

Part 1 General

1.1 SUMMARY

- .1 The top surface of slabs and beam exhibiting extensive spalling and/or delamination are to be repaired by mechanical removal of the deteriorated concrete and infilling with a rapid-setting mortar.
- .2 All spalling and/or delaminated concrete must be removed down to sound concrete in accordance with Section 03 91 10.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.
- .3 Section 03 91 10 – Surface Preparation for Concrete Delamination Repair.

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 ACI 546-04, Concrete Repair Guide.
 - .2 ACI RAP-7, Spall Repair of Horizontal Concrete Surfaces.
- .2 Canadian Standards Association (CSA)
 - .1 CSA- S448.1-10, Repair of Reinforced Concrete in Buildings.
- .3 International Concrete Repair Institute
 - .1 ICRI concrete Repair Terminology (2010 Edition).
 - .2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.
 - .3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).
 - .4 ICRI Guideline No. 320.3-2007, Guideline for Inorganic Repair Material Data Sheet Protocol (formerly No. 03740).

1.4 MEASUREMENT PROCEDURES

- .1 Prior to construction, concrete repair areas will be identified on-site via soundings completed by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be marked and agreed upon by the Contractor and Contract Administrator prior to commencement of work.
- .2 All costs associated with concrete repair and restoration required to satisfy the intent of the Drawings and Specifications must be included in the Bidders lump sum price.

1.5 QUALITY ASSURANCE

- .1 Contractor Qualifications:
 - .1 Minimum of 5 years experience in application of specified (or similar) products on projects of similar size and scope.
 - .2 Successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.
- .2 Field Mock-up:
 - .1 Upon request, install field mock-up at Project site or pre-selected area of building or location approved by Contract Administrator. Install material in accordance with this Section.
 - .2 Field mock-up will be standard for judging workmanship on remainder of Project.
 - .3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .2 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.
- .3 Keep materials in manufacturer's original, unopened containers and packaging until installation.
- .4 Protect materials during storage, handling, and application to prevent contamination or damage.

1.7 PROJECT CONDITIONS

- .1 Environmental Requirements:
 - .1 Ensure that substrate surface and ambient air temperature are minimum of 4°C and rising at application time and remain above 4°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.
 - .2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.
 - .3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

Part 2 Products

2.1 MATERIALS

- .1 Rapid Setting Repair Mortar: Two-component, screedable, shrinkage-compensated, pre-extended, portland-cement-based, flowable repair mortar, with integral corrosion inhibitor with a minimum application thickness of 1 inch (25 mm).
 - .1 Properties:
 - .1 Unit Weight, ASTM C 185: 2,147 to 2,307 kg/m³.
 - .2 Working Time, 21°C: Greater than 30 minutes.
 - .3 Setting Time, ASTM C 266:
 - .1 Standard Application Temperature, 21°C:
 - .1 Initial Setting Time: 40 to 90 minutes.
 - .2 Final Setting Time: Less than 120 minutes.
 - .2 Maximum Application Temperature, 32°C:
 - .1 Initial Setting Time: 25 to 50 minutes.
 - .2 Final Setting Time: Less than 60 minutes.
 - .3 Minimum Application Temperature, 10°C:
 - .1 Initial Setting Time: 100 to 150 minutes.
 - .2 Final Setting Time: Less than 170 minutes.
 - .4 Compressive Strength, ASTM C 109, 23°C:
 - .1 3 Hours: Greater than 10.3 MPa (1,500 psi).
 - .2 1 Day: Greater than 20.7 MPa (3,000 psi).
 - .3 7 Days: Greater than 27.6 MPa (4,000 psi).
 - .4 28 Days: Greater than 34.5 MPa (5,000 psi).
 - .5 Drying Shrinkage, ASTM C 157, Modified, 28 Days: Less than 500 percent (μ strain).
 - .6 Rapid Chloride Permeability, ASTM C 1202/AASHTO T 277: Very low range, coulombs.
 - .7 Static Modulus of Elasticity, ASTM C 469, 28 Days: 22.1 GPa (3.2 x 10⁶ psi).
 - .8 Salt Scaling Resistance, ASTM C 672, 50 Cycles, Rating: 0.
 - .9 Coefficient of Thermal Expansion, CRD C 39: 1.46 x 10⁻⁵ m/m/degree C (8.1 x 10⁻⁶ in/in/degree F).
 - .10 Freezing and Thawing Resistance, ASTM C 666, Procedure A:
 - .1 Average Durability Factor, 300 Cycles: Greater than 80.
 - .11 Cracking Resistance, ASTM C 1581, plots of steel ring strain versus specimen age for each test specimen:
 - .1 Average Initial Strain: 0.09.
 - .2 Average Maximum Strain: 41.47.
 - .3 Average Age at Cracking: Greater than 60 days.
 - .12 Compressive Creep, ASTM C 512, Average Creep Strain:

- .1 7 Days: 0.008 μ strain/psi.
- .2 28 Days: 0.034 μ strain/psi.
- .13 Direct Tensile Strength, CRD C 164, 2-inch by 4-inch specimens, Average Tensile Strength:
 - .1 1 Day: 350 psi.
 - .2 7 Days: 400 psi.
 - .3 28 Days: 500 psi.
- .14 Bond Strength, ASTM C 882, Modified per ASTM C 928, 3-inch by 6-inch slant-shear specimens, Average Slant-Shear Bond Strength:
 - .1 1 Day: Greater than 1,000 psi.
 - .2 7 Days: Greater than 1,500 psi.
 - .3 28 Days: Greater than 2,000 psi.
- .15 VOC Content: 0 lbs per gal (0 g/L), less water and exempt solvents.
- .2 Acceptable Product: ZERO-C Horizontal Extended Mortar by BASF Building Systems.
 - .1 Components:
 - .1 ZERO-C Horizontal Liquid.
 - .2 ZERO-C Extended Mortar.

2.2 ACCESSORIES

- .1 Evaporation retardant: Confilm by BASF Building Systems at a minimum application rate of 4.9 m²/L.

Part 3 Execution

3.1 PREPARATION

- .1 Protection: Protect adjacent Work areas and finish surfaces from damage during repair mortar application.
- .2 Surface Preparation:
 - .1 Complete concrete delamination repairs to 03 91 10 – Surface Preparation for Concrete Delamination Repairs.
- .3 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.
- .4 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .5 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

- .6 Forming:
 - .1 Unless otherwise indicated provide plywood formwork to match existing profiles.
 - .2 Install chamfers at outside corners and filets at inside corners in accordance with Section 03 10 00 or to match existing profiles.
 - .3 Design formwork to accommodate the mass and pressure of the repair material and construction live loads.
 - .4 Securely anchor formwork to substrate. Anchors to be sized and space to prevent deflection of the forms during placement and curing.
 - .5 Construct forms to fit tightly against existing concrete surfaces. Seal around edge of formwork with sealant to prevent leakage during grouting.
 - .6 Anchors shall be completely removable. All anchor holes shall be patched with same grout mixed to dry pack consistency. Completely fill all anchor holes.
 - .7 A minimum of 1 inch concrete cover over the primary reinforcing steel will be required, thus, an adjustment of the formwork such as a notch may be required to ensure sufficient cover.
 - .8 Use form-release agent to facilitate removal of forms from cast material.
 - .9 Test formwork for leaks. Any areas of leakage are to be sealed prior to placement of repair material. Re-test as required.

3.2 INFILLING PROCEDURES

- .1 Obtain Contract Administrator's approval before placing repair material. Provide minimum 24 hours notice.
- .2 Maintain the substrate in a saturated surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .3 Mixing of rapid-setting mortar
 - .1 Mix materials in accordance with manufacturer's instructions.
 - .2 Precondition components to 16°C to 27° C for 24 hours before mixing.
 - .3 Ensure repair mortar is thoroughly mixed.
 - .4 Do not use free-fall mixers.
 - .5 Never mix partial bags.
- .4 Bonding Slurry Application:
 - .1 Apply the bonding slurry consisting of neat rapid-setting mortar to a saturated surface dry (SSD) substrate with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove standing water by vacuuming.
 - .2 Scrub plastic slurry into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area.
 - .3 Place repair material while the bonding slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not retemper. If the bond slurry dries prior to placement of the concrete, removal of the dried slurry

will be required. The concrete substrate will then be cleaned and prepared in accordance with the requirements described in the previous sections.

- .5 Immediately place repair material, into the prepared patch area from one side to the other. Work the repair material firmly into the bottom and sides of the patch, and underneath reinforcing steel, to assure good bond.
- .6 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.
- .7 Continuously consolidate and finish to matching elevations, ensuring patch thickness and required elevations are maintained.
- .8 Ensure reinforcement, floor drains, inserts, etc. are not disturbed during concrete placement.

3.3 FINISHING

- .1 Following consolidation and screeding, the surface shall be immediately bull-floated to close and smooth the surface.
- .2 Surface to receive a smooth finish free of ridges and trowel marks.
- .3 Apply evaporation retardant at manufacturers recommended coverage rate immediately following final finishing. Do not apply evaporation retardant during any finishing operation nor should it be worked into the surface.
- .4 Protect freshly placed concrete from exposure to dust, debris and precipitation.

3.4 CURING

- .1 Concrete repairs to be wet cured for a minimum of 3 days at 10°C.
- .2 Immediately after final finishing, apply evaporation retardant to prevent drying shrinkage until the concrete has enough strength to support the placement of the wet burlap.
- .3 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
- .4 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" and be securely held in place without marring the concrete surface.
- .5 Wet curing with burlap and water must be maintained throughout entire curing period.
- .6 Workers shall not be allowed on the overlay for 12 hours after placement. Do not place load upon new concrete until curing period is over.
- .7 Leave formwork in place until repair mortar reaches compressive strength for minimum 3 days.

3.5 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 2 10 - Allowances.
- .3 Not less than one test per 50 square feet of patching material placed and not less than one test for each day of placement.
 - .1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.
- .4 Bond tests will be completed at the discretion of the Contract Administrator.
 - .1 Infilling of the core hole will be the responsibility of the General Contractor. Unless otherwise directed by the Contract Administrator, repair in accordance with this Section.
- .5 Testing agency to submit copies of concrete test reports directly to Owner and Contract Administrator.
- .6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.6 DEFECTIVE CONCRETE

- .1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

END OF SECTION