NEW YORK STATE OF OPPORTUNITY. Department of Transportation	ENGINEERING INSTRUCTION	EI 18-004

Title: **SPECIAL SPECIFICATION FOR CEMENT GROUTED ROCK BOLTS**

SUPERSEDED BY EB 23-024
EFFECTIVE 8/3/23

Approved:
Robert L. Sack, P.E.
Deputy Chief Engineer (Research)
22 May 18
Date

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the lettings on or after January 1, 2019.
- This EI does not supersede any previous issuances.
- The special specification issued with this EI will reside in the Special Specifications directory of the Toolbox Server.

PURPOSE: The purpose of this EI is to issue a new special specification for cement grouted rock bolts.

TECHNICAL INFORMATION:

- A revision to the Standard Specification Section 212 *Rock Slope Reinforcement and Catchment Systems* is being issued concurrently via EI 18-002.
- A revision to the Standard Specification §731-03 *Rock Bolt Assembly* and §710-06 *Rock Slope Net and Wire Mesh Assemblies* is being issued concurrently via EI 18-003.
- A revision to Standard Sheet 212-02 Chain Link Rock Catchment Fence is being issued concurrently via EB 18-020.
- PIN Approval: The cement grouted rock bolt special specification is to be approved on a project-by-project basis. Designers will need to send their request for approval to the Geotechnical Engineering Bureau through their special specification (SS) coordinator via SpecTracker.

IMPLEMENTATION:

- The following special specification is approved:
  US Cust Item 203.17170017: Cement Grouted Rock Bolts – One and One Quarter Inch Nominal Diameter (Grade 150)

TRANSMITTED MATERIALS:

Attached is the following special specification:
Item 203.17170017: Cement Grouted Rock Bolts – One and One Quarter Inch Nominal Diameter (Grade 150)

BACKGROUND: Rock bolts consist of a steel tensioned element generally used in reinforcing a rock slope by transferring load from the unstable exterior to the confined interior of the rock mass. Rock bolts are also used as part of a rock catchment system by anchoring the catchment device.

Resin Rock Bolts

A typical resin product is made up of two component cartridges containing a resin and a catalyst in separate compartments. The cartridges are pushed to the end of the drillhole ahead of the bolt rod that is then spun into the resin cartridges by the drill. The plastic sheath of the cartridges is broken and the resin and catalyst mixed by this spinning action.

Resin Rock Bolts are specified via Item 203.17140017 *Resin Rock Bolts – One and One Quarter Inch Nominal Diameter (Grade 150)*

Cement Grouted Rock Bolts
Cement grout is used to develop a bond between the bolt and the rock. Slightly oversized holes are drilled and the centralized bolt is placed. The drill hole is then tremie grouted. After the drill hole grout has cured, the bolts are tested and tensioned to a specified lock-off load.

CONTACT: Questions or comments regarding this issuance should be directed to Randall J. Romer, P.E., of the Geotechnical Engineering Bureau at (518) 457-4714, or via e-mail at randy.romer@dot.ny.gov. Questions or comments regarding the technical aspects of the special specification should be directed to Matt Balmer of the Geotechnical Engineering Bureau at (518) 457-4726, matt.balmer@dot.ny.gov.

ITEM 203.17170017- CEMENT GROUTED ROCK BOLTS - ONE AND ONE QUARTER INCH NOMINAL DIAMETER (GRADE 150)

DESCRIPTION

Drill the necessary holes, and furnish and install rock bolts and appurtenances in accordance with the provisions of this specification. The Engineer shall provide the locations, orientations, and unbonded lengths for the rock bolts. The bolts shall use either single stage grouting along with a smooth PVC sleeve bond breaker for the unbonded length, or double stage grouting. Provide corrosion protection consisting of, at a minimum:

1. Fusion bonded epoxy coated rock bolts.
2. Galvanized steel bearing plate, washers, and hex nut.
3. Grease/wax gel filled schedule 40 PVC sleeve for the unbonded length.
4. Grease or cement grout filled trumpet for single stage grouting.
5. Minimum 1 inch grout cover along full length of rock bolt.
6. Grease or cement grout filled anchor head protection.

SUBMITTALS

The Contractor shall submit a detailed plan for the rock bolting including:

1. Construction schedule and sequence, including whether single or double stage grouting will be used.
2. Drilling methods and equipment.
3. Hole diameter.
4. Rock bolts and appurtenances.
5. Minimum bond zone length.
6. Grout mix design.
7. Calibration data for the hollow-ram hydraulic jack used to test and tension the rock bolts.

MATERIALS

1. Bolts

   Furnish rock bolts of at least Grade 150, ASTM A-722, Type II (deformed) bar, one and one quarter inch nominal diameter, high-strength prestressing steel. Bolts must have rolled thread-like deformations over the entire length. Larger diameter bolts are acceptable if supplied at no additional cost to the State. Bolts must be fusion bonded epoxy coated in accordance with ASTM A-775 for corrosion protection. Additional corrosion protection methods may be utilized, as recommended by the bolt manufacturer.

2. Appurtenances

   Furnish fasteners recommended by the bolt manufacturer for the size and grade bolt supplied, consisting of a steel keyhole bearing plate, a hardened washer, and an anchor nut. Two beveled washers per bolt may be required, as ordered by the Engineer. Galvanize all plates, washers, and nuts according to ASTM A-153.

Furnish trumpets (for single stage grouting), schedule 40 PVC sleeve, grease/wax gel corrosion protection, centralizers, grout tubes, grout sealers, and anchor head protection as recommended by the bolt manufacturer.

3. Grout
Grout shall consist of concrete grouting material conforming to the requirements of Subsection § 701-05 Concrete Grouting and Anchoring Material of the NYSDOT Standard Specification.

For single-stage grouting, the smooth PVC sleeve used for corrosion protection may be used as the bond breaker. The sleeve shall extend from the top of the bond zone through the stressing zone but shall not be long enough to come into contact with the anchor head or bearing plate during stressing. The sleeve shall be sealed to prevent grout intrusion from the bond zone.

For single-stage grouting, the trumpet shall be long enough to overlap the unbonded zone corrosion protection by at least 4 inches and shall be completely filled with grout after the anchor is stressed. The end of the trumpet shall be sealed to prevent grout from escaping into the unbonded zone and causing the grout in the trumpet to slump.

For two-stage grouting, provide a means for determining the level of the grout in the bond zone and a means for protecting the stressing and anchor zones between grouting operations.

CONSTRUCTION DETAILS

Proceed with the installation of rock bolts from the top of the slope downward. The bolt shall be placed in the drill hole with at least six inches protruding from the hole to allow tensioning. The steel bearing plate shall be at 90 ± 15 degrees to the axis of the rock bolt and at least three quarters of the plate shall be in contact with the rock surface. The method of leveling the rock surface shall be approved by the Engineer. Acceptable methods include, but are not limited to, the following:

1. Chipping the rock surface.
2. Applying a special mix supplied by the bolt manufacturer for leveling purposes.
3. Use of steel wedges in addition to a leveling mix.
4. A combination of chipping and leveling with or without wedges.

Install a minimum 2 centralizers per bolt on 10 foot centers or less. The lowest centralizer should be located within 1 foot of the end of the bolt

Grouting:
All grout pipes, tubes and fittings shall be clean and free from dirt particles, grease, hardened grout, or other foreign matter before grouting is commenced for any bolt. All surplus water and diluted grout shall be flushed or blown from all lines before commencing injection.

The grout equipment shall produce grout free of lumps and un-dispersed cement. The pump shall be equipped with a pressure gauge near the discharge end to monitor grout pressures. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The grout shall be injected from the lowest point of the drill hole and shall fully encapsulate the bolt. The quantity of the grout and the grout pressures shall be recorded.

Proof Testing:
Tension and proof test the first bolt to 150 Kips (80% of the ultimate strength of the bolt), or as ordered by the Engineer, by means of a hollow-ram hydraulic jack. Hold this tension for a minimum 10 minutes. If no loss of load occurs in this time period, the rock bolt is accepted. Lock off the load at 110 kips by tightening the anchor nut against the anchor plate.

Tension and proof test the remaining bolts to 110 Kips, or as ordered by the Engineer. Hold this tension for a minimum 10 minutes. If no loss of load occurs in this time period, the rock bolt is accepted. Lock off the load at 110 kips by tightening the anchor nut against the anchor plate.

If a failure of a bolt or anchorage occurs, install a new bolt at no cost to the State.

For single-stage grouting, grout the trumpet and install the anchor head protection.

For two-stage grouting, grout the stressing zone and install the anchor head protection.

METHOD OF MEASUREMENT

Rock bolting is measured by the number of linear feet of rock bolts satisfactorily installed.

BASIS OF PAYMENT

The unit price bid per linear foot of this Item shall include the cost of furnishing all materials, equipment, labor and tools necessary to complete all installation and testing work.