

SECTION 03 01 02

RAPID SET CONCRETE - MAINTENANCE AND REHABILITATION OF CONCRETE

This section includes repair of both Cast-In-Place and Precast Concrete and patching or repair of damaged or deteriorated horizontal and sloping concrete surfaces, using cementitious repair materials. Repair of integral structural reinforcement requires detailed analysis on individual Project basis. This section includes only basic repair of concrete reinforcement.

This section includes provision for work performed using unit price payment method, when applicable.

Contact CeraTech at tel: 1-888 341-2600 or email at fieldengineering@ceratechinc.com for technical assistance. Visit the CeraTech web site at www.ceratechinc.com for additional product information.

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete reinforcement repair.
 - 2. Concrete surface repair using rapid set concrete.
- B. Related Sections:

Include list of concrete sections requiring repair.

- 1. Section 03 30 00 - Cast-In-Place Concrete.
- 2. Section 03 38 00 - Post Tensioned Concrete.
- 3. Section 03 41 00 - Precast Structural Concrete.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

Use this article when work of this section is performed under unit price payment method.

- A. Concrete Surface Repair:
 - 1. Basis of Measurement: By the 53.5 pound (24.3 kg) bag.
 - 2. Basis of Payment: Includes surface preparation, [reinforcement and] concrete repair, and finishing.

1.3 REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

- A. American Concrete Institute:
 - 1. ACI 546R-96 - Concrete Repair Guide.

- B. ASTM International:
 - 1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
 - 4. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 5. ASTM C78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
 - 6. ASTM C109/C109M - Standard Test Method for Compressive strength of Hydraulic Cement Mortars (Using 2-in. or (50 mm) Cube Specimens).
 - 7. ASTM C157/C157M - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
 - 8. ASTM C469 - Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
 - 9. ASTM C496/C496M - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - 10. ASTM C666/C666M - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
 - 11. ASTM C672/C672M - Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
 - 12. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.

- C. American Association of State Highway and Transportation Officials:
 - 1. AASHTO TP-60-00 - Standard Method of Test for Coefficient of Thermal Expansion of Hydraulic Cement Concrete.

- D. American Welding Society:
 - 1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

- E. International Concrete Repair Institute:
 - 1. ICRI 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete from Reinforcing Steel Corrosion.
 - 2. ICRI 03732 - Guide for Selecting and Specifying Surface Preparation of Sealers, Coatings and Membranes.

1.4 SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

- A. Product Data:
 - 1. Submit product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.
- B. Manufacturer’s Instructions:
 - 1. Submit mixing instructions.
- C. Manufacturer's Certificate:
 - 1. Certify [Products] [_____] meet or exceed [specified requirements] [_____].

1.5 SUSTAINABLE DESIGN SUBMITTALS

Retain “Sustainable Design Submittals” article when specifying CERATECH Inc., “D.O.T.Line™” cementitious rapid setting concrete product for LEED Projects. Verify source for local and regional materials and distance from Project site. Delete the entire article “Sustainable Design Submittals” when LEED Requirements are not required.

- A. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
 - 1. Materials Resources Certificates:
 - a. Certify recycled material content for recycled content products.
 - b. Certify source for local and regional materials and distance from Project site.
- B. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
 - 1. Provide cost data for the following products:
 - a. Products with recycled material content.
 - b. Local and regional products.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 - 1. Accurately record actual locations of structural reinforcement repairs, type of repair, repair depth, reinforcing depth, and [_____].

1.7 QUALITY ASSURANCE

- A. Perform welding work in accordance with AWS D1.4.

Retain “Sustainable Design Requirements” article when specifying CERATECH Inc., “D.O.T.Line™” cementitious rapid setting concrete product for LEED Projects. Verify if the product is manufactured within 500 miles of Project Site if not delete 500 miles subarticle statement. Delete the entire article “Sustainable Design Requirements” when LEED Requirements are not required.

- B. Sustainable Design Requirements:
 - 1. Recycled Content Materials: Furnish materials with recycled content.
 - 2. Regional Materials: Furnish materials (aggregate) extracted, processed, and manufactured within 500 miles (800 km) of Project site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

CERATECH Inc. provides on site and off site initial and recurrent training when requested.

- B. Applicator: Company specializing in concrete repair with minimum two years [documented] experience approved by manufacturer.

1.9 MOCK-UP

Use this article for assessing repair procedures, coordination of work, testing, and observation of operation.

- A. Construct mockup of each type of repair.
 - 1. Panel 2 feet (0.6 m) long by 1 foot (0.3 m) wide, thickness as required, illustrating patching method, color and texture of repair surface and [_____].
- B. Prepare [one] [_____] mockup of each type of patching procedure.
- C. Locate [where directed by Architect/Engineer.] [where indicated on Drawings.]
- D. Incorporate accepted mockup as part of Work.

***** [OR] *****

- E. Remove mockup [when directed by Architect/Engineer.] [_____].

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Comply with instructions for storage, shelf life limitations, and handling.
- B. Deliver materials to site in manufacturer’s unopened bags and containers.
- C. Store materials in manufacturer’s dry unopened bags and containers.
- D. Stored materials must be kept dry and protected from the weather.

PART 2 PRODUCTS

2.1 CEMENTITIOUS RAPID SETTING CONCRETE

RECOMMENDED USES: D.O.T.Line has been designed for horizontal applications providing for cost effective structural repair of roads, bridges, airfields, runways, taxiways, and full & partial depth slab replacement.

- A. Manufacturers:
 - 1. CERATECH Inc.; Basis of Design Product - D.O.T.Line™.
 - 2. Substitutions: Not Permitted.

- B. Rapid Setting Concrete: Single compound, aggregate extended, water activated, semi-leveling, cementitious structural repair concrete, It is rapid setting, with 25 minutes of working time reaching compressive strengths of more than 2,500 psi within 2 hours from addition of water.

- C. Hot Weather Admix: Warm Weather Additive as recommended by rapid setting concrete manufacturer.

Characteristic	Test Method	Results
Compressive Strength 2 hours 24 hours 7 days 28 days	ASTM C39	2,514 psi (14.3 MPa) 5,210 psi (35.9 MPa) 7,220 psi (49.8 MPa) 9,300 psi (64.1 MPa)
Flexural Strength 7 days 28 days	ASTM C78	855 psi (5.9MPa) 1008 psi (6.9 MPa)
Splitting Tensile Strength 24 hours 7 days 28 days	ASTM C496	530 psi (3.7 MPa) 790 psi (5.4 MPa) 900 psi (6.2 MPa)
Bond Strength 24 hours 7 days	ASTM C882	2,004 psi (11.4 MPa) 3,018 psi (17.1 MPa)
Rapid Freeze Thaw Resistance (Durability Factor - retained percentage of Dynamic Modulus) 300 cycles	ASTM C666/C666M	0 percent
Scaling Resistance, lbs/ft2 (kg/m2) 50 cycles	ASTM C672	0
Modulus of Elasticity 28 days	ASTM C469	4.9 psi
Coefficient of Thermal Expansion 28 days	AASHTO TP 60	4.7 in/in/F

Length Change, Percent of total length 28 days soak 28 days dry	ASTM C157	-0.0280 percent -0.0080 percent
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2.2 REINFORCEMENT MATERIALS

Repair of structural reinforcement will require specific Project analysis to determine stress criteria, materials to repair, splicing methods, and special cleanup required. Verify existing reinforcement type and requirements prior to editing the following paragraphs. Reinforcing steel conforming to ASTM A615/A615M with yield strengths of 40 or 60 ksi (276 or 414 MPa) is most commonly used.

- A. Reinforcing Steel: ASTM A615/A615M, [40] [60] [75] ksi ([276] [414] [517] MPa) yield grade billet-steel [plain] [deformed] bars, [unfinished] [galvanized] finish.

***** [OR] *****

- B. Reinforcing Steel: ASTM A996/A996M, [40] [60] ksi ([276] [414] MPa) yield grade axle-steel deformed bars, [unfinished] [galvanized] finish.

***** [OR] *****

- C. Reinforcing Steel: ASTM A996/A996M, [50] [60] ksi ([345] [414] MPa) yield grade rail-steel deformed bars, [unfinished] [galvanized] finish.

- D. Stirrup Steel: [ASTM A82] [_____].

- E. Splicing Sleeves: [_____] type, [_____] manufactured by [_____].

2.3 MIXING CEMENTITIOUS RAPID SETTING CONCRETE

- A. Mix cementitious rapid setting concrete to consistency required for purpose intended. Mix components in clean equipment or containers. Conform to pot life and workability limits.
- B. Mix components in accordance with manufacturer's Standard Mixing Procedures mixing instructions using rotating drum concrete mixer.
- C. Start mixer add water, D.O.T.Line™ requires a total of 2 quarts of water per unit.
- D. Pre-wet mixer with water then drain, do not drain into repair site.
- E. Start mixer turning and add pre-determined units of D.O.T.Line™.
 - 1. Minimum 2 bag batch is recommended.

D.O.T.Line™ is water-cement ratio sensitive. Ensure mix water volume is within manufacturer's recommended limits.

- F. Add 2 quarts of water (1.9 L) per unit of D.O.T.Line™.

Allowable placement working times will vary when mix water temperatures are outside of manufacturer's recommended limits.

- 1. For ambient temperatures less than 50 degrees F (10 degrees C), use water between 70 degrees F (22 degrees C) and 90 degrees F (32 degrees C).
- 2. For ambient temperatures greater than 85 degrees F (29 degrees C), use water between 50 degrees F (10 degrees C) and 60 degrees F (22 degrees C).

Contact CERATECH Technical Support for additional information for making repairs during hot weather.

- G. For repair areas with surface temperatures greater than 90 degrees F (32 degrees C), add 1 unit of hot weather admix per unit of Mainline™.
- H. Mix for 7 minutes total, pour contents into repair area.
- I. Do not re-temper with water.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces are ready to receive work.
- B. Verify soundness of repair area.
- C. Verify structural integrity of reinforcing.
- D. Beginning of installation means acceptance of existing surfaces.

3.2 PREPARATION

- A. Remove defective concrete, clean concrete and steel surfaces; develop concrete surface profile in accordance with manufacturer's installation instructions and as specified.

The use of a pneumatic jack hammers or chip hammer under 35 lbs reduces micro-cracking in concrete immediately surrounding repair area.

- B. Break up and remove unsound substrate using pneumatic tool. Do not exceed 35 psi (240 kPa) supply pressure for pneumatic tool.
- C. Prepare surfaces in accordance with ICRI 03730 and ACI 546R-96.
- D. Use mechanical methods to obtain exposed aggregate surface with a minimum surface profile of plus or minus 1/16 inch (1.5 mm) in accordance with ICRI 03732.
- E. Use oil-free compressed air, blower or power washer to evacuate area of loose debris.
- F. Remove loose scale from reinforcing.
- G. When more than 1/2 of reinforcing bar is exposed, remove concrete from under rebar to expose at least 1/2 inch (13 mm) of annular space surrounding reinforcing to ensure mechanical lock of concrete repair.
- H. Remove standing water from repair site.

3.3 REINFORCING STEEL REPAIR

 Edit the following paragraph to suit specific repair techniques.

- A. Repair reinforcing steel by welding [new reinforcing steel to existing reinforcing steel] [_____] with [sleeve splices] [_____]. Strength of welded [splices] [and] [reinforcing steel] to exceed original stress values.

3.4 APPLICATION - CEMENTITIOUS RAPID SETTING CONCRETE

- A. Dampen repair surface with water. Remove standing water before placing concrete.
- B. Install concrete repair materials in accordance with manufacturer's instructions.
 - 1. Ensure materials are placed within allowable working time for ambient temperature, aggregate and mix water.
 - 2. Provide desired surface textured finish according to intended use.

 There are no restrictions to the depth of the final repair profile.

- C. Fill repair area with concrete to thickness required to complete repair, but not less than 1.25 inches (320 mm).
- D. Place successive layers of concrete before underlying layer reaches final set.

 Upon final set, the material can be saw-cut, drilled, sanded and or polished.

- E. Upon initial set, finish repair surface to match adjacent existing finish.

3.5 POST-REPAIR JOINT RE-ESTABLISHMENT

- A. Re-establish joints in repair area to match existing joint lines.

 It is imperative that joints be re-cut to full depth of repair.

- B. When repair occurs along existing control joint, re-cut joint to full depth of repair and original design width.
 - 1. Use portable or walk-behind concrete saw with diamond tipped blade to re-cut joints.
- C. Re-establish previously existing joints within 1 to 3 hours of final set.

3.6 PROTECTION

- A. Protect finished installation in accordance with manufacturer’s installation instructions.
- B. Protect with blankets or equivalent in ambient temperatures below 32 degrees F (0 degrees C).

3.7 TRAFFIC LOADING TIME - CEMENTITIOUS RAPID SETTING CONCRETE

- A. General loading for wheeled traffic is 2 - 3 hours and 1 – 1 1/2 hours for foot traffic after addition of water.
- B. In ambient and or surface temperatures less than 32 degrees F (0 degrees C), extend the loading time by 60 minutes for each 10 (5.5) degrees below 32 degrees F (0 degrees C).

END OF SECTION