Section 813. SLOPE PROTECTION

813.01. Description. This work consists of constructing precast and cast-in-place concrete slope paving, including plain, heavy, and grouted riprap, and associated headers.

813.02. Materials. Provide materials in accordance with 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

Provide a retarding admixture, selected from the Qualified Products List, if additional time is required between adding water to the concrete mixture, and placing the concrete, but do not exceed the manufacturer’s recommended maximum initial set time.

813.03. Construction.

A. Base Preparation. Excavate or fill to the required subgrade. Compact and shape the subgrade for the following:

1. The bottom of the riprap,
2. Precast and cast-in-place concrete slope paving, or
3. The bottom of the granular material layer.

Dispose of the surplus excavated subgrade material in accordance with subsection 205.03.P. Trim the subgrade to the Class A slope tolerances specified in subsection 205.03.N. Construct the granular material layer in accordance with subsection 301.03 except, compact the material to at least 90 percent of the maximum unit weight.

B. Precast Concrete Slope Paving. Place precast concrete for slope paving in accordance with the weather and temperature limitations specified in subsection 602.03.T. Place the precast units on a layer of granular material base. Fill the joints between precast units with Type R-3 mortar. Ensure the edges of the precast units are moist when placing the mortar. Place mortar beginning at the lower end of the joints and proceeding to the upper end of the joints. Completely fill the joints between the precast units after consolidation. Remove excess mortar.
from the surface of the slope paving. Cure and protect the mortar in accordance with subsection 813.03.C.3.

C. **Concrete Slope Paving.**

1. **Forms.** Use wood or metal forms, straight and free of warp, and capable of resisting deflection during concrete placement. Form the concrete full depth. Stake 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.** Place concrete in accordance with the weather and temperature limitations specified in subsection 602.03.T. Wet the base immediately before concrete placement. Place concrete to the required depth in a continuous operation.

   Place concrete within 1½ hours of introducing the mixing water in the mix. Do not re-temper.

   Consolidate the concrete along the faces of the forms. Tamp the concrete surface to remove voids and strike off with a strike board to the required grade and cross section.

   Finish the concrete surface with a wood float. Round the edges and joints to a ¼-inch radius with a Department-approved finishing tool. Remove edging and finishing tool marks with a float and soft bristle brush.

3. **Curing and Protection.** Cure the concrete for at least four days by keeping the concrete surface continuously wet, or by applying a transparent membrane curing compound specified in subsection 903.07.A.

D. **Slope Paving Headers.** Use forms for slope paving headers in accordance with subsection 813.03.C.1.

   If concrete placement is required below the elevation of the slope paving subgrade, or granular material layer, the Contractor may cast the concrete neat to the earth, as approved by the Engineer.

   Place steel reinforcement in accordance with subsection 802.03.C. Place and finish slope paving header concrete in accordance with subsection 813.03.C.2. Cure slope paving header concrete in accordance with subsection 813.03.C.3.

E. **Riprap.** Place geotextile liner under the riprap. Place the liner in a key trench at the toe of the slope if the riprap ends at or below a high water elevation. After the riprap is in place, anchor the geotextile in a key trench at the tops of slopes with a ratio of 1:3 or steeper. Construct
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the upper key trench to 1½ feet deep, 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 otherwise directed by
the Engineer.

Overlap geotextile seams by at least 2 feet. If laying geotextile
horizontally, start at the bottom of the slope and shingle lap additional
layers to direct surface runoff. Place riprap onto the geotextile without
dumping or dropping riprap into place.

1. **Plain Riprap.** Begin the riprap placement in the trench at the toe of
   the slope and progress upward. Place individual stones, embedding
each stone into the slope, and interlock against adjoining stones.
Place random and well-broken joints between consecutive rows of
stones. Compact the riprap as construction progresses. Unless
using precast concrete blocks, ensure riprap is at least 8 inches thick
measured perpendicular to the slope.

2. **Grouted Riprap.** Construct grouted riprap in accordance with
subsection 813.03.E.1. Fill the spaces between the stones with
Type R-3 mortar. Place the mortar from joint bottom to top and
completely fill the voids between the stones after consolidation.
Leave the top surface of the stone exposed. Immediately remove
excess mortar with a stiff brush. Cure and protect grouted riprap in
accordance with subsection 813.03.C.3.

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

813.04. Measurement and Payment.

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
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<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>
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<tr>
<td>Riprap, Plain, LM</td>
<td>Cubic Yard</td>
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<tr>
<td>Riprap, Heavy</td>
<td>Square Yard, Ton</td>
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</table>
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A. **Concrete Acceptance.** Conduct concrete quality control as specified in section 604. The Engineer will conduct quality assurance as specified in section 605. The Department will pay for this work based on the quality assurance results.

B. **Slope Paving.** The unit prices for slope paving pay items include the cost of admixtures and excavation and disposal of surplus materials. The unit prices for slope paving pay items also include the cost of granular material, unless the plans include the pay item Granular Material.

C. **Slope Paving Header.** The Engineer will measure **Slope Paving Header** in place, including both sides and the toe.

D. **Riprap.** The unit prices for the relevant riprap pay items include the cost of the following:

1. Providing and placing the geotextile liner;
2. Excavating and disposing of surplus materials; and
3. Constructing riprap headers and trenches.