
PART 1 - GENERAL

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| <u>1.1 Related Sections</u> | .1 | Section 03 20 00 Concrete Reinforcement |
| | .2 | Section 03 30 10 Concrete Repair and Patching |
| <u>1.2 References</u> | .1 | Canadian Standards Association (CSA) |
| | .1 | CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction |
| | .2 | CAN/CSA-O86-14, Engineering Design in Wood (Limit States Design). |
| | .3 | CSA-O121-08 (R2013), Douglas Fir Plywood. |
| | .4 | CSA-O151-09 (R2014), Canadian Softwood Plywood. |
| | .5 | CSA-O153-13, Poplar Plywood. |
| | .6 | CAN/CSA-S269.3-M92 (R2013), Concrete Formwork. |

PART 2 - PRODUCTS

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| <u>2.1 Materials</u> | .1 | Formwork materials: |
| | .1 | For exposed to view flat surfaces use medium density overlay plywood, 19 mm thick. |
| | .2 | Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, preventing patching materials from sticking to forms. |
| | .3 | Form stripping agent to be colorless mineral oil, subject to Departmental Representative approval. |
| | .4 | The release agent shall be non-staining. |

PART 3 - EXECUTION

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| <u>3.1 Fabrication and Erection</u> | .1 | Verify lines, levels and centers before proceeding with formwork/falsework and ensure dimensions agree with drawings. |
| | .2 | Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated on plans. |
| | .3 | Formwork and all supporting or bracing members shall be designed such that they will not deflect noticeably under the weight or pressure of the concrete and other loadings incidental to construction. |
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- .4 Formwork must be constructed with watertight joints. To prevent leakage of paste at corners and joints in the forms and against existing concrete, use gaskets or other approved means which will not mar the finished appearance of the work.
- .5 Form surfaces using single, jointless sheets of form material.
- .6 Match edge treatment of adjacent concrete.
- .7 Clean formwork in accordance with CSA A23.1 before placing concrete.
- .8 Inspect forms after each use. Damaged surfaces must be replaced or repaired so that no evidence of the damage is apparent in the finished concrete.

3.2 Removal

- .1 Leave formwork in place for minimum 3 days.
- .2 Forms shall not be removed until concrete achieved 15 MPa minimum strength and form removal will not cause damage.

3.3 Formwork

- .1 Ensure formwork is constructed, installed and supported in accordance with applicable standards.
- .2 Ensure formwork is tightly affixed and fluid tight. Install all necessary accessories to produce repair surfaces to match original concrete. Include all necessary chamfers, angles, and workmanship to complete the repair to match original.
- .3 Install form release that will not impair subsequent work such as coating application.
- .4 Remove formwork subsequent to proper curing.

3.4 Allowable Tolerances

- .1 Variations from the plumb:
 - .1 In the lines and surfaces of edges of concrete embedments: -6 mm per 3 metres but not to exceed 20 mm.

END OF SECTION

PART 1 - General

<u>1.1 Related Section</u>	.1	Section 03 10 00 - Concrete Formwork
	.2	Section 03 30 10 - Concrete Repair and Patching
<u>1.2 References</u>	.1	American Concrete Institute (ACI) .1 SP-66(04), ACI Detailing Manual - 2004.
	.2	American Society for Testing and Materials (ASTM) .1 ASTM A1064/A1064M-15 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
	.3	Canadian Standards Association (CSA) .1 CAN/CSA-G30.18-09 (R2014) Carbon Steel Bars for Concrete Reinforcement.
	.4	Reinforcing Steel Institute of Canada .1 Reinforcing Steel Manual of Standard Practice, RSIC, Fourth Edition, 2004.
<u>1.3 Source Quality Control</u>	.1	Upon request, inform Departmental Representative of proposed source of materials to be supplied.

PART 2 - PRODUCTS

<u>2.1 Materials</u>	.1	Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
	.2	Cold-drawn annealed steel wire ties: to. ASTM A1064/A1064M.
	.3	Chairs, bolsters, bar supports, spacers: to CSA-A23.1. Non-metallic where within 40 mm of exposed concrete surfaces.
<u>2.2 Fabrication</u>	.1	Fabricate reinforcing steel in accordance with CSA-A23.1, ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, unless indicated otherwise.

PART 3 - EXECUTION

<u>3.1 Placing Reinforcement</u>	.1	Place reinforcing steel in accordance with CSA-A23.1.
	.2	Ensure cover to reinforcement is maintained.

- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Clean reinforcement before placing concrete.
- .5 The Departmental Representative shall be notified when the reinforcing steel is in place and in sufficient time to permit an inspection of same prior to placement of patching materials. 24-hour minimum notification is required.

END OF SECTION

PART 1 - GENERAL

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| <u>1.1 Related Sections</u> | .1 | Section 03 10 00 Concrete Forming and Accessories. |
| | .2 | Section 03 20 00 Concrete Reinforcing. |
| <u>1.2 References</u> | .1 | American Society for Testing and Materials International (ASTM) |
| | .1 | ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete. |
| | .2 | ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete. |
| | .3 | ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete. |
| | .4 | ASTM C881/C881M-10, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete. |
| | .2 | Canadian Standards Association (CSA) |
| | .1 | CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete. |
| | .2 | CSA A283-06 (R2011), Qualification Code for Concrete Testing Laboratories. |
| | .3 | CSA-A3000-08, Cementitious Materials Compendium. |
| <u>1.3 Certificates</u> | .1 | Submit certificates in accordance with Section 01 33 00 Submittal Procedures. |
| | .2 | Provide certification indicating the concrete supplier is certified in accordance with the Atlantic Provinces Ready Mix Concrete Association Program or equivalent. |
| | .1 | Only concrete supplied from such certified plants shall be acceptable to the Departmental Representative. |
| | .2 | Plant certification shall be maintained for the duration of the fabrication and erection until the warranty period expires. |
| | .3 | Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. |
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- .4 Provide mix design in compliance with CSA-A23.1 to provide concrete of quality, yield and strength as specified under 2.2 Mix Design. Mix design to be prepared by and stamped by an engineer licensed to practice in the Province of New Brunswick.
- .5 Prior to starting concrete work, submit to Departmental Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Supplementary cementing materials.
 - .4 Admixtures.
 - .5 Aggregates.
 - .6 Water.

1.4 Waste Management
and Disposal

- .1 Designate a cleaning area for concrete trucks off site, at a company owned site for such a purpose meeting all federal and provincial requirements.
- .2 Use trigger operated spray nozzles for water hoses.
- .3 Designate a cleaning area for tools to limit water use and runoff.
- .4 Carefully coordinate the specified concrete work with weather conditions.
- .5 Prevent plasticizers, water-reducing agents and air-entraining agents from entering the brook. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal.
- .6 Choose least harmful, appropriate cleaning method which will perform adequately.

PART 2 - PRODUCTS

2.1 Materials

- .1 Blended hydraulic cement: Type GUb-F/SF to CSA-A3001.
- .2 Supplementary cementing materials: to CSA-A3001.
- .3 Water: to CSA-A23.1.

- .4 Aggregates: to CSA-A23.1/A23.2. Coarse aggregates to be normal density.
- .5 Air entraining admixture: to ASTM C260.
- .6 Chemical admixtures: to ASTM C494/C494M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Concrete retarders: to ASTM C494/C494M water based, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.
- .8 Anchorage Adhesive: to ASTM C881/C881M, Type IV, Grade 3, Class A, B, and C.
 - .1 Acceptable Products:
 - .1 Epcon Acrylic 7 by ITW Ramset/Red Head.
 - .2 HIT HY200 Injection Adhesive System by HILTI.
 - .3 Acrylic-Tie Anchoring System by Simpson Strong-Tie.
 - .4 UCAN Flo-Rok FR5 Max by UCAN Fastening Products.
 - .5 Alternate Materials: Approved by addendum in accordance with Instructions to Tenderers.

2.2 Mix Design

- .1 The contractor shall be responsible for the concrete mix design.
- .2 It shall be the responsibility of the Contractor to ensure that the mixture proportions shall be properly batched, mixed, placed and cured such that the concrete conforms to the specifications.
- .3 Proportion normal density concrete in accordance with the New Brunswick Department of Transportation and Infrastructure's Standard Specifications, 2015 edition, Item: 302, to meet the requirements of Concrete in Structures 'C', exposure class C-XL.

PART 3 - EXECUTION

3.1 Preparation

- .1 Inform Department Representative before placing concrete. Provide 24 hours notice prior to placing of concrete.

- .2 Pumping of concrete is permitted only after review of equipment and mix.
- .3 Ensure reinforcement is not disturbed during concrete placement.
- .4 Prior to placing of concrete advise Departmental Representative of proposed method for protection of concrete during placing and curing in adverse weather.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

3.2 Construction

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1.

3.3 Preparation of Existing Concrete Surfaces

- .1 Remove all laitance, dirt, dust, debris, adhesives, grease, or other substances that would interfere with the bond between the existing base course concrete and the new concrete.
- .2 The surface of the base course concrete shall be roughened to a 6 mm profile, using high pressure water blasting, or other approved methods.
- .3 Remove all loose materials from the prepared surface.
- .4 The surface of the base concrete shall be kept continuously moist for at least one hour prior to placement of the new concrete. Excess water shall be removed, the surface cleaned and flushed with fresh water and permitted to become saturated surface-dry before the placement of the new concrete.

3.4 Finishing

- .1 Only ACI (American Concrete Institute) certified or other pre-approved concrete finishers are to be utilized in finishing all concrete works.
- .2 Finish concrete in accordance with CSA-A23.1.
- .3 All formed surfaces to be smooth form finish.

Dickson Brook
Culvert Repairs
Parks Canada
Fundy National Park, NB
Project No. R.078605.001

Cast-in-Place Concrete

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3.5 Field Quality
Control

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Departmental Representative in accordance with CSA-A23.1 and Section 01 45 00 Testing and Quality Control.
- .2 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .3 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.

END OF SECTION

PART 1 - GENERAL

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| <u>1.1 Related Sections</u> | .1 | Section 02 41 18 Selective Demolition |
| | .2 | Section 09 96 67 Cementitious Coating |
| <u>1.2 References</u> | .1 | Canadian Standards Association (CSA). |
| | .1 | CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete. |
| | .2 | CSA-A3000-13, Cementitious Materials Compendium. |
| <u>1.3 Construction Quality Control</u> | .1 | Submit proposed quality control procedures for Departmental Representative's review. |
| | .2 | Minimum 3 weeks prior to starting concrete repair and patching work, submit proposed quality control procedures for Departmental Representative's approval for following items: |
| | .1 | Surface preparation for patching. |
| | .2 | Installation of patching mortars. |
| | .3 | Finishes |
| | .4 | Curing. |
| | .5 | Joint repair and reinstatement. |
| | .3 | Inspection or testing by Departmental Representative will not augment or replace Contractor's quality control nor relieve him of his contractual responsibilities. |
| <u>1.4 Samples</u> | .1 | Submit samples in accordance with Section 01 33 00 - Submittal Procedures. |
| <u>1.5 Mock-up</u> | .1 | Construct mock-up in accordance with Section 01 61 00 - Common Product Requirements. |
| | .2 | Construct mock-up to demonstrate repair procedure for each type of repair and patching work specified or as required to complete the work. Include: |
| | .1 | Patching of existing concrete culvert interior surfaces above level of new concrete encasement. |
| | .2 | Application of cementitious coating system to existing concrete substrate and patched areas as per Section 09 96 67. |
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- .3 Construct mock-up under supervision of Departmental Representative to demonstrate that a full understanding of specified procedures, techniques and formulations is achieved before work commences.
- .4 Construct mock-up where directed.
- .5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with related concrete repair and patching work represented by mock-up.
- .6 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work subject to approval from the Departmental Representative.

1.6 Pre-Construction Meeting and Related Preparations

- .1 Manufacturers' Technical Representatives to be on site for pre-construction meeting and mock-up and to review and approve surface preparation, mixing of materials, and repair material installations, application, and curing.
- .2 Departmental Representative, General Contractor and representative of all related trades to attend pre-construction meeting.

1.7 Waste Management and Disposal

- .1 Unused materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
- 2. Prevent patching mortar and other materials from entering brook. Using appropriate safety precautions, collect liquids or solidify liquids with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, provincial and national regulations.

PART 2 - PRODUCTS

2.1 Materials

- .1 Patching mortar for concrete repairs for curb and culvert:
 - .1 One-component, shrinkage compensating cementitious repair mortar. Acceptable products:
 - .1 Planitop 12 by MAPEI.
 - .2 MasterEmaco N 423RS by BASF.

- .3 SikaTop 123 Plus by Sika Canada Inc.
- .4 Alternate materials: Approved by addendum in accordance with Instructions to Tenderers.
- .2 Thin-layer mortar for concrete curb re-surfacing. Acceptable products:
 - .1 Planitop 21 by MAPEI.
 - .2 MasterEmaco N 5100 by BASF.
 - .3 SikaRepair SMB by Sika
 - .4 Alternate materials: Approved by addendum in accordance with Instructions to Tenderers.
- .3 Rebar Corrosion Inhibitor and Bonding Agent:
 - .1 Mapei lk by MAPEI.
 - .2 MasterEmaco P124 by BASF.
 - .3 SikaTop Armatec 110 EpoCem by Sika Canada Inc.
 - .4 Alternate materials: Approved by addendum in accordance with Instructions to Tenderers.
- .4 Use products of single manufacturer only.
- .5 Acceptable sand blast media products are 'Black Beauty', Noire Grit or Glass Bead. Media to be used shall conform to the latest standard limiting the production of toxic substances.

PART 3 - EXECUTION

3.1 General Repair and Patching of Concrete Substrate

- .1 Remove all laitance, dirt, dust, debris, grease, or other substances from base course surface that would interfere with the bond between the base course concrete and the patching materials.
- .2 Remove all loose materials from the prepared surface.
- .3 Saw cut edges of repair areas. Acceptable saw-cutting blades to be diamond segmented attached to equipment that will allow ease of use on the vertical and overhead plain. A mini grinder is suggested. Operators to be fully trained in the use of these tools.
- .4 Install patching mortar as per manufacturer's written instructions
- .5 Finish to patch areas shall match that of adjacent surfaces, and suit coating system requirements.

- .6 Curing of patching mortar shall be in strict accordance with manufacturer's written instructions.
- .7 Manufacturers' technical representative to be on site to approve preparation, material application, finishing and curing of repair areas.
- .8 All procedure and applications to be conducted in a manner to produce a product of the highest quality within the standard guidelines of ACI 546R.

3.2 Mock-up

- .1 Mock-up of concrete repair and patching of work is to be provided for Departmental Representative to review, inspect and test.
- .2 Installation of mock-up to be carried out under the on-site direction of the product manufacturer's representative.
- .3 Departmental Representative to approve color, texture and other visible qualities of the mock-up.
- .4 The quality, and appearance of the approved mock-up will become the basis of acceptance of the remainder of the work.

3.3 Corrosion Inhibitor/Bonding Agent

- .1 Remove deteriorated concrete as described under Section 02 41 18, Selective Demolition and as specified by patching mortar manufacturer's written directions.
- .2 Concrete substrate to be at a pH level of 9.5 or greater, and free of salts, oils, rust, and dust.
- .3 If reinforcing steel is exposed in repair areas, clean of all rust and mill scale to SSPC-SP-10 or NACE-2.
- .4 Concrete substrate to be saturated surface dry.
- .5 Apply corrosion inhibitor to all exposed rebar.

3.4 Patching Mortar

- .1 Repair all defective areas on concrete curbs and top and bottom surfaces of concrete culvert.
- .2 Mix, apply, finish and cure patching mortar repair areas in strict accordance with manufacturer's written directions and as per approved procedures used in mock-up.

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| <u>3.5 Thin-Layer Patching Mortar</u> | .1 | Thin-layer patching mortar: Prepare surfaces of repaired concrete curbs and refinish with thin-layer patching mortar. |
| | .2 | Mix, apply, finish and cure patching mortar repair areas in strict accordance with manufacturer's written directions and as per approved procedures used in mock-up. |
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<u>3.6 Field Quality Control</u> | .1 | Inspection and testing of patching materials and coating applications will be carried out by a Testing Agency designated by the Departmental Representative. |
| | .2 | Owner will pay for costs of tests as specified in Section. 01 45 00 - Testing and Quality Control. |
| | .3 | Inspection or testing by Departmental Representative will not augment or replace Contractor's quality control nor relieve him of his contractual responsibility. |

END OF SECTION
