

Kiewit Infrastructure West Co.
Klamath River Renewal Project
Technical Specifications

03 60 00 GROUTING

Prepared by:



Benoit Otis
Knight Piésold

Reviewed by:



Katrina Wechselberger
Knight Piésold

Reviewed by:



Salina Yong P.E. (CA)
Knight Piésold

Approved by:



Craig Nistor
Knight Piésold

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REVISION INDEX

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	Prepared by	Reviewed by	Reviewed by	Approved by			
0	Benoit Otis	Katrina Wechselberger	Salina Yong (CA)	Craig Nistor	052722	-	-

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SECTION 03 60 00 - GROUTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section applies to the Work that requires grout and includes:
 - 1. Supply, mixing, placement and curing of grout.
 - 2. Supply, mixing, placement and curing of Low Density Cellular Concrete Grout (LDCC).

1.2 RELATED SECTIONS

- A. Section 03 10 00 – Concrete Forming and Accessories.
- B. Section 03 20 00 – Concrete Reinforcing.
- C. Section 03 30 00 – Cast-in-Place Concrete.
- D. Section 31 70 00 – Tunnel Construction.

1.3 REFERENCE STANDARDS

- A. American Concrete Institute (ACI):
 - 1. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ASTM International (ASTM):
 - 1. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 2. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
 - 3. ASTM C150 - Standard Specification for Portland Cement.
 - 4. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
 - 5. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.

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6. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes.
7. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes.
8. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
9. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
10. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.

1.4 SUBMITTALS

- A. Items listed in this section are to be submitted to the Engineer for information prior to the start of any Works, unless noted otherwise.
- B. Grout plans are to be submitted to DSOD for review and approval at least two weeks in advance of desired approval date.
- C. Grout from pre-mix materials: Product Data: Submit manufacturer product data and information.
- D. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and non-shrink grouts.
- E. Contractor shall submit for review and approval a mix design meeting the project criteria stated in this Section, including proportions, weighs, w/c ratio, admixture use, brands and types of products, compressive strengths (7, 14, 28 day) etc.
- F. Contractor provide details for placing of grout materials.

1.5 QUALITY ASSURANCE

- A. Perform Work according to the ACI standards.
- B. Certified/accredited lab performing testing of materials and expertise in the material type.
- C. Certifications that admixtures are compatible within the proposed design.
- D. Make test cylinders for every 100 cubic yards of material placed.

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: Comply with ASTM C150 Type I and II.
- B. Nonshrink grout: Comply with ASTM C1107.
- C. Silica fume: in accordance with ASTM 1240.
- D. Water: comply with ACI 301 and ASTM A1602. clean and free from objectionable quantities of silty organic matter, oils, acids, alkali, salts, organics, and other impurities.
- E. Fine Aggregate: Comply with ASTM C33.
- F. Adhesive anchoring system: epoxy-type, as indicated on the drawings or approved by the Engineer.

2.2 GROUT MIX

- A. Pre-mixed and ready-for-use formulation requiring only addition of water.
- B. Do not use ferrous aggregate or staining ingredients in grout mixes.
- C. Include a non-shrink admixture or use a prepackaged non-shrink material.
- D. Performance and Design Criteria:
 - 1. Mix design by the Contractor as to produce the compressive strength and properties as indicated on the Drawings.

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2. Minimum compressive strength: 6,000 psi.

2.3 FORMWORK

- A. As specified in Section 03 10 00 - Concrete Forming and Accessories.

PART 3 - EXECUTION

3.1 PREPARATION PER MANUFACTURER'S RECOMMENDATIONS

- A. Execution and Closeout Requirements: Requirements for installation preparation.
- B. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by brushing, hammering, chipping, or other similar means until sound and clean concrete surface is achieved.
- C. Roughen concrete lightly, but not to interfere with placement of grout.
- D. Remove foreign materials from metal surfaces in contact with grout.
- E. Align and maintain final positioning of components to be grouted.
- F. Saturate concrete surfaces with clean water, and then remove excess water.

3.2 INSTALLATION

- A. Formwork:
 1. Install formwork with clearances to permit proper placement of grout.
 2. As specified in Section 03 10 00 - Concrete Forming and Accessories.
- B. Mixing:
 1. Portland Cement Grout:
 - a. Use proportions of two parts sand and one-part cement, measured by volume or as described by the manufacturer for prepackaged mixtures.
 - b. Prepare grout with water to obtain consistency to permit placing and packing.
 - c. Mix water and grout as per the mix design.
 - d. Mix only quantities of grout capable of being placed within 30 minutes after mixing.

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- e. Do not add additional water after grout has been mixed.
 - 2. Rapid-Curing Epoxy Grout:
 - a. Mix and prepare according to manufacturer instructions.
 - b. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
 - 3. Nonshrink Cementitious Grout:
 - a. Mix and prepare according to manufacturer instructions.
 - 4. Mix grout components in proximity to Work area and transport mixture quickly and in manner not permitting segregation of materials.
- C. Placing of Grout per Manufacturer's Recommendations:
- 1. Place grout material quickly and continuously.
 - 2. Provide equipment, pumps, and pressure vessels capable of delivering the grout at the recommended rate and pressure.
 - 3. Do not use dry-packing methods.
 - 4. Apply grout from one side only to avoid entrapping air.
 - 5. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
 - 6. Thoroughly compact final installation and eliminate air pockets.
 - 7. Do not remove leveling shims for at least 48 hours after grout has been placed.
- D. Curing:
- 1. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or by using wet burlap method or maintaining end form placement where possible.
 - 2. Control ground water or other seepage to prevent erosion of the grout material.
 - 3. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
 - 4. After grout has attained its initial set, keep damp for minimum three days (if applicable).

3.3 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS AND ANCHOR BOLTS

- A. Hole Preparation:
- 1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 1/4 inch greater than the diameter of the outer surface of the reinforcing bar deformations.
 - 2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless indicated otherwise.

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3. The hole shall be drilled by methods that do not interfere with the proper bonding of epoxy.
4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling, and the location of holes shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.
5. The hole shall be blown clean with clean, dry compressed air to remove dust and loose particles.

B. Embedment:

1. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole.
2. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets.
3. The hole shall be filled to a depth that ensures excess material will be expelled from the hole during dowel placement.
4. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy.
5. The bar shall be inserted slowly enough to avoid developing air pockets.
6. The bars shall be supported to avoid movement during the curing process.

C. Anchor bolt installation shall comply with the following:

1. Anchor diameter and grade of steel shall be per the Drawings or per equipment supplier specifications. Anchor shall be threaded or deformed full length of embedment and shall be free of rust, scale, grease, and oils.
2. Embedment depth shall be as specified. Adhesive capsules of different diameters may be used to obtain proper volume for the embedment, but no more than two capsules per anchor may be used. When installing different diameter capsules in the same hole, the larger diameter capsule shall be installed first. Any extension or protrusion of the capsule from the hole is prohibited.
3. All installation recommendations by the anchor system manufacturer shall be followed carefully, including maximum hole diameter.
4. Holes shall have rough surfaces, such as can be achieved using a rotary percussion drill.
5. Holes shall be blown clean with compressed air and be free of dust or standing water prior to installation.
6. Anchor shall be left undisturbed and unloaded for full adhesive curing period.
7. Concrete temperature (not air temperature) shall be compatible with curing requirements of adhesives per adhesive manufacturer. Anchors shall not be placed in concrete below 25 degrees F.

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3.4 FIELD QUALITY CONTROL

- A. Quality Requirements: Requirements for inspecting and testing.
- B. Inspection and Testing:
 - 1. Comply with ACI 301 and as specified in Quality Requirements.
 - 2. Submit proposed mix design of each class of grout to Engineer for review and approval prior to commencement of Work.
 - 3. Tests of grout components may be performed to ensure compliance with specified requirements.

3.5 PROTECTION AND CLEANUP

- A. At completion and during progress of the work maintain premises in a neat and orderly manner. Dispose of all rubbish, construction debris and surplus materials at least on a weekly basis.
- B. Cover and protect the work from damage including water leakage onto curing concrete.
- C. Protect the work of other sections from damage resulting from the work of this section.

END OF SECTION 03 60 00