



*Florida Department of Transportation*

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MIKE DEW  
SECRETARY

May 24, 2018

Khoa Nguyen  
Director, Office of Technical Services  
Federal Highway Administration  
3500 Financial Plaza, Suite 400  
Tallahassee, Florida 32312

Re: State Specifications Office  
Section: **530**  
Proposed Specification: **5300102 Revetment Systems.**

Dear Mr. Nguyen:

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

The changes are proposed by Catherine Earp of the State Roadway Design Office to modify the language.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to [dan.hurtado@dot.state.fl.us](mailto:dan.hurtado@dot.state.fl.us).

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

Sincerely,

Signature on file

Dan Hurtado, P.E.  
State Specifications Engineer

DH/dt

Attachment

cc: Florida Transportation Builders' Assoc.  
State Construction Engineer

**REVETMENT SYSTEMS.****(REV ~~3-13-18~~ 4-11-18)**

SUBARTICLE 530-1.2 is deleted and the following substituted:

**530-1.2 Articulating Concrete Block (ACB) Revetment Systems:** Furnish and install an ACB revetment system in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Plans. Submit vendor drawings for review and approval by the Engineer. Submit signed and sealed calculations of the block and cable sizing design for approval. Comply with the National Concrete Masonry Association's Design Manual for Articulating Concrete Block Revetment Systems, Second Edition, or the National Highway Institute, Hydraulic Engineering Circular (HEC) No. 23, Publication No. FHWA NHI 09-110. Use a minimum Factor of Safety of 1.5 and 0.5 inch for the block projection.

Blocks must be open cell and non-tapered unless otherwise stated in the Plans. Revetment cabling must be bi-directional or, for mono-directional cabling, the block installation must include a permanent mechanism within the block matrix to prevent lateral displacement of the installed blocks. Cabling must be polyester and free to move within the block.

Use only ACB revetment systems currently listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6, and include certified test reports from an independent test laboratory certifying the ACB revetment system meets the requirements of this Section.

If the ACB revetment system is intended for use as bridge abutment protection, include the following drawings with the APL submittal:

1. At the corner transition between the front and side slopes.
2. For anchorages, geosynthetic textile materials filter fabric, treatment of voids between adjacent blocks, limits on void size between adjacent blocks and other special details required to successfully install the ACB.
3. For areas adjacent to bridge abutments, detail mat placement around curves, connections, protection of mat ends, and splicing of mat.

SUBARTICLE 530-2.1.1 is deleted and the following substituted:

**530-2.1.1 General:** Meet the following requirements:

|  |                                   |
|--|-----------------------------------|
| Portland Cement.....                     | Section 921                       |
| Fine Aggregate.....                      | Section 902                       |
| Grout .....                              | Section 934                       |
| Type D-2 Geotextile Filter Fabric* ..... | Section <del>514</del> <u>985</u> |

\*Use products listed on the Department's APL.

SUBARTICLE 530-2.2 is deleted and the following substituted:

**530-2.2 Articulating Concrete Block (ACB) Revetment Systems:** Obtain all precast block, cabling, anchors, and necessary incidental materials from the same manufacturer. ACB revetment systems must meet the requirements of ASTM D6684, ASTM D7276 and

ASTM D7277. Submit to the Engineer certification from the manufacturer that the ACB revetment system meets the requirements of this Section.

ACB system components must meet the following requirements:

Concrete .....Section 347, ASTM D6684

Cables and Fittings .....ASTM D6684

Type D-2 Geotextile ~~synthetic Material~~ ~~Filter Fabric~~ \*Section ~~514~~985

Granular Underlay .....Section 901

\*Use products listed on the Department's APL.

Cables must maintain at least 85% of original tensile strength (ASTM D638) after 1000 hours exposure to a saturated solution of calcium hydroxide (pH greater than or equal to 11) at 73°F, plus or minus three degrees. Cables must not exceed a maximum of 0.5% moisture absorption at seven days, per ASTM D570. Cable crimps must be aluminum or stainless steel Type 304 or 316.

SUBARTICLE 530-2.3.5 is deleted and the following substituted:

**530-2.3.5 Miscellaneous Components:** Miscellaneous components for gabion installations must meet the following requirements:

Type D-2 Geotextile ~~Filter~~ Fabric\* .....Section ~~514~~985

Granular Underlay .....Section 901

Anchors .....Section 451 or manufacturer's recommendations

\*Use products listed on the Department's APL.

~~SUBARTICLES 530-3.1 through 530-3.6 are~~ is deleted and the following substituted:

**530.3.1 Geotextile Fabric:** Place geotextile fabric under all revetment in accordance with Section 514.

**530-3.1.2 Sand-Cement:**

**530-3.1.2.1 Mixing Materials:** Proportion sand and cement in the ratio of 5 cubic feet of sand to 94 pounds (one bag) of cement. If proportioning the materials by mass, use a density of 85 pounds per cubic foot (loose volume) for sand. The Contractor may batch sand at the moisture content occurring in the stockpile.

Mix the sand and cement until the mixture is of uniform color.

**530-3.1.2.2 Filling Sacks:** Accurately measure the mixed material into each sack, taking care to place the same amount of material in each sack; keep at least the top 6 inches of the sacks unfilled to allow for proper tying or folding and to ensure against breaking of the sack during placing.

**530-3.1.2.3 Placing:** Place the filled sacks with their tied or folded ends all in the same direction. Lay the sacks with broken joints, in a regular pattern. Ram or pack the sacks against each other so as to form a close and molded contact after the sand and cement mixture has set up. Remove and replace sacks ripped or torn in placing with sound, unbroken sacks. Then, thoroughly saturate all sacks with water.

**530-3.1.2.4 Grouting:** Immediately after watering, fill all openings between sacks with dry grout composed of one part Portland cement and five parts sand.

**530-3.12.5 Toe Walls:** The Contractor may construct toe walls of riprap for fill slopes of poured in place concrete in lieu of sand cement in sacks. Meet the concrete requirements as specified in Section 347. If using sand cement in sacks for the toe walls, fill the entire trench excavated for the toe walls with sand cement in sacks.

**530-3.23 Rubble:** Dump rubble in place forming a compact layer conforming to the neat lines and thickness specified in the Plans. Ensure that rubble does not segregate so that smaller pieces evenly fill the voids between the larger pieces.

**530-3.34 Bedding Stone:** Place a minimum one foot thick layer of bedding stone under all rubble riprap without puncturing or tearing the geosynthetic textile material filter fabric. The Engineer will allow an in place thickness tolerance of plus or minus one inch.

Remove and replace geosynthetic textile material filter fabric damaged as a result of operations at no expense to the Department.

**530-3.45 Articulating Concrete Block (ACB) Revetment System:** Install the ACB revetment system in accordance with ASTM D6884 and the manufacturer's recommendations, unless directed otherwise by the Engineer.

Prior to installation, construct the area to be stabilized to an elevation such that, upon completion of stabilizing operations, the completed stabilized subgrade will conform to the lines, grades and cross sections shown in the Plans. Bring the subgrade surface to a plane approximately parallel to the plane of the proposed finished surface, such that, upon placement of the mat, no individual block within the ACB mat will protrude more than one-half inch from any adjacent block. Uniformly compact each subgrade layer to achieve the density required in the Plans. If the Plans do not provide for stabilizing, compact the subgrade in both cuts and fills, to the density specified in ASTM D6884.

Embed anchors at least six feet into the subgrade at a 45 degree angle into the bank with a minimum pullout resistance of 875 pounds. In the presence of the Engineer, perform on-site anchor strength testing to verify the required pull out resistance is achieved. Anchor strength testing must be performed on the first two and final two installed anchors, and randomly throughout the installation operation such that 5% of all installed anchors are tested for pullout resistance. If any anchor fails to meet the pullout resistance requirement, test every subsequent installed anchor until a revised installation plan is proposed and approved by the Engineer. Anchor spacing cannot exceed four feet.

Immediately prior to placing the geosynthetic textile material filter fabric and ACB system, inspect the prepared subgrade to ensure it is free of loose material and the surface is smoothly compacted. Place the geosynthetic textile material filter fabric directly on the prepared area, in intimate contact with the subgrade and free of folds or wrinkles. Do not glue or physically bond the geosynthetic textile material filter fabric to the ACB mat. Install a six inch thick layer of bedding stone under the geosynthetic textile material filter fabric, when called for in the Plans.

When installing ACB systems around curves, the mats shall be matched up to the greatest extent possible. Gaps greater than one block size shall be filled with a block and grouted the depth of the block with non-structural grout.

Do not install blocks with chips that result in any block weighing less than 95% of the manufacture specified weight.

**530-3.56 Gabions:** Install double-twisted wire mesh gabions in accordance with ASTM D7014. Install welded wire fabric gabions and polymeric gabions in accordance with the manufacturer's recommendations.

Prior to installation, complete any required excavation and preparation of the foundation as shown in the Plans or as directed.

Install soil anchors as specified in the Plans.

All adjoining gabion units shall be connected along the perimeter of their contact surfaces to obtain a monolithic structure. If more than one tier, stagger the vertical joints of subsequent rows by one half cell length and adjoin the empty gabions to the top of the lower tier along the front and back edges of the contact surface.

Fill gabions in a manner that minimizes voids, protects against local deformation of the basket or mattress and prevents damage to PVC coating. At no point in the filling process may rock be mechanically placed from a height of over 36 inches from machine to fill area. Uniformly overfill gabions by 1 to 2 inches to compensate for future rock settlements.

Any damage to the basket, mattress, or coatings during assembly, placement, or filling shall be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion baskets.

SUBARTICLE 530-5.4 is deleted and the following substituted:

**530-5.4 Geosynthetic ~~textile~~ Material ~~Filter~~ Fabric:** Include the cost of materials and installation of the geosynthetic ~~textile~~ material ~~filter~~ fabric in the Contract unit price for riprap or ACB revetment system.

**REVETMENT SYSTEMS.****(REV 4-11-18)**

SUBARTICLE 530-1.2 is deleted and the following substituted:

**530-1.2 Articulating Concrete Block (ACB) Revetment Systems:** Furnish and install an ACB revetment system in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Plans. Submit vendor drawings for review and approval by the Engineer. Submit signed and sealed calculations of the block and cable sizing design for approval. Comply with the National Concrete Masonry Association's Design Manual for Articulating Concrete Block Revetment Systems, Second Edition, or the National Highway Institute, Hydraulic Engineering Circular (HEC) No. 23, Publication No. FHWA NHI 09-110. Use a minimum Factor of Safety of 1.5 and 0.5 inch for the block projection.

Blocks must be open cell and non-tapered unless otherwise stated in the Plans. Revetment cabling must be bi-directional or, for mono-directional cabling, the block installation must include a permanent mechanism within the block matrix to prevent lateral displacement of the installed blocks. Cabling must be polyester and free to move within the block.

Use only ACB revetment systems currently listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product shall submit an application in accordance with Section 6, and include certified test reports from an independent test laboratory certifying the ACB revetment system meets the requirements of this Section.

If the ACB revetment system is intended for use as bridge abutment protection, include the following drawings with the APL submittal:

1. At the corner transition between the front and side slopes.
2. For anchorages, geotextile fabric, treatment of voids between adjacent blocks, limits on void size between adjacent blocks and other special details required to successfully install the ACB.
3. For areas adjacent to bridge abutments, detail mat placement around curves, connections, protection of mat ends, and splicing of mat.

SUBARTICLE 530-2.1.1 is deleted and the following substituted:

**530-2.1.1 General:** Meet the following requirements:

Portland Cement.....Section 921

Fine Aggregate.....Section 902

Grout .....Section 934

Type D-2 Geotextile Fabric\* .....Section 985

\*Use products listed on the Department's APL.

SUBARTICLE 530-2.2 is deleted and the following substituted:

**530-2.2 Articulating Concrete Block (ACB) Revetment Systems:** Obtain all precast block, cabling, anchors, and necessary incidental materials from the same manufacturer. ACB revetment systems must meet the requirements of ASTM D6684, ASTM D7276 and

ASTM D7277. Submit to the Engineer certification from the manufacturer that the ACB revetment system meets the requirements of this Section.

ACB system components must meet the following requirements:

Concrete .....Section 347, ASTM D6684

Cables and Fittings .....ASTM D6684

Type D-2 Geotextile Fabric\* .....Section 985

Granular Underlay .....Section 901

\*Use products listed on the Department's APL.

Cables must maintain at least 85% of original tensile strength (ASTM D638) after 1000 hours exposure to a saturated solution of calcium hydroxide (pH greater than or equal to 11) at 73°F, plus or minus three degrees. Cables must not exceed a maximum of 0.5% moisture absorption at seven days, per ASTM D570. Cable crimps must be aluminum or stainless steel Type 304 or 316.

SUBARTICLE 530-2.3.5 is deleted and the following substituted:

**530-2.3.5 Miscellaneous Components:** Miscellaneous components for gabion installations must meet the following requirements:

Type D-2 Geotextile Fabric\* .....Section 985

Granular Underlay .....Section 901

Anchors .....Section 451 or manufacturer's recommendations

\*Use products listed on the Department's APL.

ARTICLE 530-3 is deleted and the following substituted:

**530.3.1 Geotextile Fabric:** Place geotextile fabric under all revetment in accordance with Section 514.

**530-3.2 Sand-Cement:**

**530-3.2.1 Mixing Materials:** Proportion sand and cement in the ratio of 5 cubic feet of sand to 94 pounds (one bag) of cement. If proportioning the materials by mass, use a density of 85 pounds per cubic foot (loose volume) for sand. The Contractor may batch sand at the moisture content occurring in the stockpile.

Mix the sand and cement until the mixture is of uniform color.

**530-3.2.2 Filling Sacks:** Accurately measure the mixed material into each sack, taking care to place the same amount of material in each sack; keep at least the top 6 inches of the sacks unfilled to allow for proper tying or folding and to ensure against breaking of the sack during placing.

**530-3.2.3 Placing:** Place the filled sacks with their tied or folded ends all in the same direction. Lay the sacks with broken joints, in a regular pattern. Ram or pack the sacks against each other so as to form a close and molded contact after the sand and cement mixture has set up. Remove and replace sacks ripped or torn in placing with sound, unbroken sacks. Then, thoroughly saturate all sacks with water.

**530-3.2.4 Grouting:** Immediately after watering, fill all openings between sacks with dry grout composed of one part Portland cement and five parts sand.

**530-3.2.5 Toe Walls:** The Contractor may construct toe walls of riprap for fill slopes of poured in place concrete in lieu of sand cement in sacks. Meet the concrete requirements as specified in Section 347. If using sand cement in sacks for the toe walls, fill the entire trench excavated for the toe walls with sand cement in sacks.

**530-3.3 Rubble:** Dump rubble in place forming a compact layer conforming to the neat lines and thickness specified in the Plans. Ensure that rubble does not segregate so that smaller pieces evenly fill the voids between the larger pieces.

**530-3.4 Bedding Stone:** Place a minimum one foot thick layer of bedding stone under all rubble riprap without puncturing or tearing the geotextile fabric. The Engineer will allow an in place thickness tolerance of plus or minus one inch.

Remove and replace geotextile fabric damaged as a result of operations at no expense to the Department.

**530-3.5 Articulating Concrete Block (ACB) Revetment System:** Install the ACB revetment system in accordance with ASTM D6884 and the manufacturer's recommendations, unless directed otherwise by the Engineer.

Prior to installation, construct the area to be stabilized to an elevation such that, upon completion of stabilizing operations, the completed stabilized subgrade will conform to the lines, grades and cross sections shown in the Plans. Bring the subgrade surface to a plane approximately parallel to the plane of the proposed finished surface, such that, upon placement of the mat, no individual block within the ACB mat will protrude more than one-half inch from any adjacent block. Uniformly compact each subgrade layer to achieve the density required in the Plans. If the Plans do not provide for stabilizing, compact the subgrade in both cuts and fills, to the density specified in ASTM D6884.

Embed anchors at least six feet into the subgrade at a 45 degree angle into the bank with a minimum pullout resistance of 875 pounds. In the presence of the Engineer, perform on-site anchor strength testing to verify the required pull out resistance is achieved. Anchor strength testing must be performed on the first two and final two installed anchors, and randomly throughout the installation operation such that 5% of all installed anchors are tested for pullout resistance. If any anchor fails to meet the pullout resistance requirement, test every subsequent installed anchor until a revised installation plan is proposed and approved by the Engineer. Anchor spacing cannot exceed four feet.

Immediately prior to placing the geotextile fabric and ACB system, inspect the prepared subgrade to ensure it is free of loose material and the surface is smoothly compacted. Place the geotextile fabric directly on the prepared area, in intimate contact with the subgrade and free of folds or wrinkles. Do not glue or physically bond the geotextile filter fabric to the ACB mat. Install a six inch thick layer of bedding stone under the geotextile fabric, when called for in the Plans.

When installing ACB systems around curves, the mats shall be matched up to the greatest extent possible. Gaps greater than one block size shall be filled with a block and grouted the depth of the block with non-structural grout.

Do not install blocks with chips that result in any block weighing less than 95% of the manufacture specified weight.

**530-3.6 Gabions:** Install double-twisted wire mesh gabions in accordance with ASTM D7014. Install welded wire fabric gabions and polymeric gabions in accordance with the manufacturer's recommendations.

Prior to installation, complete any required excavation and preparation of the foundation as shown in the Plans or as directed.

Install soil anchors as specified in the Plans.

All adjoining gabion units shall be connected along the perimeter of their contact surfaces to obtain a monolithic structure. If more than one tier, stagger the vertical joints of subsequent rows by one half cell length and adjoin the empty gabions to the top of the lower tier along the front and back edges of the contact surface.

Fill gabions in a manner that minimizes voids, protects against local deformation of the basket or mattress and prevents damage to PVC coating. At no point in the filling process may rock be mechanically placed from a height of over 36 inches from machine to fill area. Uniformly overfill gabions by 1 to 2 inches to compensate for future rock settlements.

Any damage to the basket, mattress, or coatings during assembly, placement, or filling shall be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion baskets.

SUBARTICLE 530-5.4 is deleted and the following substituted:

**530-5.4 Geotextile Fabric:** Include the cost of materials and installation of the geotextile fabric in the Contract unit price for riprap or ACB revetment system.