. Place the backfill closely following the erection of each course of precast components or soil reinforcement layers and spread by moving the machinery parallel to the wall face. Do not allow equipment heavier than eight tons closer than three feet behind the wall face. Place backfill in a manner to avoid any damage or disturbance to the wall materials or misalignment of the facing materials. Remove and replace any wall materials which become damaged or disturbed during backfill placement at no cost to the Department, or correct as directed by the Engineer. Remove and reconstruct any misalignment or distortion of the wall facing due to placement of backfill outside the limits of this specification at no cost to the Department.

Compact coarse aggregate backfill with a minimum of three passes of a vibratory compactor weighing between 600 and 1,000 pounds or two passes of vibratory compactor weighing over 1,000 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. Sheepsfoot, grid rollers or other types of equipment employing a foot are not allowed for any backfill type. Achieve compaction of all backfill types within three feet of the back of the wall face using a power operated roller or plate weighing less than 1,000 pounds. At a distance greater than three feet from the back of the wall, a vibratory roller may be used, provided that the frequency and amplitude combined with bulk weight of the roller has performed satisfactorily at a trial section of the same type of wall. For select backfill, a smooth wheel or rubber tire roller is considered adequate. For walls employing geosynthetic reinforcement, limit the weight of compaction equipment to 25,000 pounds. Ensure that the maximum lift thickness after compaction does not exceed six inches. Decrease the lift thickness if necessary, to obtain specified density.

All transitions from coarse aggregate backfill to select backfill must occur at least six inches above and below any layers of backfill reinforcement. Place a separation geotextile in accordance with 548-2.~~5~~4.4 between the coarse aggregate backfill and select backfill and embankment.

Perform backfill compaction in a way that the compactor moves in a direction parallel to the wall face and proceeds from a distance not less than three feet behind the wall face toward the end of the soil reinforcement element.

When placing select backfill, the moisture content of the backfill material prior to and during compaction must be uniformly distributed throughout each layer of material. Use backfill material having a placement moisture content at the dry side of the optimum moisture content. To achieve the required compaction moisture content, use water that meets the requirements of Section 923. Do not transport excessively moist backfill materials to the site for any reason. Determine the optimum moisture content in accordance with the test method used to determine maximum density in 548-9.

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.

SUBARTICLE 548-8.6 is deleted and the following substituted:

548-8.6 Compressible Free Draining Seal: ~~Seal all joints between panels of reinforced concrete panel MSE walls with compressible free draining material (open cell) to prevent plant growth from seeds or spores that may be in the joints or transported to the joints by wind or rain.~~ Install the seal at all joints between reinforced concrete MSE wall panels at least 1-1/2-inches from both the front and rear faces of the panel. Protect the free draining seal during the application of coatings and sealants. Should the seal become coated or clogged, remove and replace the coated or clogged free draining seal. The installation must be secure and free draining to keep the seal securely in place until uninstalled and to prevent hydrostatic forces from building up behind the panel.

SUBARTICLE 548-9.6 is deleted and the following substituted:

548-9.6 Frequency: Conduct sampling and testing at a minimum frequency listed in the table below. The Engineer will perform verification sampling and tests at a minimum frequency listed in Table 548-5 below.

Table 548-5
Minimum Frequency Testing

Test Name	Quality Control (QC)	Verification
Maximum Density	One per soil type	One per soil type
Density	One per LOT	One per four LOTs for each wall zone
Gradation	One per Maximum Density	One per Maximum Density
LL&PI	One per Maximum Density	One per Maximum Density
Soil Classification	One per Maximum Density	One per Maximum Density
Organic Content	One per soil type	One per soil type
pH	One per soil type	One per soil type
Direct Shear	Three per soil type when required by 548-9.5	One per soil type

In addition, for permanent walls utilizing metallic soil reinforcement, test for corrosiveness at a minimum frequency of one test per soil type at point of placement according to the electro-chemical table in 548-2.~~6~~5. The Engineer will collect enough material to split and create two separate samples and retain one for resolution at point of placement until LOTs represented by the samples are accepted. The Engineer will perform verification tests for corrosiveness at a minimum frequency of one test per soil type.

SUBARTICLE 548-9.7.4 is deleted and the following substituted:

548-9.7.4 Gradation: The Engineer will verify the QC results if the verification result meets the gradation limits set forth in the gradation table of 548-2.~~6~~5. Otherwise, the Engineer will test the sample retained in 548-9.7.1. The State Materials Office (SMO) or an AASHTO accredited laboratory designated by the SMO will perform resolution testing. The material will be sampled and tested in accordance with AASHTO T 27 and FM 1-T 011.

If the resolution test result satisfies the required gradation limits, the LOTs will be verified. If the resolution test results do not meet the required gradation limits, reconstruct the LOTs with acceptable material. The Engineer will perform new verification testing.

SUBARTICLE 548-9.7.5 is deleted and the following substituted:

548-9.7.5 Liquid Limit and Plasticity Index (LL&PI): The Engineer will verify the QC results if the verification result satisfies the plasticity index and liquid limit criteria set forth in 548-2.~~6~~5. Otherwise, the Engineer will test the sample retained in 548-9.7.1. The SMO or an AASHTO accredited laboratory designated by the SMO will perform resolution testing. The material will be sampled and tested in accordance with AASHTO T 90 and AASHTO T 89, respectively.

If the resolution test result satisfies the required criteria, LOTs of that soil type will be verified. If the resolution test results do not meet the required criteria, reconstruct the corresponding LOTs with acceptable material. The Engineer will perform new verification testing.

SUBARTICLE 548-9.7.6 is deleted and the following substituted:

548-9.7.6 Corrosiveness: The Engineer will verify the QC results if the verification result satisfies the electro-chemical and pH test criteria set forth in 548-2.~~6~~5. Otherwise, the Engineer will test the sample retained in 548-9.7.1. The SMO or an AASHTO accredited laboratory designated by the SMO will perform resolution testing. The material will be sampled and tested in accordance with FM 5-550, FM 5-551, FM 5-552 and FM 5-553. For coarse aggregate backfill, the material will be sampled and tested in accordance with ASTM D8262 in lieu of FM 5-550 for pH.

If the resolution test result satisfies the required criteria, material of that soil type will be verified and accepted. If the resolution test results do not meet the required criteria, reject the material and reconstruct with acceptable material.

SUBARTICLE 548-9.7.7 is deleted and the following substituted:

548-9.7.7 Organic Content: The Engineer will verify the QC results if the verification result satisfies the organic content test criteria set forth in 548-2.~~6~~5. Otherwise, the Engineer will collect three additional samples. The material will be sampled and tested in accordance with FM 1-T 267 and by averaging the test results for three randomly selected

samples from at least one lift per soil type. The SMO or an AASHTO accredited laboratory designated by the SMO will perform resolution testing.

If the resolution test result satisfies the required criteria, material of that soil type will be verified and accepted. If the resolution test results do not meet the required criteria, reject the material and reconstruct with acceptable material.

ARTICLE 548-10 is deleted and the following substituted:

548-10 Certification.

Submit all test reports to the Engineer necessary to document compliance with the Specifications, at least ten days prior to wall construction.

~~Also s~~Submit ~~a~~ the wall supplier's certificate of compliance certifying that the retaining wall materials~~, backfill and construction practices comply with this Section.~~ comply with the Contract Documents and all shipping tickets to the Engineer.

For SBW systems, the Engineer will randomly select samples of each type of block used in the ~~segmental block retaining wall~~SBW system and review a copy of the certified test report corresponding to the sample at a frequency of one sample per type of block for each wall.

Acceptance of furnished material will be based on the certificate of compliance, accompanying test reports, and visual inspection by the Engineer.

RETAINING WALL SYSTEMS
(REV 6-9-26)

ARTICLE 548-1 is deleted and the following substituted:

548-1 Description.

Construct permanent and temporary retaining wall systems in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Contract or established by the Engineer. Sheet pile walls and cast-in-place walls are not included in this Section. Construct all walls of a specific type such as mechanically stabilized earth (MSE), counterfort, segmental block wall (SBW), etc., using the same wall system and supplier. If different types of wall systems must be used in such a manner that causes one wall to interact with or influence another wall, coordinate the detailing of these areas of interaction/influence with the assistance of the Contractor's Engineer of Record.

When shown in the Plans or approved by the Engineer, a SBW MSE system may be provided as a substitute for a reinforced concrete panel MSE wall system. All SBW systems must meet the requirements of Section 936 and herein.

ARTICLE 548-2 is deleted and the following substituted:

548-2 Materials.

Meet the following requirements:

Structural Portland Cement Concrete	Section 346
Portland Cement Concrete – Class NS	Section 347
Reinforcing Steel	Section 931
Fiber Reinforced Polymer (FRP)	Section 932
Horizontal Joint Pads	Section 936
Structural Geosynthetic Type R-3*	Section 985-5
Joint Cover Geotextile Type D-2 or D-3*	Section 985-3
Geotextile Separator Type D-4*	Section 985-3

*Use products listed on the Department's APL.

Provide a wall system listed on the Department's Approved Product List (APL) based on the wall type shown in the Plans. Purchase components, soil reinforcement, attachment devices, joint filler, geotextile, and all necessary incidentals for each wall from the same wall supplier.

548-2.1 Concrete: Ensure that concrete utilized for all wall components is consistent with the concrete class, environmental classification and admixture requirements for durability as stated in the Contract Documents.

Produce and supply concrete for the leveling pad meeting the requirements of Section 347 using Department approved mix designs.

548-2.2 Backfill Reinforcement: For walls utilizing backfill reinforcement, use reinforcement meeting the requirements of Section 936 as required for the wall system chosen. Ensure backfill reinforcement is of the same length from top to bottom of wall at any section. For tiered walls, ensure backfill reinforcement is of the same length within the height of each tier at any section.

Use shop-fabricated hot rolled steel tie straps meeting the minimum requirements of ASTM A1011/A1011 M, Grade 50, or as shown in the Contract.

Field drilled holes for bin walls are permitted. Repair field drilled holes; field cut ends and other damage to galvanized surfaces in accordance with Section 562.

For walls utilizing geosynthetic reinforcement, ensure the reinforcement is Type R-3 structural geosynthetic and approved for use with the wall system. For walls utilizing uncoated polyester (PET) reinforcements or reinforcements weakened or damaged by high pH environments, do not place reinforcement within any portion of flowable fill, below the flood elevation, or other controlling water elevation shown in the Plans.

548-2.3 Attachment Devices: Use backfill reinforcement attachment devices as required by the wall system chosen.

548-2.4 Joint Materials and Geotextiles:

548-2.4.1 Horizontal Joint Pads: Use joint pads in all horizontal joints between precast components as recommended by the wall supplier and meeting the requirements of Section 936.

548-2.4.2 Joint Covers for Non-SBW Walls: For walls supporting bridge abutments on spread footings, cover joints and other wall openings with Type D-2 geotextile within a horizontal distance equal to the larger of:

1. the length of the reinforcement under the footing plus 25 feet, or
2. twice the maximum height of the footing above the leveling pad,

measured from the nearest edge of the footing, surrounding the reinforced backfill for the abutment.

For all other walls, cover all joints and wall openings with Type D-2 or D-3 geotextile. In portions of the wall backfilled with coarse aggregate, use Type D-2 geotextile.

Apply an adhesive approved by the Engineer to the back of the precast component for attachment of the geotextile material.

548-2.4.3 Alignment Pins: Ensure that pins used to align the precast components during construction are of the size, shape, and material required for the wall system chosen.

548-2.4.4 Separation Geotextile: Provide a Type D-2(a) or D-3(a) separation geotextile between coarse aggregate and the select backfill/embankment at the bottom, top, and sides of the coarse aggregate.

548-2.4.5 Compressible Free Draining Seal: Provide compressible free draining material (open cell) to prevent plant growth from seeds or spores that may be in the joints or transported to the joints by wind or rain. Provide a sample of the free draining material to the Engineer ten days prior to wall construction.

548-2.5 Backfill Material:

548-2.5.1 General: Provide compacted select backfill or coarse aggregate backfill within the retaining wall volume as shown in the Plans. For permanent walls, provide coarse aggregate backfill to the elevation shown in the Plans. Provide flowable fill within the retaining wall volume in lieu of compacted select backfill or coarse aggregate backfill only when the option for flowable fill is shown in the Plans. The retaining wall volume is defined to extend from the top of the leveling pad or footing, or bottom of walls which do not have footing or leveling pads, to the finish grade line and from the face of the wall to a vertical plane passing through the end of the extreme wall component (straps, counterforts, etc.) plus one foot.

548-2.5.2 Compacted Select Backfill: Meet the requirements of Sections 105 and 120 except as noted within this Section. Have all backfill material tested for electro-chemical properties as specified in Table 548-1 and 548-2. All electro-chemical testing shall be performed by a Department approved qualified laboratory. Submit a certification, signed and sealed by a

Professional Engineer registered in the State of Florida, that the results have met the requirements of this Section.

Table 548-1 Electro-Chemical Requirements for Metallic Reinforcement	
Test Method	Criteria
FM 5-550	$5 \leq pH \leq 10$
	*$4.5 \leq pH \leq 10$
FM 5-551	Resistivity $\geq$ 3000 Ohm-cm
FM 5-552	Soluble Chlorides $\leq$ 100 PPM
FM 5-553	Soluble Sulfates $\leq$ 200 PPM
*Meet the following wall panel requirements: (1) Interior face of the MSE wall panels have three inches of concrete cover over the reinforcement (2) Concrete used in the panels contain either a highly reactive pozzolan or the ternary mix design meeting the requirements of Table 346-2 with a surface resistivity $\geq$ 29 kOhm-cm and there are no steel piles and metallic elements/pipes other than metallic reinforcement placed within the backfill.	

Table 548-2 Electro-Chemical Requirements for Geosynthetic Reinforcement		
Test Method	Base Polymer	Criteria
FM 5-550	Polypropylene (PP) & High Density Polyethylene (HDPE)	$5 \leq pH \leq 10$
		*$3 \leq pH \leq 10$
	Polyester (PET)	$5 \leq pH \leq 9$
		*$3 \leq pH \leq 9$
*See Table 548-1 for wall panel requirements		

For constructing the retaining wall volume, do not use backfill material containing more than 2.0% by weight of organic material, as determined by FM 1-T 267, by averaging the test results for three randomly selected samples from each stratum or stockpile of a particular material. If an individual test value of the three samples exceeds 3%, the stratum or stockpile will not be suitable for constructing the retaining wall volume.

Ensure that the material is non-plastic as determined by AASHTO T 90 and the liquid limit as determined by AASHTO T 89 is less than 15.

For walls using soil reinforcement, use backfill that meets the following gradation limits determined in accordance with AASHTO T 27 and FM 1-T 011:

Table 548-3 Gradation Limits	
Sieve Size	Percent Passing
3-1/2 inches	100
3/4 inch	70-100
No. 4	30-100
No. 40	15-100
No. 100	0-65
No. 200	0-12

For walls not utilizing soil reinforcement, use backfill that meets the following gradation limits determined in accordance with AASHTO T 27 and FM 1-T 011:

Table 548-4 Gradation Limits Not Using Soil Reinforcement	
Sieve Size	Percent Passing
3-1/2 inches	100
No. 200	0-12

548-2.5.3 Flowable Fill: Meet the requirements of Section 121 except as noted within this Section and the Plans.

548-2.5.4 Coarse Aggregate Backfill: Provide 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 on the Plans. Have all coarse aggregate backfill material tested for electro-chemical properties as specified in Table 548-1 and 548-2 prior to placement, except replace FM 5-550 with ASTM D8262. All electro-chemical testing shall be performed by a Department qualified laboratory. Submit a certification, signed and sealed by a Professional Engineer registered in the State of Florida, that the results of these tests meet the requirements of 548-2.5.2.

548-2.5.5 Drainage Aggregate: For SBW systems, provide drainage aggregate comprised of coarse aggregate backfill and a drainage geotextile to separate the drainage aggregate from the reinforced backfill as specified for each approved wall system.

ARTICLE 548-3 is deleted and the following substituted:

548-3 General Requirements

Ensure that each shipment of products to the job site meets the requirements of 936-4.

ARTICLE 548-4 is deleted and the following substituted:

548-4 Shop Drawings.

Procure shop drawings meeting the requirements of Section 936. When the backfill friction angle depicted in the shop drawings exceeds 30 degrees for sand backfill or 34 degrees for limerock backfill, provide laboratory test results in accordance with 548-9.5 verifying the

backfill to be used for the wall meets the design soil characteristics specified in the shop drawings.

ARTICLE 548-5 is deleted and the following substituted:

548-5 Marking of Precast Components:

Ensure precast components are marked in accordance with Section 936.

SUBARTICLE 548-6.1 is deleted and the following substituted:

548-6.1 Reinforced Concrete Components: For precast concrete wall components that have not been installed, evaluate for cracks, spalls, and other deficiencies in accordance with 450-12. Repair deficiencies in accordance with 450-13 or the plant's approved repair methods that are included as part of the Producer Quality Control Plan. The original performance and durability of repaired wall components must be maintained. Use materials for concrete repair that meet or exceed the strength requirement for the class of concrete used. Materials meeting the requirements of Section 930 may be substituted for non-shrink grout when required by 450-13.

For precast concrete wall components that have been installed, the disposition of concrete cracks will be determined in accordance with 400-21.

The Department will reject all precast concrete wall components 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:
    a. Signs of aggregate segregation
    b. Broken or cracked corners
    c. Soil reinforcement attachment devices improperly installed/damaged
    d. Lifting inserts not useable
    e. Exposed reinforcing steel
    f. Insufficient cover over reinforcing steel
    g. Cracks at the alignment pipe or pin
    h. Insufficient concrete compressive strength
    i. Precast component thickness in excess of plus or minus 3/16 inch from that shown in the Contract Documents
    j. Stained front face, due to excess form oil or other reasons. If the face of the precast component is stained or discolored to the point of rejection, the stain or discoloration may be removed, or a Department approved stain or a Class 5 finish may be applied to attain a uniform appearance for the entire structure, to the satisfaction of the Engineer.

ARTICLE 548-7 is deleted and the following substituted:

548-7 Handling and Storage.

Handle and store all concrete wall components in a manner that prevents chipping, cracks, fractures, excessive bending stresses, mud, dirt and debris. Support precast panels and counterfort components in storage on firm blocking located immediately adjacent to the attachment device.

The Contractor is permitted to verify the shipping strength test, before 28 days, by testing compressive strength cylinders that are cured under the conditions similar to the product or by testing temperature match cured cylinders.

Store the geosynthetics at temperatures above 20ºF and below 140ºF. Prevent mud, wet cement, epoxy, and similar 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 in the wall system.

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

SUBARTICLE 548-8.1 is deleted and the following is substituted:

548-8.1 General: Due to the unique nature of the structure and concept, procure from the wall supplier fully detailed shop drawings, technical instructions, guidance in preconstruction activities, and on-site technical assistance during construction. Closely follow any instructions from the wall supplier, unless otherwise directed by the Engineer. Submit any instructions from the wall supplier to the Engineer. Verify all pertinent retaining wall information (soil parameters, wall alignment, utility locations, conflicting structures) prior to the wall supplier finalizing shop drawings. Bring any conflicts not shown in the Contract to the Engineer's attention.

SUBARTICLE 548-8.3 is deleted and the following substituted:

548-8.3 Foundation Preparation: Grade the foundation for the structure level for a width equal to or exceeding the limits of the retaining wall volume or as shown in the Contract. Prepare the foundation in conformance with Section 125.

In addition to the compaction requirements of Section 125, compact the graded area with an appropriate vibratory roller weighing a minimum of eight tons for at least five passes or as directed by the Department's District Geotechnical Engineer. Remove and replace any soft or loose foundation subsoils incapable of sustaining the required compaction to the Engineer's satisfaction.

For permanent MSE wall systems, provide an unreinforced concrete leveling pad as shown in the Contract Documents. Cure the leveling pad a minimum of 12 hours before placement of precast wall components.

For SBW MSE wall systems, a geogrid reinforced, geotextile wrapped, compacted aggregate leveling pad may be used in lieu of the unreinforced concrete leveling pad. The compacted aggregate leveling pad must be at least 24 inches wide and at least 8 inches thick after compacting, and the geogrid must be at least 6 inches below the top of the leveling pad. Wrap the aggregate leveling pad with a Type D-2 or D-3 separation geotextile. The geotextile

may run up the front and back of the first block course or between the aggregate leveling pad and the first block course.

SUBARTICLE 548-8.4 is deleted and the following substituted:

548-8.4 Wall Erection: Assemble, connect, and support wall components as recommended by the wall supplier. As backfill material is placed behind the wall face of MSE wall systems utilizing reinforced concrete panels, maintain the wall in the vertical position or slightly battered into the backfill to provide a final vertical alignment (by means of bracing, temporary wooden wedges placed in the joint at the junction of the two adjacent precast components on the external side of the wall or other alignment aids). Remove wooden wedges as soon as the precast component above the wedged precast component is completely erected and backfilled. External bracing is required for the initial lift of MSE systems.

For SBW systems, carefully place the first course of concrete block units on the leveling pad. Up to 1/2 inch of sand may be placed between the concrete leveling pad and the buried first course of blocks to provide a level and stable base. A one-inch gap between the first course of facing units is allowed, provided a suitable geotextile is placed behind the foundation units as specified for each approved wall system. Each unit must be in full contact with the base and checked for level and horizontal alignment. Voids must be kept to a minimum to prevent point loading and cracking, unless otherwise indicated in the shop drawings. Place units side by side for the full length of wall alignment. Fill the hollow cores or cells and the space within blocks with drainage aggregate. Sweep away excess material from top of units and install the next course.

Place soil reinforcement normal to the face of the wall, unless otherwise shown in the Contract or as directed by the Engineer. Do not cut or kink soil reinforcement. Do not connect soil reinforcement to piles or allow soil reinforcement to bear against piles. Field cut soil reinforcement only at locations as shown in the approved shop drawings. Prior to placement of the reinforcement, compact the backfill in accordance with 548-8.5.

For SBW systems, shims made of non-degradable materials may be used as specified for each approved wall system. The shim thickness per course of block must not exceed 1/8 inch and must not be installed on reinforcement elevations when the reinforcement connection relies on any friction.

548-8.4.1 Tolerances for Permanent Walls: Walls that do not meet the following tolerances will not be accepted by the Department and must be removed and reconstructed at no cost to the Department.

548-8.4.1.1 Reinforced Concrete MSE Wall Systems: Vertical tolerances (plumbness) and horizontal alignment tolerances must not exceed 3/4 inch when measured with a 10-foot straightedge. The maximum allowable offset in the joint between precast components is 3/4 inch. The final overall vertical tolerance of the completed wall (plumbness from top to bottom) must not exceed 1/2 inch per 10 feet of wall height. Horizontal and vertical joints between precast components must not be less than 1/2 inch or more than 1-1/4 inches.

548-8.4.1.2 SBW Systems: Horizontal alignment tolerances must not exceed 3/4 inch per10 feet of wall length. The maximum allowable gap between segmental retaining wall blocks above the first course must not exceed 1/16 inch. The final overall vertical

tolerance of the completed wall (deviation from plumbness from top to bottom or batter shown in the Plans) must not exceed 1/2 inch per 10 feet of wall height.

548-8.4.2 Tolerances for Temporary Walls: Vertical tolerances (plumbness) and horizontal alignment tolerances must not exceed three inches when measured with a 10 foot straightedge. The final overall vertical tolerance of the completed wall (plumbness from top to bottom) must not exceed one inch per three feet of wall height, not to exceed a total of six inches.

SUBARTICLE 548-8.5.1 is deleted and the following substituted:

548-8.5.1 Compacted Select and Coarse Aggregate Backfill: A LOT is defined as a single lift of finished embankment not to exceed 500 feet in length of continuous or interconnected walls. Backfill within 3 feet from the panels and backfill beyond 3 feet from the panels are separate LOTs. Overlapping retaining wall volumes may be considered one LOT, excluding the 3-foot width behind the panels. Strips up to 8 feet wide between two retaining wall volumes constructed with the same material in a single operation may be considered as one LOT with the retaining wall volumes. Isolated compaction operations will be considered as separate LOTs. For multiple phase construction, a LOT will not extend beyond the limits of the phase. When bridge abutments on spread footings are shown in the Plans, the material within 3 feet behind the wall face and within the limits defined in 548-9.4.2 are considered as separate LOTs.

Remove wrinkles in geosynthetic reinforcement prior to covering with backfill. Place the backfill closely following the erection of each course of precast components or soil reinforcement layers and spread by moving the machinery parallel to the wall face. Do not allow equipment heavier than eight tons closer than three feet behind the wall face. Place backfill in a manner to avoid any damage or disturbance to the wall materials or misalignment of the facing materials. Remove and replace any wall materials which become damaged or disturbed during backfill placement at no cost to the Department, or correct as directed by the Engineer. Remove and reconstruct any misalignment or distortion of the wall facing due to placement of backfill outside the limits of this specification at no cost to the Department.

Compact coarse aggregate backfill with a minimum of three passes of a vibratory compactor weighing between 600 and 1,000 pounds or two passes of vibratory compactor weighing over 1,000 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. Sheepsfoot, grid rollers or other types of equipment employing a foot are not allowed for any backfill type. Achieve compaction of all backfill types within three feet of the back of the wall face using a power operated roller or plate weighing less than 1,000 pounds. At a distance greater than three feet from the back of the wall, a vibratory roller may be used, provided that the frequency and amplitude combined with bulk weight of the roller has performed satisfactorily at a trial section of the same type of wall. For select backfill, a smooth wheel or rubber tire roller is considered adequate. For walls employing geosynthetic reinforcement, limit the weight of compaction equipment to 25,000 pounds. Ensure that the maximum lift thickness after compaction does not exceed six inches. Decrease the lift thickness if necessary, to obtain specified density.

All transitions from coarse aggregate backfill to select backfill must occur at least six inches above and below any layers of backfill reinforcement. Place a separation

geotextile in accordance with 548-2.4.4 between the coarse aggregate backfill and select backfill and embankment.

Perform backfill compaction in a way that the compactor moves in a direction parallel to the wall face and proceeds from a distance not less than three feet behind the wall face toward the end of the soil reinforcement element.

When placing select backfill, the moisture content of the backfill material prior to and during compaction must be uniformly distributed throughout each layer of material. Use backfill material having a placement moisture content at the dry side of the optimum moisture content. To achieve the required compaction moisture content, use water that meets the requirements of Section 923. Do not transport excessively moist backfill materials to the site for any reason. Determine the optimum moisture content in accordance with the test method used to determine maximum density in 548-9.

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.

SUBARTICLE 548-8.6 is deleted and the following substituted:

548-8.6 Compressible Free Draining Seal: Install the seal at all joints between reinforced concrete MSE wall panels at least 1-1/2-inches from both the front and rear faces of the panel. Protect the free draining seal during the application of coatings and sealants. Should the seal become coated or clogged, remove and replace the coated or clogged free draining seal. The installation must be secure and free draining to keep the seal securely in place until uninstalled and to prevent hydrostatic forces from building up behind the panel.

SUBARTICLE 548-9.6 is deleted and the following substituted:

548-9.6 Frequency: Conduct sampling and testing at a minimum frequency listed in the table below. The Engineer will perform verification sampling and tests at a minimum frequency listed in Table 548-5 below.

Table 548-5
Minimum Frequency Testing

Test Name	Quality Control (QC)	Verification
Maximum Density	One per soil type	One per soil type
Density	One per LOT	One per four LOTs for each wall zone
Gradation	One per Maximum Density	One per Maximum Density
LL&PI	One per Maximum Density	One per Maximum Density
Soil Classification	One per Maximum Density	One per Maximum Density
Organic Content	One per soil type	One per soil type
pH	One per soil type	One per soil type

Direct Shear	Three per soil type when required by 548-9.5	One per soil type

In addition, for permanent walls utilizing metallic soil reinforcement, test for corrosiveness at a minimum frequency of one test per soil type at point of placement according to the electro-chemical table in 548-2.5. The Engineer will collect enough material to split and create two separate samples and retain one for resolution at point of placement until LOTs represented by the samples are accepted. The Engineer will perform verification tests for corrosiveness at a minimum frequency of one test per soil type.

SUBARTICLE 548-9.7.4 is deleted and the following substituted:

548-9.7.4 Gradation: The Engineer will verify the QC results if the verification result meets the gradation limits set forth in the gradation table of 548-2.5. Otherwise, the Engineer will test the sample retained in 548-9.7.1. The State Materials Office (SMO) or an AASHTO accredited laboratory designated by the SMO will perform resolution testing. The material will be sampled and tested in accordance with AASHTO T 27 and FM 1-T 011.

If the resolution test result satisfies the required gradation limits, the LOTs will be verified. If the resolution test results do not meet the required gradation limits, reconstruct the LOTs with acceptable material. The Engineer will perform new verification testing.

SUBARTICLE 548-9.7.5 is deleted and the following substituted:

548-9.7.5 Liquid Limit and Plasticity Index (LL&PI): The Engineer will verify the QC results if the verification result satisfies the plasticity index and liquid limit criteria set forth in 548-2.5. Otherwise, the Engineer will test the sample retained in 548-9.7.1. The SMO or an AASHTO accredited laboratory designated by the SMO will perform resolution testing. The material will be sampled and tested in accordance with AASHTO T 90 and AASHTO T 89, respectively.

If the resolution test result satisfies the required criteria, LOTs of that soil type will be verified. If the resolution test results do not meet the required criteria, reconstruct the corresponding LOTs with acceptable material. The Engineer will perform new verification testing.

SUBARTICLE 548-9.7.6 is deleted and the following substituted:

548-9.7.6 Corrosiveness: The Engineer will verify the QC results if the verification result satisfies the electro-chemical and pH test criteria set forth in 548-2.5. Otherwise, the Engineer will test the sample retained in 548-9.7.1. The SMO or an AASHTO accredited laboratory designated by the SMO will perform resolution testing. The material will be sampled and tested in accordance with FM 5-550, FM 5-551, FM 5-552 and FM 5-553. For

coarse aggregate backfill, the material will be sampled and tested in accordance with ASTM D8262 in lieu of FM 5-550 for pH.

If the resolution test result satisfies the required criteria, material of that soil type will be verified and accepted. If the resolution test results do not meet the required criteria, reject the material and reconstruct with acceptable material.

SUBARTICLE 548-9.7.7 is deleted and the following substituted:

548-9.7.7 Organic Content: The Engineer will verify the QC results if the verification result satisfies the organic content test criteria set forth in 548-2.5. Otherwise, the Engineer will collect three additional samples. The material will be sampled and tested in accordance with FM 1-T 267 and by averaging the test results for three randomly selected samples from at least one lift per soil type. The SMO or an AASHTO accredited laboratory designated by the SMO will perform resolution testing.

If the resolution test result satisfies the required criteria, material of that soil type will be verified and accepted. If the resolution test results do not meet the required criteria, reject the material and reconstruct with acceptable material.

ARTICLE 548-10 is deleted and the following substituted:

548-10 Certification.

Submit all test reports to the Engineer necessary to document compliance with the Specifications, at least ten days prior to wall construction. Submit the wall supplier's certificate of compliance certifying that the retaining wall materials comply with the Contract Documents and all shipping tickets to the Engineer.

For SBW systems, the Engineer will randomly select samples of each type of block used in the SBW system and review a copy of the certified test report corresponding to the sample at a frequency of one sample per type of block for each wall.

Acceptance of furnished material will be based on the certificate of compliance, accompanying test reports, and visual inspection by the Engineer.