813.01

Section 813. SLOPE PROTECTION

813.01 Description. Construct precast and cast-in-place concrete slope paving, including headers, and grouted riprap, plain riprap, and heavy riprap.

813.02 Materials. Use materials meeting the following.

- Concrete, Grade P2 ................................ 601
- Mortar, Type R-3 ................................. 702
- Cement ........................................ 901
- Granular Material Class II ...................... 902
- Curing Compound ................................. 903
- Steel Reinforcement ............................... 905
- Geotextile Liner .................................. 910
- Precast Concrete Slope Paving Blocks ............. 913
- Riprap ......................................... 916
- Heavy Riprap .................................. 916

Place concrete within one and one half hours of introducing the mixing water in the mix. If additional time is required, use a retarding admixture selected from the Qualified Products List. Stay within the manufacturers’ recommended maximum initial set time. Do not retemper. The Engineer will not allow additional compensation for the admixture.

813.03 Construction.

A. Base Preparation. Excavate or fill the subgrade, compact to ensure stability, and shape for the bottom of the riprap, precast and cast-in-place concrete slope paving, or to the bottom of the granular material layer. Dispose of the surplus excavated subgrade material according to subsection 205.03.P. Trim the subgrade to the Class A slope tolerances specified in subsection 205.03.N. Construct the granular material layer according to subsection 301.03 except, compact the material to not less than 90 percent of its maximum unit weight. Place geotextile on the prepared base.

B. Precast Concrete Slope Paving. Place the precast units on a layer of granular material. Fill the joints between precast units with Type R-3 mortar. The edges of the precast units must be moist when the mortar is placed. Place mortar from bottom to top using enough material to completely fill the joints between the precast units when consolidated. Remove all excess mortar from the surface of the slope paving. Cure and protect the mortar according to subsection 813.03.C.3. The weather and temperature limitations of subsection 602.03.T will apply.
C. **Concrete Slope Paving.**

1. **Forms.** Use wood or metal forms, straight and free from warp, and sufficiently strong to resist deflecting during concrete placement. Form the full depth of the concrete. Stake all forms, including slab division forms, to the required line and grade. Provide straight and continuous slab division joints. Form blocks of the dimensions shown on the plans.

2. **Placing and Finishing Concrete.** Wet the base immediately before concrete placement. Place concrete to the proper depth in a continuous operation, Thoroughly consolidate the concrete along the faces of the forms. Tamp the concrete surface to remove all voids and strike off with a strike board to the finished grade and cross section. Finish the concrete surface with a wood float. Round all edges and joints to a radius of $\frac{1}{4}$ inch with an approved finishing tool. Remove edging and finishing tool marks with a float and soft bristle brush. The weather and temperature limitations of subsection 602.03.T will apply.

3. **Curing and Protection.** Cure the concrete for a minimum of four days by keeping continuously wet, or by applying transparent membrane curing compound meeting subsection 903.06.A.

D. **Slope Paving Headers.** Use forms according to subsection 813.03.C.1. Concrete placed below the elevation of the slope paving subgrade, or granular material layer when specified, may be cast neat to the earth, as approved by the Engineer. Place steel reinforcement according to subsection 802.03.C. Place and finish slope paving header concrete according to subsection 813.03.C.2. Cure slope paving header concrete according to subsection 813.03.C.3.

E. **Riprap.** Place geotextile liner under all riprap. Place the liner in the key trench at the toe of the slope if the riprap terminates at or below a designated high water elevation. After the riprap is in place, anchor the geotextile in a second key trench at the top of all slopes 1:3 or steeper. Construct this second key trench to a depth of 1.5 feet or three times the minimum riprap dimension, whichever is greater. Provide a setback between the top of the slope and the upper key trench at least equal to the trench depth. Backfill the upper trench with riprap material unless directed otherwise.
813.03

Overlap all seams in geotextile a minimum of 2 feet. If geotextile is laid horizontally, start at the bottom of the slope and shingle lap the layers to direct surface runoff. Place riprap carefully onto geotextile; do not dump or drop riprap into place.

1. Plain Riprap. Begin the riprap in a trench below the toe of the slope and progress upward. Place the individual stones; firmly embed each stone into the slope and interlocked against the adjoining stones. Place random and well broken joints between consecutive rows of stones. Thoroughly compact the riprap as the construction progresses, to present an even, tight finished surface. Unless using precast concrete blocks, riprap must be at least 8 inches thick measured perpendicular to the slope.

2. Grouted Riprap. Construct grouted riprap according to subsection 813.03.E.1. Fill the spaces between the stones with Type R-3 mortar. Place mortar from bottom to top and use sufficient mortar to completely fill all voids between the stones when consolidated. Leave the top surface of the stone exposed. Immediately remove all excess mortar with a stiff brush. Cure and protect grouted riprap according to subsection 813.03.C.3.

3. Heavy Riprap. Construct heavy riprap according to subsection 813.03.E.1. Unless using precast concrete blocks, construct heavy riprap at least 16 inches thick measured perpendicular to the slope. Place broken pavement in two layers with staggered joints and fill all voids with smaller pieces of broken pavement, as approved by the Engineer.

813.04 Measurement and Payment.

<table>
<thead>
<tr>
<th>Contract Item (Pay Item)</th>
<th>Pay Unit</th>
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</thead>
<tbody>
<tr>
<td>Slope Paving, Precast Conc</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Slope Paving, Conc</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Slope Paving Header</td>
<td>Foot</td>
</tr>
<tr>
<td>Riprap, Grouted</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Riprap, Plain</td>
<td>Square Yard, Ton</td>
</tr>
<tr>
<td>Riprap, Plain, LM</td>
<td>Cubic Yard</td>
</tr>
<tr>
<td>Riprap, Heavy</td>
<td>Square Yard, Ton</td>
</tr>
<tr>
<td>Riprap, Heavy, LM</td>
<td>Cubic Yard</td>
</tr>
</tbody>
</table>
A. **Slope Paving** includes the granular material unless the pay item Granular Material is specified on the plans. The work includes excavation and disposal of surplus materials.

B. **Slope Paving Header**, both sides and toe, will be measured in place.

C. **Riprap** includes furnishing and placing the geotextile liner, excavation and disposal of surplus materials, and riprap headers/trenches.