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**BEDFORD
13527**

January 27, 2011

SPECIAL PROVISION

AMENDMENT TO SECTION 225 – ROCK BOLT

ITEM 225.1 – ROCK BOLT ANCHORS FOR WIRE MESH

Description

1.1 This work shall consist of furnishing, drilling, and installing rock bolt anchors and accessories at the locations and in the patterns shown on the plans or as ordered.

1.2 This special provision provides for rock bolt anchors with applications to Item 225.1 only.

Materials

2.1 General. Materials shall meet the requirements set forth by the American Mining Congress Standards except as may be modified below.

2.2 Rock Bolt Anchors

2.2.1 Rock bolt anchors shall be field cut from thread-deformed bars, which shall be fabricated and processed from high-strength alloy steel conforming to ASTM A 322. The use of foreign steel will be permitted only after approval by the Engineer upon suitable certification from a recognized domestic laboratory. During manufacture, the bars shall be cold-stretched to a minimum yield and then subjected to a stress-relieving heat treatment to meet the following requirements:

- a) Yield at 0.2% offset of 85% guaranteed ultimate strength.
- b) 4% minimum elongation in 20 diameters after rupture.
- c) Minimum area reduction from measured area of 20%.

2.2.2 Bars to be used for bolting shall be 1-inch diameter with a minimum strength rating of 110,000 psi. These bars shall be procured in the 30-foot stock length, unless otherwise directed for later individual field fabrication of bolts.

2.3 Anchorage Accessories. Anchorage accessories shall develop at least 95% of the minimum guaranteed strength of the bars and shall be those provided by the manufacturer of the bars. Bearing plates shall be 6" x 6" x 3/8". No couplers shall be allowed.

2.4 Cement Grout

2.4.1 Rock bolt anchor grout shall be a non-shrink neat cement with a maximum water to cement ratio of 0.45 by weight.

2.4.2 Water for mixing grout shall be potable and free from substances which might be deleterious or corrosive to concrete or steel.

2.4.3 Grout strength accelerators shall not be used. Admixtures, which control bleed and retard set may be used. Admixtures shall be mixed and placed in accordance with the manufacturer's recommendations.

2.4.4 The cement grout mix shall provide a minimum compressive strength of 3000 psi.

2.4.5 Appropriate measures shall be taken to preclude freezing of the grout prior to its reaching design strength.

2.4.6 Cement shall conform to AASHTO M 85/ASTM C 150, Type I, II, or III Portland cement.

Construction Requirements

3.1 General. The Design-Builder shall have the total estimated quantity of rock bolt anchors on the project prior to commencement of the drilling operation. Typical and detail sheets are shown in a separate Wire Mesh Figure document.

3.2 Holes for rock bolt anchors shall be drilled at an angle normal to the plane of the rock slopes for the wire mesh being secured. Drilling shall be done dry for the required depth of the rock bolt anchor hole. The minimum hole diameter shall be selected such that a minimum of 1.25 inches of grout cover is provided around the entire rock bolt anchor bar. All holes shall be thoroughly cleaned of chips and debris prior to the rock bolt anchor installation.

3.3 The Rock anchor steel that is not embedded shall be painted with a cold galvanizing compound following installation.

3.1.1 Rock pieces encountered, which in the opinion of the Engineer require anchoring to adjacent solid rock, shall be secured following the Special Provisions for

Prestressed Rock Bolts (Item 225.2) or Rock Dowels – Untensioned Rock Bolt (Item 225.3).

3.4 Grouting of Rock Bolt Anchors

3.4.1 Grouting of the annular space around the rock bolt shall be accomplished by pressure grouting with a grout pump, providing a minimum of 90 psi capacity. Mixers and pumps shall have adequate capacity and hoses shall be sized to allow continuous grouting of an individual bolt within one hour or less.

3.4.2 All grout pipes, tubes and fittings shall be clean and free from dirt particles, grease, hardened grout, or other contamination before grouting is commenced for any bolt. All surplus water and diluted grout shall be flushed or blown from all lines before commencing injections. The grout line shall be attached to the grout injection tube with suitable fittings such that leakage is entirely prevented.

3.4.3 The grout shall be injected at a pressure, which is sufficient to overcome hydrostatic head. The pressure, which is used shall be approved by the Engineer. Dewatering or pre-grouting may be required for proper grouting of the rock bolt in groundwater or poor rock conditions.

3.4.4 Bolts in upward inclination shall use a sealing grout to seal the opening around the bolt prior to grouting through a short tube, which extends through the sealing grout. Such bolts shall be considered grouted when there is a full return of grout through a vent hole within the sealing grout.

3.4.5 The anchor length shall be grouted by injecting grout at the lowest point in the anchor.

3.5 Rock bolt anchors, Type 1A and 1B, shall extend a minimum of 5 feet into solid bedrock. Rock bolt anchors to secure the wire mesh to the slope shall be grouted but not stressed. Rock bolts installed for the purpose of anchoring unstable rock described in 3.2.1 shall be stressed employing a centerpull jack equipped with a gage calibration in psi. The design load for rock bolts anchoring unstable rock shall be determined by the Engineer.

3.6 At every 40-foot interval, rock bolt anchors (Type 1A, securing the upper limits of the mesh) shall be equipped with an additional steel plate. At the intersection of the horizontal and vertical wire ropes (at every 120-foot interval, above the break in slope), Type 1A rock bolt anchors shall be installed. In the Type 1A installation the rock bolt anchors shall be placed through the wire mesh and a 4-1/2 inch diameter steel ring, with the steel ring sandwiched between the two steel plates (refer to detail sheets). At all other locations, above the break in slope and on the rock face, rock bolt anchors (Type 1B) shall be placed through the wire mesh so as to position it between the rock and steel bearing plate.

3.7 All personnel involved in drilling for rock bolt anchors shall be equipped with adequate protection in accordance with applicable provisions of 107.05.