

SECTION 03 01 00

RAPID SET MORTAR - 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 mortar.
- 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 [5 gallon] [2 gallon] ([18.9 L] [7.6 L]) bucket.
 - 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 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

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

1.7 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.

1.8 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 minimum, 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.] [_____.]

1.9 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 CEMENTITIOUS RAPID SETTING MORTAR

RECOMMENDED USES: Pavemend VR™ has been designed specifically for use in vertical and overhead applications such as spall repair and impact damage on beams, columns, pile and pile caps, tendon grouting, pressure bearing pre-cast pipe, curbs, steps, pre-stressed panels, tunnels, sewers, loading docks, silos, retaining walls, culverts, catch basins, decorative moldings, parapet walls, septic tanks, cold storage vaults and other pre-cast product repair application.

- A. Manufacturers:
 - 1. CERATECH Inc.; Basis of Design Product - Pavemend VR™.
 - 2. Substitutions: Not Permitted.
- B. Rapid Setting Mortar: Single compound, water activated, cementitious, rapid setting, one step vertical and overhead structural repair mortar. 25 to 30 minute of working time reaching compressive strengths of more than **2,500 psi (20.7 MPa)** within three hours from final set.

NTBT - Not to be tested. TBD – To be determined

Characteristic	Test Method	Results-Net / Results Extended
Compressive Strength	ASTM C109 / ASTM C39	
3 hours		2,753 psi (19.0 MPa)
24 hours		4,298 psi (29.7 MPa)
7 days		5,539 psi (38.2 MPa)
28 days		8,960 psi (61.8 MPa)

Flexural Strength 7 days 28 days	ASTM C78	578 psi (4.0 MPa) 792 psi (5.5 MPa)
Splitting Tensile Strength 7 days 28 days	ASTM C496	307 psi (2.1 MPa) 590 psi (4.0 MPa)
Direct Tension Strength 7 days 28 days	ASTM C496	319 (2.2) TBD
Bond Strength 24 hours 7 days	ASTM C882	2,067 psi (14.3 MPa) TBD
Scaling Resistance, lbs/ft ² (kg/m ²) 25 cycles	ASTM C672	0
Modulus of Elasticity 28 days	ASTM C469	3.16 psi (2.1 MPa)
Coefficient of Thermal Expansion 28 days	AASHTO TP 60	TBD
Length Change, Percent of total length 28 days soak 28 days dry	ASTM C157	TBD TBD

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 MORTAR

- A. Mix cementitious rapid setting mortars to consistency for purpose intended. Mix components in clean containers. Conform to pot life and workability limits.
- B. Mix components in accordance with manufacturer's NEAT Procedure mixing instructions using bucket and paddle mixer.
- C. Loosen material by tumbling bucket and dry mixing before adding water.
- D. To ensure product performance, do not divide or separate individual units into smaller portions. Mix entire contents at one time.

 Maximum drill speed is important. Drills with speeds greater than 800 RPMs may entrain air in mix and reduce performance. Do not hand mix.

- E. Use drill rated 6 amp minimum with mixer blade turning at least 500 to 800 rpm.
- F. Begin mixing and add proper amount of water:
 1. For each 51 lb (23kg) 5 U.S. gallon (19.8 L) bucket add 3 U.S. quarts (2.8 L) of water.
 2. For each 17 lb (7.7kg) 2 U.S. gallon (7.6 L) add 1 U.S. quart of water.
 3. Maintain mix water temperature between 65 degrees F (18 degrees C) and 75 degrees F (24 degrees C).
 4. After adding water, rapidly incorporate dry Pavemend VR™ powders into water to achieve a uniform wet mixture within first 30 seconds of mixing.
- G. Mixing Time:
 1. Mix material for 4 1/2 minutes in ambient temperatures of 72 degrees F (29 degrees C) to 80 degrees F (27 degrees C)
 2. Mix material for 3 1/2 minutes in ambient temperatures of 80 degrees F (27 degrees C) to 90 degrees F (32 degrees C)
 3. Mix material for 3 minutes in ambient temperatures above 90 degrees F (32 degrees C)

 Pavemend VR™ undergoes an exothermic chemical reaction during blending. Mix temperature is the best indication that the reaction is complete and that the product is ready to be poured.

- 4. For ambient temperatures less than 72 degrees F (22 degrees C), mix until Critical Mix Temperature of 80 degrees F (27 degrees C) is reached. Place material into repair area when this temperature has been achieved.

- a. Measure mortar temperature using thermal gun or temperature probe to ensure mix reaches Critical Mix Temperature.
- b. When Critical Mix Temperature cannot be reached, mix until 20 degrees F rise in material temperature is achieved.

 Mixing time to reach the Critical Mix Temperature will vary with ambient air and mix water temperatures, however, never mix Pavemend VR™ for less than 3 minutes

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. Do not place rapid setting mortar when surface temperatures are above 120 degrees F (49 degrees C) or below 40 degrees F (10 degrees C).
- E. 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 MORTAR

Adding water to surface of repair area will negatively affect cured material properties.

- A. Install mortar repair materials in accordance with manufacturer's instructions.
 - 1. Ensure materials are placed within allowable working time for surface temperature and repair depth.
 - 2. Begin as soon as material reaches critical mix temperature.
 - 3. Provide desired surface textured finish according to intended use.

There are no restrictions to the depth of the repair profile when placing profiles greater than 4.00" (10 cm) layering is required to minimize sag.

- B. Fill repair area with mortar to thickness required to complete repair, but not less than 0.06 inch (1.5 mm).
- C. 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.

3.7 TRAFFIC LOADING TIME - CEMENTITIOUS RAPID SETTING MORTAR

A. General loading for wheeled traffic is 2 - 3 hours and 1 hour for foot traffic.

B. In ambient and/or surface temperatures below 60 degrees F (15 degrees C), extend the loading time by 30 minutes for each 10 degrees below 60 degrees F (15 degrees C).

END OF SECTION