

5480000 RETAINING WALL SYSTEMS  
INTERNAL/INDUSTRY REVIEW COMMENTS

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Comments: (7-5-16, Internal)

Referring to D-2 or D-3 is that all category's, ie D-2 a,b,c,d,e,f, and the same for D-3 a,b,c,d,e,f?

Response: Yes, as limited by Specification 985 for the immediately adjacent soils. However, D-3 has only a through e. No change made.

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Comments: (7-5-16, Internal)

Note that subsections "f" and "g" are listed twice under section 548-6.1.

Response: This has been corrected.  
Change made.

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Comments: (7-6-16)

1. There are a few locations where the Specification refers to the "Contractor's Engineer of Record" and other sections refer to "the Specialty Engineer". If these are the same, I recommend using consistent terminology.

Response: The terms "Specialty Engineer" and "Contractor Engineer of Record" are defined in Article 1-3. They are similar, but not the same. Both work for the Contractor, but there are different levels of work that they can perform. We require a Contractor's EOR for most structural issues.  
No change made.

2. Likewise, the term "Contract" and "Plans" seem to be interchanged throughout.

Response: The terms do not mean the same thing. The following definitions are located in 1-3 of the Specifications.

<p>▪ <b>Contract.</b>¶</p> <p>→ The term "Contract" means the entire and integrated agreement between the parties thereunder and supersedes all prior negotiations, representations, or agreements, either written or oral. The Contract Documents form the Contract between the Department and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to, the performance of the Work and the basis of payment.¶</p>
<p>▪ <b>Contract Documents.</b>¶</p> <p>→ The term "Contract Documents" includes: Advertisement for Proposal, Proposal, Certification as to Publication and Notice of Advertisement for Proposal, Appointment of Agent by Nonresident Contractors, Noncollusion Affidavit, Warranty Concerning Solicitation of the Contract by Others, Resolution of Award of Contract, Executed Form of Contract, Performance Bond and Payment Bond, Specifications, Plans (including revisions thereto issued during construction), Addenda, or other information mailed or otherwise transmitted to the prospective bidders prior to the receipt of bids, work orders and supplemental agreements, all of which are to be treated as one instrument whether or not set forth at length in the form of contract.¶</p> <p>→ Note: As used in Sections 2 and 3 only, Contract Documents do not include work orders, and supplementary agreements. As used in Section 2 only, Contract Documents also do not include Resolution of Award of Contract, Executed Form of Contract, and Performance and Payment Bond.¶</p>
<p>▪ <b>Plans.</b>¶</p> <p>→ The approved Plans, including reproductions thereof, showing the location, character, dimensions, and details of the work.¶</p>

**Simplified:**

“Contract” includes all communications, negotiations, agreements, documents, etc., between the Department and Contractor related to a specific project.

“Contract Documents” broadly include everything written related to a specific project. However, regarding Specifications Sections II and III, Contract Documents do not include those documents executed after construction begins. In Specifications Section II, Contract Documents also do not include those documents executed after award of the Contract but prior to the beginning of construction.

“Plans” (as approved), show what is to be built and where it is to be constructed.

3. In Subarticle 548-4, Item 8, remove "No." when referencing Design Standards, Index 286.

Response: This is standard Specification language. (Design Standards, Index No. XXX)  
No change made.

4. For Subarticle 548-5.3, should the APL number also be added to the marking? This is generally a requirement for other APL products.

Response: This has not been necessary for the last 20 years since all items should be associated with the same system (same APL item), if we begin having issues, we will consider the change.  
No change made.

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Comments: (7-8-16)

The proposed revision contains the following text "Purchase the precast components, soil reinforcement, attachment devices, joint filler, filter fabric, and all necessary incidentals for each wall from the same wall supplier chosen." Is this not dictating means and methods? I believe a more suitable version would be something to the effect of " the contractor will ensure that all precast components, soil reinforcement, attachment devices, joint filler, filter fabric and all necessary incidentals are compatible with each other and do not compromise the integrity of the finished product."

Response: No, this is not dictating means and methods. Retaining walls are constructed as a system, so all the components must be obtained from the same manufacturer. These components are part of the vendor's APL submittal to ensure compatibility.

No change made.

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Comments: (7-19-16)

1) Sec 548-1.3. Please clarify what is meant by "mechanical shear connection" between blocks. Can this be a shear connection manufactured into the blocks; like a lip or an external device like a bar, clip or pin?

Response: Yes.  
No change made.

2) Sec 548-5.2.2. Sentence 1. and 2. seem to be redundant regarding the individual block tolerance of 1/16'

Response: Agree. Item 2 has been deleted.  
Change made.

3) Sec 548-8.1. Request to change party responsible for the detailed shop drawings from wall supplier to Engineer of record.

Response: Shop Drawings are submitted by the Contractor, not the EOR. Please refer to Specification Section 5 (5-1.4).  
No change made

4) Sec-8.4.1.2 Minimum allowable gap of 1/32" between blocks above the first course is unrealistic, 1/8" is recommended. The stated horizontal tolerance over 10' of finished wall of 3/4" is unrealistic; NMCA 3rd edition recommends +/- 1.25" over 10 feet. The stated vertical tolerance over 10' of finished wall of 1/2" is unrealistic; NMCA Segmental Retaining Wall Guide 3rd edition recommends +/- 1.25" over 10 feet.

Response: The minimum gap of 1/32" was developed with Industry input. We have not been seeing issues with blocks kept flush with each other staying on running bond, but I see the potential for an issue in a scenario described below in another comment. However, if a block is 1/16 inch short, it should be 1/32 inch short on each end. Therefore the max gap needed to stay on running bond should not exceed 1/16 inch.

1/32 inch changed to 1/16 inch.  
Change made.

Horizontal and Vertical tolerances are the same for reinforced concrete panel MSE walls and segmental block MSE walls. These tolerance requirements have been in place for over 20 years. This may require more extensive QC effort by the Contractor than generally anticipated by NCMA.

No change made.

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Comments: (7-22-16)

548-2.6.1. Consider adding the language in bold italics following the sentence shown here: 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.--- Flowable fill shall be made in lifts not exceeding 6" high up to two third height of individual wall panel.

(The reason for this comment is that if we pour flowable fill in one shot to the entire height of wall panel, the wall panel will get pushed out, unless it is braced and supported from outside to with stand the pressure of the flowable fill. Once it is more than half the height, the sliding resultant force is with in the middle third height of the wall panel.)

Response: This is a means and methods issue. The contractor is responsible for ensuring the panels or blocks are in the correct position when filling is complete.  
No change made.

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Comments: (7-27-16)

Recommend the following edits to accommodate gravity walls constructed using precast modular blocks:

1. 548-1, add paragraph: Gravity walls constructed using precast modular blocks (PMB) may be substituted for MSE walls. PMB units shall have a minimum face area of 5 square feet and a minimum weight of 900 pounds. PMB units may be reinforced or unreinforced, but shall meet all other requirements for reinforced concrete precast units.

Response: Walls comprising large precast modular blocks may need to be addressed in a future specification revision.  
No change made.

2. 548-2.2, add at the end of the paragraph: ... or welded wire mesh.

Response: This is covered in Section 931 referenced by this Article.  
No change made.

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Comments: (7-29-16)

1. 548-8.4.1.2 SBW Systems: Horizontal alignment tolerances must not exceed 3/4 inch per 10 feet of wall length. The maximum allowable gap between segmental retaining wall blocks above the first course must not exceed 1/32 inch. Below per referenced section

Response: We have not been seeing issues with blocks kept flush with each other staying on running bond, but I see the potential for an issue in your scenario. However, if a block is 1/16 inch short, it should be 1/32 inch short on each end. Therefore the max gap needed to stay on running bond should never exceed 1/16 inch.  
1/32 inch changed to 1/16 inch.  
Change made.

2. 548-5.2.2 you will see that the normal block dimensions must be within 1/16th inch of the specified dimension (same as per the NCMA specification). So if you have two 18" blocks next to each other that are 1/16th inch small, you could have up to a 1/4 inch gap between the block to keep them on running bond. That is ok as long as the gap between the units does not allow the stone used between/ behind the units to come out between the gaps. The 1/32 inch tolerance mentioned above is not achievable with masonry SRW block and would cause problems staying on running bond. To make both sections work, I suggest the 1/32 inch be changed to 1/4 inch to match what is achievable in the field and per NCMA.

Response: See response to (1) above.

3. 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.

Response: Correct.  
No Change made.

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Comments: (8-2-16)

**1. 548-1**

Description Item **2. a)** – FLDOT may want to add language similar to AASHTO, “...with vertical spacing of not more than 2x the block depth, or 30 inches whichever is less.” Most block systems are 8 inches tall, however there are 15 inch tall block systems. The current wording will allow spacing of 16 inches for 8 inch systems and 30 inches for a 15 inch system, for no apparent reason.

Response: The only reference to block depth ( $W_u$ ) I was able to find in AASHTO is that for certain blocks where  $W_u$  exceeds the block height, the reinforcing spacing should not exceed  $W_u$ .

No change made.

Recommend Removing item **2. b)** Comments: SBW systems shall have continuous horizontal reinforcement coverage as stated in item a). AASHTO’s basic requirement for geosynthetics is full coverage with no gaps. Partial reinforcement coverage, ie: strip style reinforcement is not recommended when using geosynthetics. The effect of partial reinforcement coverage is not possible to determine in a lab with conventional testing protocols, hence remains somewhat of an unknown.

Response: Agree. This was intended for an additional wall type to be added to the specification at a later time. This item has been deleted.

Change made.

**2. 548-2 Materials** Recommend updating the last sentence in the introduction. “Furnish and install components, soil reinforcement, attachment devices, materials and all necessary incidentals for each wall.” Reasoning is that generally it is not in the best interest for contract issuers (DOT’s) to have suppliers who do not supply some products within their normal distribution to purchase and markup products. Best pricing comes from contractors who can buy from separate suppliers for each specialized product type, provided those products meet the requirements of your specification.

Response: APL submittals are based on the overall system. For panel faced MSE walls connections to the panel need to be consistent and compatible. For SBW MSE this is a particular issue when friction behavior is required to mobilize pull-out resistance.

No change made.

**3. 548-2.1 Concrete** This Section is for wet cast concrete only (reinforced concrete precast panels). A note or sentence should be added to this section indicating that SBW systems are dry cast and shall follow section 548-5 of this specification. (Note: Suggested edits below move portions of 548-5 to 548-2.) Mix designs for the various products will be different for dry cast products than wet cast products.

Response: Agree. The last sentence is changed to “Produce and supply concrete for all reinforced concrete wall components meeting the requirements of Section 346.”

Change made.

**4. 548-2.5.1 Horizontal Joint Pads:** Recommend adding (for reinforced concrete precast walls only). SBW systems do not utilize joint pads.

Response: Disagree. When the SBW wall manufacturer does not recommend pads, they would not be required.

No change made.

**5. 548-2.5.2 Joint Covers:** Recommend adding (for reinforced concrete precast walls only). SBW systems do not utilize joint covers.

Response: Agree. However, wall systems include counterfort and other proprietary systems as well. Heading changed to “548-2.5.2 Joint Covers for non-SBW walls:”

Change made.

**6. 548-2.6.2 Compacted Select Backfill:** FLDOT may want to consider adding language that resistivity, sulfate and chloride content testing is only required on metallic reinforcement. pH testing is required for all reinforcement types. Sieve chart should indicate that 3-1/2 Inch size is for metallic reinforcement only. Suggest adding an \* next to the 3/4” with the following note “\*3/4” max. when using extensible reinforcement.”

Response: Disagree. The requirements are not for metallic reinforcement only.

No change made.

**7. 548-2.6.4 Coarse Aggregate Backfill:** replace “natural stones” with “crushed gravel or stone from natural sources”

Response: Disagree. This is covered in 901-2.

No change made.

#### **8. 548-3 Approved Product List (APL)**

a. Opening Paragraph: What is “independently certified test reports” referring to? The labs that perform these tests issue reports signed by a PE, is this sufficient?

Response: (Language not part of proposed revisions) (This information can be found in Sections 6 and 105 of the Specifications (6-1.3.1.1 Approved Products List and 105-7 Lab Qualification Program).

No change made.

b. What is section 6? Referencing this document or separate document?

Response: This is standard Specification language. “Section 6” refers to Specifications Section 6 of the FDOT Standard Specifications for Road and Bridge Construction.

No change made.

c. **Item 7. M) Added (Metallic Only) Portions of sections 6 and 7 pertain to metallic reinforcement only, should this be clarified?**

Response: This has not been an issue for panel wall suppliers utilizing geosynthetic reinforcement for the past 20 plus years.  
No change made.

**d. Item 8**, we recommend the following changes: “Pull-out test data for the proposed wall reinforcement in soil, and size and type of soil reinforcement for wall system. Testing shall be completed by an independent soil testing laboratory or testing agency. 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.” The purpose here is to separate pull out testing of reinforcement in soil, versus the connection. Also, it does not seem likely that FDOT desires to be in the business of “Certifying” testing labs.

Response: Specification 548 has included this language for many years without issues.  
No change made.

**e. Add new item 9**, following 8 above, which would be a revised version of section 548-4 Shop Drawings Item 9. “For SBW systems include the results of short and long term connection capacity testing. Tests must be performed in accordance with ASTM D6638 to determine the short-term ultimate connection strength reduction factor (CRu), and the long-term connection strength reduction factor (CRcr) value as determined by Appendix A of Elias et al. (2001). As referenced in section 11.10.6.4.4b of AASHTO 2104 LRFD Bridge Design Manual with 2016 interims. The design calculations for each wall shall include these values in the calculations for each wall height increment noted in the shop drawings.” Comments: Requiring long term creep connection testing is an important distinction. Long term connection testing requires a significant investment in money and time. There are about 8 to 10 SBW systems that have completed this testing. These 8 to 10 systems are supported by companies that are serious players in the structural wall market and are the industry leaders in this segment. Allowing default long term connection values to be used for design will open up FDOT to in excess over 35 to 40 systems, including systems that are not necessarily proven over time to be fully supported and adept at designing and supply the type of structures needed by FDOT. Current No. 9 & 10 would now become No. 10 & 11.

Response: The recommended test procedure is only vaguely described in the referenced document and requires too much reader interpretation to be part of this specification. The specified test procedure is explicitly described in the current AASHTO 2104 LRFD Bridge Design Specification. This has been previously discussed with the commenter.  
No change made.

**9. 548-4 Shop Drawings** Remove item 9 from this section and place as new item 9 in section 548-3, as noted above.

Response: Disagree as noted above.  
No change made.

**10. 548-5.2.2 Unreinforced Concrete SBW Components** Revise to item 1: “Length and width of each individual block must be within 1/8” of specified dimension, except for split face. Hollow units must have a minimum wall thickness of 1-1/4”. “ Comments: AASHTO states length and width dimensions to be 1/8” tolerance, not a 1/16”. Height is covered under item 2, which should be 1/16”. Also, consider moving this section to Section 548-2.

Response: I was unable to find any such tolerances in either the AASHTO LRFD Construction Specification or the AASHTO LRFD Bridge Design Specification. The AASHTO LRFD Bridge Design Specification discusses segmental block faced MSE systems, but the AASHTO LRFD Construction Specification does not. These tolerances have not been an issue for the past few years during which walls were constructed using Developmental Specification 548.  
No change made.

#### **11. 548-8.4 Wall Erection**

**a. Second paragraph** remove sentence “A one-inch gap between the first course of facing units is allowed, provided a suitable filter fabric is placed behind the foundation units as specified by the Contractor’s Engineer of Record.” Gapping of units is not a good design and construction practice.

Response: This will be considered for a future revision.  
No change made.

**b. Fourth paragraph**, add to last sentence. “The shim thickness per course of block must not exceed 1/8” and shall not be installed on reinforcement elevations.”

Response: Last sentence revised to: “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.”  
Change made.

**12. 548-8.4.1.2 SBW Systems** Replace 1/32” with 1/4”. 1/32 tolerance is too stringent. Contractors will not be able to meet that requirement, nor is it necessary.

Response: 1/32 has not been an issue for the past few years under the developmental specification. However, 1/32” is changed to 1/16 inch for reasons described above.  
Change made.

**13. 548-8.5.1 Compacted Select and Coarse Aggregate Backfill:** Third paragraph near the end of the paragraph. Replace 6 inches with 8 inches. Sentence will read the following: “Ensure that the maximum lift thickness after compaction does not exceed 8 inches.” Contractors work in 8” lift increments (block coursing), and would still fit AASHTO lift thickness requirements. Also, given the quality of backfill specified, obtaining compaction in an 8” lift is typically not an issue.

Response: Disagree. FDOT has performed parametric studies and found the six inch lift thickness to be optimal for reliability and reducing wall movements during construction. Contractors using 8-inch high block courses may need to work in 4-inch lifts.  
No change made.

**14. 548-9.4.1 Optional Acceptance Criteria for A-3 and A-2-4 Materials** See revision notes for 548-8.5.1, replace 6 inches with 8 inches.

**Response: Disagree. This optional criteria is requires a six inch lift thickness.  
No change made.**

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Comments: (8-2-16)

1. 548-2.6.2, paragraph 2: The requirement for 3 inches of concrete cover over the panel reinforcement in low pH backfill environment is not in agreement with the MSE Retaining Wall Classification Table in Std Index 6020 and the Structures Design Guideline Section 3.12C.3.e. The SDG defines the Wall Type by proximity to water levels with a high chloride content or to a source releasing air contaminants. The Table on Index 6020 listing the Wall Types dictate concrete cover (2” for 2A & 2B / 3” for 2C thru 2F). pH levels do not dictate the Wall Type in the Structures Design Guideline or Retaining Wall Classification. Contract Plans for Wall Types 2A and 2B with 2” of concrete cover would preclude the use of backfill material with pH between 3 and 5.0. The panel thickness should be specified in the contract plans per the Structure Design Guidelines and not be changed as a function of the backfill pH as determined by FM-5-550.

**Response: 548-2.6.2 provides requirements for backfill materials, not panel thickness.  
No change made.**

2. 548-1, fifth paragraph: “When shown in the plans or approved by the engineer...” Does this mean approved by the engineer prior to bid or after the bid?

**Response: The contract is not in place until after the bid.  
No change made.**

3. 548-2.6.1, fourth sentence: “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 finished grade line”... Is this correct? Where is “the finished grade”? Is this the top of the wall? We think of the finished grade as the final ground line in front of the wall & not the top of the wall.

**Response: The specification language is correct.  
No change made.**

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