

Part 1 General

1.1 SUMMARY

- .1 Slab soffit areas, beams, columns and walls exhibiting extensive spalling and/or delamination in which patching would be uneconomical are to be repaired by mechanical removal of the deteriorated concrete and replacement with a pumpable grout.
- .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 20 00 – Concrete Reinforcing.
- .2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repairs.
- .3 Section 03 93 10 – Hand Patching.
- .4 Section 07 92 10 – Concrete Joint Sealants.

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 ACI 546-04, Concrete Repair Guide.
 - .2 ACI RAP-5, Surface Repair Using Form-and-Pump Techniques.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-08, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. (50-mm) Cube Specimens).
 - .2 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 Canadian Standards Association (CSA)
 - .1 CSA- S448.1-10, Repair of Reinforced Concrete in Buildings.
- .4 International Concrete Repair Institute (ICRI)
 - .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).

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 Comply with Section 01 61 00.
- .2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.
- .4 Keep materials in manufacturer's original, unopened containers and packaging until installation.
- .5 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 One-component, shrinkage-compensated, micro concrete consisting of cement, graded aggregate, shrinkage-compensating agents, and additives complying with the following performance requirements:

- .1 Compressive Strength, ASTM C109:
 - .1 1 day: minimum 17.0 MPa.
 - .2 7 days: minimum 34.5 MPa.
 - .3 28 days: minimum 41.0 MPa.
- .2 Slant Shear Bond Strength, ASTM C 882:
 - .1 1 Day: minimum 5.0 MPa.
 - .2 7 Days: minimum 10.0 MPa.
 - .3 28 days: minimum 16.0 MPa.
- .3 Drying Shrinkage, ASTM C157, Unmodified, 1-inch (25-mm) prisms:
 - .1 28 Days: less than 350 μ strain.
- .4 Drying Shrinkage, ASTM C157, Modified, 3-inch (76-mm) prisms, air cured at 73 degrees F (23 degrees C), 50 percent relative humidity:
 - .1 7 Days: less than 225 μ strain.
 - .2 28 Days: less than 500 μ strain.
- .5 Coefficient of Thermal Expansion, ASTM C531:
 - .1 28 days: $10 \pm 0.1 \times 10^{-6}$ cm/cm per degree C.
- .6 Freeze/Thaw Resistance, ASTM C666 at 300 cycles:
 - .1 minimum 96% relative dynamic modulus.
- .7 Splitting Tensile Strength, ASTM C496:
 - .1 28 days: minimum 4.0 MPa.
- .8 Rapid Chloride Permeability, ASTM C1202:
 - .1 Less than 1,000 Coulombs

- .2 Acceptable product is:

- .1 LA Repair Mortar by BASF Building Systems.

2.2 EQUIPMENT

- .1 Pumping equipment: Mono-type, piston/ball valve, or hydraulic/swing valve pumps capable of pumping specified grout. Pumping equipment must have adequate controls to regulate flow rates and pressures

2.3 ACCESSORIES

- .1 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
 - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.
 - .2 Kure-N-Seal WB by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .2 Sealants: to Section 07 91 20.

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 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 but not less than 14 psi (100 kPa).
 - .4 Securely anchor formwork to substrate. Anchors to be sized and space to prevent deflection of the forms during pressure grouting.
 - .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 utilized for the repairs but 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 Provide drainage outlets in formwork for presoaking and, if beneath a soffit, provide air venting. Provide suitable access points to pump mixed repair mortar into place.

- .9 Space ports for pump line attached in a grid pattern.
- .10 Use form-release agent to facilitate removal of forms from cast material.
- .11 Within two (2) hours immediately prior to grouting, pressure test formwork to determine watertightness. Completely fill formwork with clean water and let stand for not less than 15 minutes. Any areas of leakage are to be sealed prior to grouting. 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:
 - .1 Mix materials in accordance with manufacturer's instructions.
 - .2 Ensure repair mortar is thoroughly mixed.
 - .3 Do not use free-fall mixers.
 - .4 Never mix partial bags.
- .4 Within 15 minutes of mixing, pump the grout into the prepared form. Work in a manner to avoid air entrapment with a variable pressure pump.
- .5 Start pumping at one corner for horizontal surfaces, or at the lowest point for vertical surfaces, continue filling in a manner that prevents air entrapment.
- .6 Continue pumping until material flows from adjacent ports and all air is expelled. After all air is expelled, temporarily stop pumping, close off port, and begin pumping from next port that has seen material flow. Repeat sequence until the cavity is completely filled.
- .7 Monitor pump-line pressure to prevent excessive back-pressure when pumping long distances.
- .8 Vibrate the form while pumping, as required, to achieve flow and compaction. Flowable grout must be confined in either the horizontal or vertical direction, leaving a minimum of exposed surface.

3.3 CURING

- .1 Concrete repairs to be cured for a minimum of 3 days at 10°C.
- .2 Leave formwork in place until repair mortar reaches compressive strength of 20 MPa but not less than 3 days.
- .3 Upon removal of forms, apply two coats curing compound in accordance with manufacturer's specifications. Apply the first coat immediately upon removal of forms. Apply the second coat about 24 hours later.

3.4 FINISHING

- .1 After stripping of formwork, any spaces not filled should be trimmed, cleaned, and dry-packed with grout to the desired profile. Do not proceed with repairs without Contract Administrators written approval.

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 01 210 - 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