

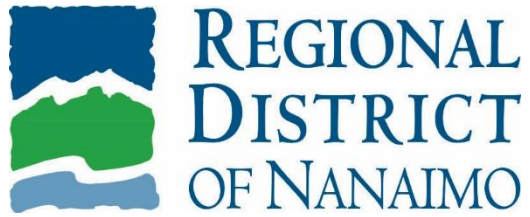


RWW, SRS and PE Service Applications

Reference Number: SP-S-0005 Rev 2

Revision History

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UNLINED CONCRETE TANK REPAIR SPECIFICATION

SP-S-0005

RWW, SRS and PE Service Applications

Revision 2

Date: July 24, 2026

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1 General

1.1 Scope of Specification

- 1.1.1 This document serves as the RDN’s governing specification for the process-side repair of ventilated, atmospheric pressure, unlined concrete tanks for raw wastewater (RWW), screened raw sewage (SRS) or primary effluent (PE) applications, with process fluid operating parameters substantially within the following ranges:

Parameter	Average	Minimum	Maximum
Specific gravity	1.01	1.0	1.02
pH	7	6	8
Temperature (C)	16	10	24

- 1.1.2 This document may also be applied to tank-like concrete wastewater process structures with similar operating conditions, where heavy erosion is not a factor.
- 1.1.3 The scope of this specification is limited to surficial concrete repairs where the reinforcing steel is generally not exposed during the course of initial demolition and removal of deteriorated concrete. Should the Pre-Work Concrete Assessment described in Section 1.11 below indicate that the average depth of demolition exceeds 32 mm (1.25 in), the RDN’s Professional Engineer shall be engaged to assist in developing a repair plan.
- 1.1.4 The scope of this specification includes spot concrete repairs up to 50 mm (2 in) in thickness, in discrete areas up to 1 m² (10.8 ft²).
- 1.1.5 Where supplemental guidance is provided by the RDN’s Professional Engineer, this specification may be applied to concrete repairs where the average depth of demolition exceeds 32 mm (1.25 in) and the spot depth of demolition exceeds 50 mm (2 in).

1.2 Definitions

- 1.2.1 The “Applicator” shall mean the Contractor or sub-contractor actually completing the repair Work, including but not limited to application of the repair product(s).
- 1.2.2 The “Assessor” shall mean the qualified professional responsible for assessing the condition of the concrete in advance of the Work.
- 1.2.3 “Concrete repair thickness” shall mean the maximum total thickness of the concrete repair, including the host concrete surface preparation excavation depth, plus any

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extra corrosion allowance thickness, but not including any wastewater process-resistant top coating(s).

- 1.2.4 The “Contractor” shall mean the corporate entity taking overall responsibility for completion of the Work.
- 1.2.5 “Cove” shall mean a fillet or concave arch, formed at the angular (90 degree or otherwise) junction of a wall with a floor, a wall with a wall or a wall with a ceiling/tank top.
- 1.2.6 The “Designer” shall mean the engineer responsible for the detailed design of any concrete structures included in the Work;
- 1.2.7 The “Engineer” shall mean the RDN’s Professional Engineer, or other person assigned responsibility to directly manage, coordinate or monitor the Work on behalf of the RDN.
- 1.2.8 “High pressure water cleaning” (HP WC) shall mean water pressure washing performed at pressures from 34 MPa (5000 psi) to 70 MPa (10,000 psi) and intended to clean surface contaminants from sound concrete.
- 1.2.9 “High pressure water jetting” (HP WJ) shall mean erosive water jetting performed at pressures from 70 MPa (10,000 psi) to 210 MPa (30,000 psi) and intended to excavate unsound or chemically contaminated concrete.
- 1.2.10 “Low pressure water cleaning” (LP WC) shall mean water pressure washing performed at pressures up to 34 MPa (5000 psi) and intended to clean loose surface contaminants from sound, cured concrete, or remove laitance from green concrete.
- 1.2.11 The “Plant” shall mean the greater overall facility where the Work is being carried out, such as but not limited to a wastewater treatment center or pump station.
- 1.2.12 The “Owner” or “RDN” means the Regional District of Nanaimo.
- 1.2.13 “Ultra-high pressure water jetting” (HP WJ) shall mean erosive water jetting performed at pressures in excess of 210 MPa (30,000 psi) and intended to excavate unsound or chemically contaminated concrete.
- 1.2.14 The “Work” shall mean all Contractor and sub-contractor work, identified on the Drawings and other Contract Documents, to be completed as part of the identified RDN project.

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1.3 Scope of Work

- 1.3.1 Provide concrete tank rehabilitation work as indicated on the Drawings and/or in other Contract Documents. Unless noted otherwise, the scope of work includes all inside concrete faces of the tank(s) identified in the Contract Documents.
- 1.3.2 Coordinate and phase all work to maintain continuous operation of the Plant and complete the Work as per the RDN approved construction schedule.
- 1.3.3 Remove all defective and deteriorated concrete indicated on the Drawings and/or in other Contract Documents.
- 1.3.4 Complete crack repair as required within the areas of concrete rehabilitation in accordance with these specifications and crack repair material manufacturer's instructions.
- 1.3.5 Complete joint repair work in accordance with these specifications and the joint repair material manufacturer's instructions if within the Scope of Work.
- 1.3.6 Clean the concrete substrate sufficiently to remove deleterious contaminants as required by the specifications and the repair product manufacturer's instructions or recommendations. The higher or more stringent standard shall be used in case of a conflict between the documents.
- 1.3.7 Complete concrete repair in accordance with these specifications and the repair product manufacturer's instructions regarding surface preparation, application, inspection and requirements for safety.
- 1.3.8 Clean all construction debris from tank(s) and work area(s) before demobilizing from site, and dispose of same, in accordance with municipal, provincial and federal regulations.
- 1.3.9 Consult the Engineer for more specific, detailed repair instructions whenever the scope of repair exceeds that outlined in this specification.
- 1.3.10 Provide a Representative on site when work is ongoing to represent the Contractor and to have authority to receive and execute all instructions given by the Engineer.

1.4 References

The latest approved editions of the following codes and standards, as well as any codes and standards embedded within, shall apply to the Work, with specific interpretations and exceptions as noted in the following sections.

- 1.4.1 American Concrete Institute (ACI)

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- ACI 364.17T-18 (TechNote) – How to Measure pH of a Concrete Surface Prior to Installation of a Floor Covering
- ACI E706 RAP Bulletin 1 – *Structural Crack Repair by Epoxy Injection*
- ACI E706 RAP Bulletin 10 – *Leveling and Reprofiling of Vertical and Overhead Surfaces*

1.4.2 American Society for Testing and Materials (ASTM)

- ASTM C109/109M – *Standard Test Method for Compressive Strength of Hydraulic Cement Mortars*
- ASTM C1583 – *Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)*
- ASTM D4258 – *Standard Practice for Surface Cleaning Concrete for Coating*
- ASTM F21 - *Standard Test Method for Hydrophobic Surface Films by the Atomizer Test*

1.4.3 Association for Materials Protection and Performance (AAMP)

Note: AAMP is formerly Steel Structural Painting Council / Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) / NACE International, The Corrosion Society).

- AMPP SP21548 – *Pressurized Water Cleaning of Concrete and Cementitious Materials – Thorough Cleaning*
- NACE No. 6/SSPC-SP-13 – *Surface Preparation of Concrete*

1.4.4 Canadian Standards Association (CSA)

- CSA A23.2 – *Test Methods and Standard Practices for Concrete*

1.4.5 International Concrete Repair Institute (ICRI)

- 310.1R – *Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion*
- 310.2R – *Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair*
- 320.1R – *Guide for Selecting Application Methods for the Repair of Concrete Surfaces*
- 320.2R – *Guide for Selecting and Specifying Materials for Repair of Concrete Surfaces*

1.5 Submittals

1.5.1 Unless otherwise noted, issue submittals listed below to the Engineer for review/approval and/or receipt/record:

- If applicable, the concrete Assessor's statement of qualifications (for review);

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- Construction schedule, sufficiently detailed to outline all significant milestones, tasks and phases of the Work (for review/approval);
 - Procedures proposed for the accomplishment of the repair Work. Include a detailed description of the methods and equipment to be used for each operation, including diagrams and/or photos where sensible, and the sequence of operations to be coordinated with other works in progress (for review/approval);
 - A detailed project-specific Quality Control Plan (QCP), including an Inspection and Testing Plan (ITP) for the Work, with appropriate hold points (for review/approval). Refer to the quality assurance/control requirements in this specification outlined below. See Appendix A for example of an example of an ITP template;
 - Product data sheets, including performance criteria, surface preparation, ambient condition requirements and applications, curing requirements, volatile organic compound (VOC) data, and safety requirements, for all repair materials to be incorporated into the Work (for receipt/record);
 - A letter from the Manufacturer of the specified repair materials, on the manufacturer's letterhead, signed by an officer of the company, stating that the Contractor/applicator has been trained in the proper techniques for the preparation of the surface, and proper methods for mixing, placing, curing, and caring of the Manufacturer's products and that the Contractor/applicator is on the manufacturer's approved list of contractors (for receipt/record);
 - Safety Data Sheets (SDS) for any controlled materials brought on-site including all repair system materials, solvents and abrasive blast media (for receipt/record);
 - Upon completion of the Work, a comprehensive quality assurance and control package consisting of a cover page, the completed ITP, and copies of all supporting quality control record documents.
- 1.5.2 Make submittals with reasonable promptness and in an orderly sequence to avoid any delay in the Work. Failure to submit in ample time is not considered cause for an extension of Contract Time, and no claim for extension by reason of such default will be allowed. Allow three weeks for review and return, or acceptance, of each submittal.
- 1.5.3 Do not proceed with Work affected by submittals until review/approval is complete and/or receipt of record issues is acknowledged.
- 1.5.4 The submittal reviews do not authorize changes in cost or time. Changes involving cost or time are authorized only by a signed change order.

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1.6 Quality Assurance

- 1.6.1 Contractor shall prepare and submit for approval, well in advance of any field work, a detailed project-specific Quality Assurance Plan (QAP), including an Inspection and Testing Plan (ITP), indicating the quality control measures to be performed, the test methods used, frequency at which the testing will be performed, acceptance criteria and hold points. Refer to the quality assurance and control requirements in this specification for key points to cover in the QAP.
- 1.6.2 The Contractor shall coordinate and convene a Pre-Construction Meeting, a minimum of 4 weeks in advance of the site Work beginning, to review the work specifications and procedures and address any questions arising. The meeting shall be attended by the Engineer, any other representatives or agents of the RDN deemed necessary by the Engineer, the Contractor, any sub-contractors directly involved in the repairs and the concrete repair product material manufacturer's technical representative. The concrete Assessor may also attend the Pre-Construction Meeting if deemed necessary by the Engineer or the Contractor.
- 1.6.3 Contractor shall provide the services of a qualified repair product material manufacturer's technical representative to visit the site at the start of the Work. The technical representative shall witness application of each type of product used in the Work *for a minimum of four hours* and provide written certification that product materials are being stored, mixed and applied properly and surfaces to receive these products have been prepared properly, all in conformance with manufacturer's requirements.
- 1.6.4 Contractor shall provide any additional technical field support or training services required by the repair product material manufacturer(s) at no additional cost to the RDN.
- 1.6.5 Use only new repair product materials and use within the shelf-life limitations set forth by the product manufacturer. Clearly mark the shelf-life limitations of each container. Expired, or near-expired, repair products shall not be brought to site.
- 1.6.6 Comply with the repair product material manufacturer's recommendations as to environmental conditions under which materials can be stored, applied and cured.
- 1.6.7 Do not use materials where the environmental conditions of their storage history cannot be verified.
- 1.6.8 **Develop and employ a reliable system to assure the exact proportions of repair product ingredients are mixed together, as per manufacturer's directions. Such**

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system shall make use of clearly marked measuring containers or other means to allow easy verification of mixing proportions.

- 1.6.9 Do not apply materials when dust is being generated near the application area.
- 1.6.10 The Contractor is ultimately responsible for the concrete repair work. Inspections by the Engineer or Others do not limit the Contractor's responsibility.
- 1.6.11 Make all parts of the work accessible for inspections by the Engineer.
- 1.6.12 Correct any conditions not in conformance with the specifications at no additional cost to the Owner.
- 1.7 Quality Control – General
 - 1.7.1 Any nonconformance(s) in quality shall be immediately reported to the Engineer, who shall have complete authority to approve deviations and/or any proposed resolution(s) of the nonconformance(s).
- 1.8 Quality Control – By Contractor
 - 1.8.1 Contractor shall be responsible for rework and retesting, or remedial repairs as outlined in Section 1.9.3 below.
 - 1.8.2 Contractor shall arrange for and coordinate all required Engineer field inspections noted in Section 3.
 - 1.8.3 Contractor or Applicator shall perform and record the following quality control measures in this section, on a certificate(s) of a form acceptable to RDN. Unless otherwise specified, these measures shall be completed per repair patch area. See **Appendix A** for an example contractor quality control certificate.

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- 1.8.4 Verify concrete surface profile (CSP) of host concrete to receive repair products is between 3 and 10. Refer to ICRI 310.2R for reference.
- 1.8.5 Verify surface of host concrete to receive repair products has no visible dust. Refer to ASTM D4258 for reference.
- 1.8.6 Verify surface of host concrete to receive repair products has no visible surface contaminants (water droplets wet surface immediately, forming a continuous, uniform film). Refer to ASTM F21 for reference.
- 1.8.7 Verify concrete surface of substrate to receive cementitious repair products is in a saturated, surface dry (SSD) condition.
- 1.8.8 Verify the amounts of product and water mixed for each different phase of product application match that indicated on the product manufacturer's directions.
- 1.8.9 Verify thickness of resurfacing primer coat, using a thickness gauge, with RDN Engineer witness when requested. Refer to Section 3 for required primer coat thickness.
- 1.8.10 Verify thickness of resurfacing top coat, using a thickness gauge, with RDN Engineer witness when requested. Refer to Section 3 for required top coat thickness.
- 1.9 Quality Control – By RDN
 - 1.9.1 The Engineer shall complete field inspections as at critical milestones in the repair work, including after patch layout (prior to demo), post demolition, post substrate repair, and prior to protective coating application.
 - 1.9.2 Initial quality control testing for the Work, outlined below, shall be completed by firm(s) engaged directly by RDN and coordinated by the Contractor. The cost of any related rework and retesting, when required due to failed initial testing, shall be borne by the Contractor.
 - 1.9.3 All remedial repair work required as a result of the quality control testing in this section shall be performed by the Contractor.
 - 1.9.4 After host concrete demolition and prior to application of concrete repair and leveling product materials, the existing host concrete surface shall be “pull-off”/tensile tested to ASTM C1583 at a rate of one test for four patch locations, with test location(s) approved by the Engineer. Minimum tensile test value(s) shall be as indicated in Section 3 of this specification. Unless waived, in writing, by the Engineer, failure to achieve the required test value requires rework of the entire test area and completion of two additional retests. Contractor must allow 12 to 24 hours for completion of each tensile test, depending on ambient temperature.

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1.9.5 After host concrete demolition and prior to application of concrete repair and leveling product materials, the existing host concrete surface shall be pH tested to ACI 364.17T-18 at a rate of one test for four patch locations, with test location(s) approved by the Engineer. Minimum pH test value(s) shall be as indicated in Section 3 of this specification. Unless waived, in writing, by the Engineer, failure to achieve the required test value requires rework of the entire test area and completion of two additional retests. To provide interim qualitative host concrete pH guidance while awaiting lab pH testing results, the Engineer, or other firm engaged directly by the RDN, will spot test for pH using a phenolphthalein solution, as outlined in Appendix B. Unless directed otherwise by the Engineer, the ACI 364.17T-18 test results shall take precedence over the qualitative phenolphthalein test results.

1.9.6 Compressive testing of each type of concrete repair/cove product materials used in the Work shall completed according to the applicable references in this specification and as follows:

- At least three test samples will be taken a minimum of 8 days before any concrete repair/cove products are applied. These shall be tested for 7-day strength before the Work proceeds;
- At least three test samples will be taken daily throughout application of concrete repair/cove product materials;
- The test samples taken shall be tested at 3, 7 days and 28 days;
- The compressive test values achieved must meet or exceed the minimum compressive test values listed on the manufacturer's product data sheet;
- Where required, the compressive test values achieved shall also meet or exceed the minimum pre-commissioning test values specified by the Designer;
- Note that compressive testing of concrete resurfacing product materials is not required.

1.9.7 Refer to ICRI 310.2R Appendix A for additional guidance on quality control testing for Work completed under this specification.

1.9.8 Where sufficient cure time for repair product materials is provided by RDN and access to test area is possible, perform finished repair surface adhesion (tensile) testing to ASTM C1583, with due consideration to time required for application and cure of test area repairs.

1.10 Delivery, Storage and Handling

1.10.1 Provide shelter to store materials in area or areas approved by the Owner solely for this purpose. This area must be above ground and have controlled humidity and temperature as specified by the manufacturer(s) of these materials. Confine mixing,

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thinning, clean-up and associated operations and storage of debris, before authorized disposal, to these areas.

1.10.2 Confine mixing, thinning, clean-up and associated operations to designated areas on the site which are in close proximity to the repair locations. Mix all repair product materials in the sheltered mixing area, away from direct sunlight and inclement weather.

1.10.3 Do not dispose of waste materials on-site. Store waste temporarily, in a location approved by the Engineer, in closed, nonflammable containers until final disposal. Keep no garbage in Contractor's area longer than 24 hours.

1.10.4 Deliver all materials to the job site in new, unopened containers. Each container shall bear the manufacturer's name and label. Labels on all material containers shall contain the following information:

- Name of product;
- Federal Specification Number, if applicable;
- SDS information;
- Manufacturer's batch number;
- Manufacturer's name;
- Generic type of material;
- Hazardous material identification label, if applicable;
- Shelf-life date

1.10.5 Handle and store materials to prevent damage or loss of label. Protection of materials is the Contractor's responsibility.

1.11 Pre-Work Concrete Assessment

1.11.1 Well in advance of the concrete repair execution, an assessment of the tank(s) to be repaired shall be completed. When not completed in advance by RDN, the assessment shall be completed by the Contractor, as part of the Work.

1.11.2 The initial concrete assessment shall be performed by a Professional Engineer, registered in the Province of BC, or other Professional, qualified in concrete assessment by a combination of experience and training. When the assessment is not performed by a Professional Engineer, the Assessor's statement of qualifications must be submitted to the Engineer for approval before the assessment is initiated.

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1.11.3 The scope of the pre-work concrete assessment shall be determined by the Assessor, in consultation with the Engineer.

1.11.4 The assessment, and resulting report, may include, but shall not be limited to, the following:

- Visual inspection;
- Sounding (hammer testing);
- Compressive strength core testing;
- Tensile strength (pull-off) testing;
- Hardness testing;
- Depth of neutralization testing;
- Sulphate contamination testing;
- Chloride contamination testing;
- Carbonation testing;
- Petrography;
- Photographs, sketches and maps related to the above

1.11.5 Should the initial concrete assessment reveal significant concrete deterioration that is threatening the current operability of the tank, or could threaten the structural integrity of the tank during the repair process, a structural Professional Engineer, registered in the Province of BC, shall be engaged to complete an additional assessment, including development of a comprehensive response/repair plan.

2 Repair Products

2.1 General

2.1.1 This specification relies on premixed (bagged) concrete repair product materials for quality assurance purposes.

2.1.2 Any changes to the repair product materials outlined in this specification must be approved in writing by the Engineer.

2.2 Water

2.2.1 The water used for mixing concrete repair products shall be clear, potable and free of deleterious substances.

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2.3 Crack Repair

- 2.3.1 Wet or actively leaking cracks within the Scope of Work shall be repaired using low viscosity epoxy or polyurethane injection grout, or other product(s); product(s) to be approved by the Engineer.
- 2.3.2 Polyurethane injection grout should be considered where active leaking with substantial flow is encountered.
- 2.3.3 Where required, dry crack pretreatment shall be completed using a scrub coat of Gemite Cem-Kote Barrier Coat 100 followed by filling with Gemite Fibre-Patch OV, W.R. Meadows Meadow-Crete OV or Target Vertical Overhead (V/O) Structural Repair Mortar.

2.4 Discrete Leak or Weeping Surface Moisture Control

- 2.4.1 Any discrete active water leaks or weeping surfaces must be controlled by the application of W.R. Meadows Meadow-Plug, or equivalent product(s) approved by the Engineer.
- 2.4.2 Unless approved by the Engineer, crystalline products shall not be used to control water leaks due to potential interference with bond of other concrete repair, leveling and lining products prescribed in this specification.

2.5 Joint Sealant Repair

- 2.5.1 Concrete construction/expansion joints shall be repaired using Sika Sikaflex 2C/NS for vertical joints and Sika Sikaflex 2C/SL for horizontal joints, or equivalent products approved by the Engineer.
- 2.5.2 Joint sealant shall be backed by PVC, polyurethane or polyethylene foam rope joint filler (backing rod); product to be approved by the Engineer.
- 2.5.3 Underwater concrete joint surfaces shall be primed in advance of joint sealant application, using Sika Sikaflex-429 primer, or equivalent product approved by the Engineer.

2.6 Reinforcing Steel Coating

- 2.6.1 Reinforcing steel (rebar) inadvertently exposed during the Work shall be coated with W.R. Meadows Patch-Prime, or equivalent product approved by the Engineer.

2.7 Small Form and Pour Concrete Repairs or Additions

- 2.7.1 Where not specified in the Contract Documents, or by the Designer, small form and pour concrete repairs or additions shall be completed using Target Flowcrete.

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2.8 Surficial Concrete Repair and Leveling – Horizontal Surfaces

- 2.8.1 General concrete leveling thickness < 6 mm (0.25 in): Gemite Gem-Plast TC (premix)
- 2.8.2 General concrete repair thickness > 6 mm (0.25 in) and < 32 mm (1.25 in): Gemite Fibre-Patch ST or OV, W.R. Meadows Meadow-Crete H or OV, or Target Vertical Overhead (V/O) Structural Repair Mortar
- 2.8.3 Localized concrete repair thickness < 50 mm (2.0 in): Gemite Fibre-Patch ST or OV, W.R. Meadows Meadow-Crete H or OV, or Target Vertical Overhead (V/O) Structural Repair Mortar

2.9 Surficial Concrete Repair and Leveling – Vertical/Overhead Surfaces

- 2.9.1 General concrete leveling thickness < 6 mm (0.25 in): Gemite Gem-Plast TC (premix)
- 2.9.2 General concrete repair thickness > 6 mm (0.25 in) and < 32 mm (1.25 in): Gemite Fibre-Patch OV, W.R. Meadows Meadow-Crete OV, or Target Vertical Overhead (V/O) Structural Repair Mortar
- 2.9.3 Localized concrete repair thickness > 12 mm (0.5 in) and < 50 mm (2.0 in): Gemite Fibre-Patch OV or W.R. Meadows Meadow-Crete OV

2.10 Inside Corner Coves

- 2.10.1 Cove base: Gemite Fibre-Patch OV, W.R. Meadows Meadow-Crete OV or Target Vertical Overhead (V/O) Structural Repair Mortar
- 2.10.2 Primer coat 1: Gemite Cem-Kote Barrier Coat 100
- 2.10.3 Surface reinforcement: Gemite Reinforcing Fabric HD
- 2.10.4 Primer coat 2: Gemite Cem-Kote Barrier Coat 100

2.11 Concrete Resurfacing – All Positions

- 2.11.1 Primer coat: Gemite Cem-Kote Barrier Coat 100
- 2.11.2 Surface reinforcement (only where specified on the Drawings or other Contract Documents): Gemite Reinforcing Fabric HD
- 2.11.3 Top coat: Gemite Cem-Kote Flex CR

3 Repair Execution

3.1 Safety

- 3.1.1 Contractor shall meet all requirements for the BC Occupational Health and Safety Regulation related to performance of the Work.

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- 3.1.2 The Contractor shall be responsible for all aspects of confined space entry safety permitting and procedures for tank entry, except for pre-Work cleaning and equipment lockout, which will be provided by RDN.
- 3.1.3 Contractor shall pay special attention to the control of airborne crystalline silica and ensure no contract workers or Plant personnel are exposed to levels exceeding the BC Occupational Health and Safety Regulation.
- 3.1.4 The Contractor shall pay special attention to and employ industry best practices for high-pressure water jetting to meet or exceed the BC Occupational Health and Safety Regulations.

3.2 General

- 3.2.1 Create sufficient measurement datum points in and/or around the tank to facilitate the accurate recreation of the original tank inside dimensions and features, within a total point to point dimensional tolerance of 6 mm (0.25 in), or an absolute location tolerance of +/- 3 mm (0.125 in).
- 3.2.2 Employ formwork or other means to recreate critical hard faces, columns, corbels, edges, joints, slots or other features required to mate to equipment, ports, troughs, gates or other structural or mechanical items and in general maintain design functionality of the tank.
- 3.2.3 Coordinate concrete rehabilitation work with other work being performed.
- 3.2.4 Perform exterior work during dry weather OR protect unfinished work during inclement weather with tarpaulins or heavy gauge polyethylene sheeting.
- 3.2.5 Comply with the repair product material manufacturer's recommendations as to environmental conditions under which repair product materials can be applied and cured. In general, ensure the ambient temperature is higher than 5 C and lower than 25 C for best results. See sections below and product manufacturer's data sheets for additional detailed instructions.
- 3.2.6 Unless otherwise recommended by the repair product material manufacturer's technical representative, and approved in writing by the Engineer, comply precisely with the repair product material manufacturer's mixing instructions.
- 3.2.7 Apply cementitious repair product materials only to host concrete in a *saturated, surface dry* (SSD = damp) condition, to ensure a strong bond with the host concrete. Use garden sprinkler(s) or other means to soak host concrete with clean water overnight in advance of repair product material application. Use garden sprayers

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filled with clean water or other means to ensure repair surface remains in SSD condition throughout the repair product material application.

- 3.2.8 Do not apply repair product materials when dust is being generated.
- 3.2.9 Where damage from ongoing construction is possible, cover or otherwise protect finished work or other surfaces not being repaired. Protect other RDN mechanisms or appurtenances from contamination with concrete, grout, or demolition activities.
- 3.2.10 Clean surfaces thoroughly of efflorescence, oils, grease and other deleterious material in area to be repaired in accordance with the repair product material manufacturer's recommendations.
- 3.2.11 Cure repair product materials according to manufacturer's instructions. *Note that some products in this specification require a wet cure, some require drying/evaporation protection and some require a dry cure.*
- 3.2.12 Any changes to the repair work requirements or execution methods outlined in this specification must be approved in writing by the Engineer.

3.3 Demolition and Removal of Deteriorated Concrete

- 3.3.1 Deteriorated concrete shall be demolished and removed from the existing surface of the concrete to be repaired using high-pressure water jetting (HP WJ), or a combination of high-pressure water jetting and mechanical chipping or scaling/scabbling. Where mechanical demolition is employed, Contractor shall take special precautions to control airborne crystalline silica.
- 3.3.2 When the depth of demolition is not specified in the procurement or Contract Documents, the demolition method parameters shall be set to achieve the following surface preparation objectives (next page):

Property	Test Method	Test Value
Surface tensile strength (MPa/psi)	ASTM C1583	1.7/250 minimum*
Surface profile (CSP)	ICRI 310.2R	3 to 10
Surface cleanliness	ASTM D4258	No significant dust
Residual surface contaminants	ASTM F21	Water droplets wet surface immediately, forming a continuous, uniform film
pH	ACI 364.17T-18	> 10**

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Moisture content immediately before application of repair product	Visual	Saturated, surface dry (SSD)
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* Continue to excavate deteriorated concrete until the minimum test value is achieved.

** A minimum pH of 9 is acceptable, with written approval from the Engineer.

The frequency of the above testing shall be as outlined in Sections 1.8 and 1.9 above.

- 3.3.3 Any existing concrete aggregate exposed during demolition shall be chipped off if protruding more than 6 mm (0.25 in) from the prepared surface. Loose or disbonded aggregate shall be fully removed.
- 3.3.4 Arrange for the Engineer to inspect the host concrete after demolition and removal of the deteriorated concrete and before proceeding to apply repair products.
- 3.3.5 *Uncorroded* reinforcing steel partially (less than 50%) exposed during demolition shall be immediately coated with primer as indicated in Section 3.7 below and the Engineer shall be immediately advised that reinforcing steel has been exposed, along with the location. Refer to ICRI guide 310.1R for additional guidance on concrete surface preparation when reinforcing steel is exposed.
- 3.3.6 Should local demolition depth/concrete repair depth exceed 50 mm (2.0 in) or should demolition expose discrete area(s) of *corroded* reinforcing steel larger than 1 m² (10.8 ft²), stop work and immediately consult the Engineer for repair instructions, unless otherwise specified in the contract documents.
- 3.3.7 Should demolition expose discrete area(s) of corroded reinforcing steel smaller than 1 m² (10.8 ft²), notify Engineer and proceed with concrete repair as outlined in Sections 3.8 and 3.9 below.
- 3.3.8 Ensure that none of the demolition debris enters the tank drainage system or any other piping within the structure.
- 3.3.9 Demolition debris shall be removed from the site, and properly disposed of, at the expense of the Contractor.
- 3.4 Discrete Leak or Weeping Moisture Control
 - 3.4.1 After demolition of deteriorated concrete and before application of any new repair product materials, any discrete, active water leaks or weeping not resolvable with crack resin/grout injection must be controlled.
 - 3.4.2 Apply the approved moisture control product(s) in accordance with product manufacturer's directions.
 - 3.4.3 Confirm water flow is stopped for at least 1 day.

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- 3.4.4 Arrange for the Engineer to inspect the repaired leak before concrete repair, leveling and resurfacing are executed.

3.5 Crack Repair – Wet/Actively Leaking

- 3.5.1 Repair of wet or actively leaking cracks shall be executed using low viscosity epoxy or polyurethane grout injection, or other method approved by the Engineer, to resolve leaks, before proceeding with concrete repair, leveling and resurfacing.
- 3.5.2 Low viscosity epoxy or polyurethane grout injection repair of cracks shall only be completed by technicians with training and significant field experience.
- 3.5.3 Carefully choose the injection product to be applied, with confirmation based on field assessment of the crack(s) to be filled, immediately in advance of the Work, and approval of the Engineer. Refer to Section 2.3 for commentary on product choice.
- 3.5.4 Complete crack repair after high-pressure water jetting demolition of surrounding deteriorated concrete.
- 3.5.5 Clean out the crack using low pressure water cleaning (LP WC) and then blow excess moisture out the crack with clean, compressed air (wherever there are no active leaks).
- 3.5.6 Install surface mounted or socket mounted injection ports, spaced at approximately 200 mm (8”), or as determined by field conditions.
- 3.5.7 Install cap seal over crack and ports and wait for seal to fully cure.
- 3.5.8 Inject the low viscosity or polyurethane grout, starting at the widest section of a horizontal crack or the bottom of a vertical crack. Continue the injection until refusal and/or an adjacent port begins to bleed clean resin/grout (milky resin/grout indicates water contamination). When bleeding is clean, close injection port and move to the next injection port, repeating the procedure until the crack is fully repaired.
- 3.5.9 Once the injection resin/grout is cured, completely remove the ports and all of the cap seal by chipping and grinding.
- 3.5.10 Confirm water flow is stopped for at least 1 day.
- 3.5.11 Arrange for the Engineer to inspect the repaired crack before concrete repair, leveling and resurfacing are executed.

3.6 Crack Repair – Dry/Not Leaking

- 3.6.1 Dry cracks less than 0.5 mm (0.02 in) wide require no pretreatment before leveling and resurfacing are executed.

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- 3.6.2 Dry cracks greater than 0.5 mm (0.02 in) wide must be pretreated, as outlined below in this section, before leveling and resurfacing are executed.
- 3.6.3 Pretreat crack by saw-cutting and chipping a 38 mm (1.5 in) wide X 25 mm (1 in) deep slot over the crack.
- 3.6.4 Clean out the slot using low pressure water cleaning (LP WC) and then dry the crack with clean, compressed air.
- 3.6.5 Prime the slot with a scrub coat of Cem-Kote Barrier Coat 100 and allow to set for 10 to 15 minutes.
- 3.6.6 Before the primer is dry, fill the slot with one of the specified dry crack repair products.
- 3.6.7 Arrange for the Engineer to inspect the pretreated crack before concrete leveling and resurfacing are executed.
- 3.6.8 Level and resurface the cracked area as outlined in Section 3.10 below.

3.7 Joint Sealant Removal

- 3.7.1 Fully remove all existing joint sealant and foam rope joint filler (backing rod), using mechanical means, before execution of concrete repair, leveling and resurfacing.

3.8 Reinforcing Steel Primer Coating

- 3.8.1 Reinforcing steel (rebar) inadvertently exposed during the Work shall be cleaned by high-pressure water jetting or sandblasting to remove rust and contaminants, *followed by immediate application* of the specified primer, to avoid flash rust and ensure a secure bond to later applied concrete repair products.
- 3.8.2 Apply specified reinforcing steel primer in accordance with product manufacturer's directions.

3.9 Concrete Repair – Reinforcing Steel Locally Exposed

- 3.9.1 When surface preparation unexpectedly exposes a localized, discrete area of corroded reinforcing steel less than 1 m² (10.8 ft²), the repair area must be configured and reinforcing steel must be exposed, cleaned and/or repaired as outlined in ICRI guide 310.1R.
- 3.9.2 Exposed reinforcing steel in any discrete area(s) must be coated with the specified primer immediately following cleaning, to avoid flash rust and ensure a secure bond to later applied concrete repair products.
- 3.9.3 Spray host concrete in discrete repair area(s) with clean water to maintain a SSD condition throughout application of cementitious concrete repair product materials.

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- 3.9.4 Arrange for the Engineer to inspect the localized, discrete repair area(s) before repair products are applied.
- 3.9.5 If any concrete joint slots are substantially destroyed during demolition of deteriorated concrete, rebuild these joint slots during the repair steps in Section 3.10 below.
- 3.9.6 Apply specified repair product as applicable to localized, discrete area(s) with concrete repair thickness greater than 6 mm (0.25 in), in single or multiple lifts, in accordance with product manufacturer's directions, up to the discrete repair area perimeter inside edge.
- 3.9.7 Arrange for the Engineer to inspect the localized, discrete repair area(s) after repair products are applied.
- 3.9.8 Cure repaired area(s) for 24 hours, according to product manufacturer's directions, and then clean off laitance with low pressure water cleaning (LP WC).
- 3.10 Concrete Repair, Leveling and Resurfacing – Reinforcing Steel Not Exposed
 - 3.10.1 Spray host concrete in discrete repair area(s) with clean water to maintain a SSD condition throughout application of cementitious concrete repair product materials.
 - 3.10.2 Arrange for the Engineer to inspect the repair area(s) before repair products are applied.
 - 3.10.3 If any concrete joint slots are substantially destroyed during demolition of deteriorated concrete, rebuild these joint slots during the repair steps below.
 - 3.10.4 Apply specified repair product(s) as applicable, in single or multiple lifts, in accordance with product manufacturer's directions.
 - 3.10.5 Arrange for the Engineer to inspect the repaired/leveled concrete surfaces.
 - 3.10.6 Cure repaired area(s) for 24 hours, according to product manufacturer's directions, and then clean off laitance with low pressure water cleaning (LP WC).
 - 3.10.7 Arrange for the Engineer to inspect the repaired concrete surfaces before coves are installed over inside corners.
 - 3.10.8 Cut in a 3 mm (0.12 in) X 3 mm (0.12 in) reglet at the termination line of all areas to be resurfaced. Resurfacing products to be run up and into reglet, during application below, to anchor free edge.
 - 3.10.9 Install 50 mm X 50 mm coves over SSD inside concrete corners, using specified repair product.

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- 3.10.10 Once cove is firm, prime cove and adjacent concrete area about 13 cm (5.25”) on either side of cove with a 1 mm (0.04 in) thickness of concrete resurfacing primer. Cover with 25 cm (10.0”) wide Reinforcing Fabric HD, centered on cove, and then saturate the fabric with another thin layer of primer.
- 3.10.11 Provided time allows, immediately proceed to coat all adjacent flat, SSD concrete surfaces with a 1 mm (0.04 in) thickness of concrete resurfacing primer.
- 3.10.12 Only over previously identified/marked and dry/unrepaired cracks (for tensile reinforcement) and/or where specified on the Drawings or other Contract Documents (as protection from light hydraulic erosion or more significant corrosion): Cover first coat of concrete resurfacing primer on flat surfaces adjacent to any coves with one layer of Reinforcing Fabric HD and then saturate the fabric with another thin layer of primer. Fabric overlap for cracks shall be 125 mm (5 in) either side of crack.
- 3.10.13 Allow primer coat to firm up for about 10 – 15 minutes before proceeding with the final resurfacing product application in step below. If final resurfacing product application cannot be completed while the primer is still wet-green, then air dry the primer overnight, protected from wind, sun and rain, and clean off laitance next day with low pressure water cleaning (LP WC) before proceeding with the final resurfacing product application.
- 3.10.14 Apply final 1.6 mm (0.06 in) to 2 mm (0.08 in) thick layer of concrete resurfacing top coat to wet-green or SSD primer previously applied. Arrange for the Engineer to witness periodic product thickness checks performed and recorded by Applicator.
- 3.10.15 Arrange for the Engineer to inspect the final, completed concrete resurfacing top coat immediately after application.
- 3.10.16 Air dry final concrete resurfacing top coat for a minimum of three days, protected from wind, sun and rain, before returning to service.
- 3.10.17 Where the RDN schedule provides sufficient cure time before return to service, and access to test area is possible, perform repair surface adhesion testing as outlined in Section 1.7.

3.11 Joint Sealant Replacement

- 3.11.1 Execute concrete joint sealant replacement after all other concrete repair, leveling and resurfacing is complete.
- 3.11.2 Wire wheel scrub joint concrete to remove any surface contamination, such as laitance, oils, tar, asphalt, bitumen, grease, paints, coatings, sealers, curing

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compound residues, and any other foreign matter that might prevent sealant adhesion, and clean out joint using HEPA vacuum.

- 3.11.3 Arrange for the Engineer to inspect the cleaned joint before application of joint sealant primer and joint sealant.
- 3.11.4 Apply concrete joint sealant primer to inside surfaces of underwater joints.
- 3.11.5 Install foam rope joint filler, same distance below concrete surface as joint width.
- 3.11.6 Install specified sealant in joint in accordance with product manufacturer's directions, ensuring sealant mates with adjacent concrete resurfacing products.
- 3.11.7 Clean any excess sealant off adjacent exterior faces of concrete joint.
- 3.11.8 Arrange for the Engineer to inspect the repaired joints.

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APPENDIX A – QUALITY CONTROL CERTIFICATE TEMPLATES

Nanaimo Pollution Control Center - Sedimentation Tank 2 Repair Grout Removal & Concrete Substrate Surface Preparation - Rev 02

Repair Location Number:	
Repair Area (sq. m.):	
Date Work Commenced:	
Date Work Completed:	

owner/contractor/sub signoffs

Existing Grout / Concrete Demolition

Existing grout was removed to original concrete substrate. Substrate was cleaned by pressure washing and further removal of any remaining areas of grout was completed by bush hammering.

Any damage to the original perimeter sawcut caused by grout removal was corrected by re-cutting and chipping.

Concrete substrate was cleaned and prepared by 5000 psi pressure washing to remove all bruised material from concrete surface.

Repair areas were reviewed to confirm minimum depths and correct geometry in accordance with the project specifications and ICRI Technical Bulletin 310.1R

Concrete substrate was reviewed to confirm minimum concrete surface profile between CSP3 and CSP10 and that there are no aggregate particles protruding beyond 6mm.

Concrete substrate was checked for cracks and weeping areas. Non-leaking cracks over 0.5mm, leaking cracks and areas where weeping is occurring were recorded for repair.

Concrete substrate was reviewed and checked for pH by phenolphthalein solution spot checks.

Bond verification testing was completed on the concrete substrate at a frequency of 1 test per 10 sq.m. of repair to confirm minimum 1.7MPa requirement.

Hold Point - RDN Engineer review and Contractor QC to complete QC Testing and QC review of concrete removal and substrate condition.

Areas requiring concrete removal in excess of the established concrete removal limits (32mm along bottom 405mm of east and west tank walls and 50mm everywhere else) was reported for RDN review.

Areas where "uncorroded" partially exposed (less than 50%) rebar was found in an area larger than 1 sq. m. was reported to RDN for review.

Areas where "uncorroded" fully exposed (greater than 50%) rebar was found was reported to RDN for review.

Areas where "corroded" rebar was found in an area greater than 1 sq.m. with repair depths in excess of the established concrete removal limits (32mm and 50mm) was reported to RDN for review.

Areas where "corroded" rebar was found in an area less than 1 sq.m. with repair depths in excess of the established concrete removal limits (32mm and 50mm) was reported to RDN for review.

Hold Point - RDN to provide direction for areas where repair depths are to exceed the previously established concrete removal limits due to required demolition or exposed rebar.

Additional Concrete Removal and Rebar Augmentation

	MCR QC Reviewer / Date	TGL QC Reviewer / Date	RDN Reviewer / Date	Prod. Man. Reviewer / Date
Hold Point - Structural review was completed and approval to remove concrete in excess of the established removal limits at select areas was provided by RDN.				
Any required engineered bracing or shoring was installed and inspected prior to removing concrete beyond the established removal limits.				
Undercutting fully exposed and "corroded" rebar was completed in accordance with projects requirements and ICRI Guidelines for repair geometry and concrete removal around rebar.				
A review of the exposed rebar for damage or section loss due to corrosion was completed and reported to RDN.				
Additional rebar was added to the repair area as directed by RDN's structural review.				
Corrosion material was removed from exposed rebar by wet-grit blasting, concrete substrate was cleaned by 5000psi pressure washing and, corrosion inhibiting primer was applied to exposed rebar.				
Hold Point - RDN to review concrete removal at exposed rebar locations and completed rebar augmentation prior to repair material reinstatement.				

Dry / Leaking Cracks and Weeping Areas

	MCR QC Reviewer / Date	TGL QC Reviewer / Date	RDN Reviewer / Date	Prod. Man. Reviewer / Date
Dry / non-leaking cracks wider than 0.5mm found within the repair area were sawcut and chipped to create a slot over the crack 1.5" wide by 1" deep. Slot was cleaned by 5000psi pressure washing.				
Hold Point - RDN to review slot prior to repair material reinstatement.				
Slots over cracks were brought to an SSD condition prior to filling with repair mortar. Water based curing compound was immediately applied over repair mortar.				
Leaking cracks were sealed by polyurethane injection. Sealed cracks were monitored for 24 hours to confirm leaks were mitigated.				
Weeping areas of concrete substrate were sealed by application of fast-setting hydraulic cement. Sealed areas were monitored for 24 hours to confirm weeping areas were mitigated.				
Hold Point - RDN to review repaired leaking cracks and weeping areas.				
Hold Point - Final review of repair areas preparation to be completed by Contractor QC and RDN Engineer. Repair Product Manufacture Representative to review concrete removal and substrate preparation on first areas of product placement.				

Notes:

Grout Manufacturer was on site to witness and review the concrete surface preparation on:

Mock-up Test Date: _____

First Installation Date: _____

Supervisor:

Per:

Project Manager:

Per:

Nanaimo Pollution Control Center - Sedimentation Tank 2 Grout Replacement using Sika Monotop 410F - Rev 01

Repair Location Number:	
Repair Area (sq. m.):	
Date Work Commenced:	
Date Work Completed:	

Grout Replacement - Form and Pour using Sika Monotop 410F

Hold Point - Prior to repair material placement, RDN, Contractor QC and Product Manufacturer has reviewed concrete substrate.

Final clean of prepared concrete substrate was completed by 5000 psi pressure washing.

Repair location was brought to an SSD condition by soaking overnight.

Concrete substrate and ambient temperatures were confirmed to be 5 deg. C. or higher.

Tarp enclosures were setup as required to protect the repair locations from rain and direct sunlight. Heaters were setup as required to maintain minimum 5 deg C ambient conditions at the repair locations for minimum of 7 days.

Repair area was continuously wetted to ensure concrete surface was maintained at an SSD condition from overnight soaking until repair material application.

Hold Point - RDN Engineer and Contractor's QC reviewed the concrete substrate preparation and condition (SSD)

Hold Point - Product manufacturer is on site to review the repair material installation of the first completed repair locations and confirm repair contractor qualifications. Manufacturer to review conditions of repair material stored on site.

Repair mortar was pretested to confirm compressive strength compliance with the manufacture product data sheet for each production date used.

Bags of repair mortar were stored in a dry condition and pre-conditioned to a temperature above 18 deg. C.

Repair mortar used did not exceed shelf life (1 year from date of production).

Repair mortar production number for each bag of material mixed was recorded. See notes below.

Mixing water was measured for each batch and was maintained below 2.7 litres per bag.

Repair material was mixed to a uniform consistency, scrub coat was applied to the conditioned concrete substrate surface. Mixing did not exceed 3 minutes.

Repair material was placed in the repair areas by trowel application forcing the material in the edges working to the center. Single layer of repair material did not exceed 100 mm thickness.

Excess repair material was struck off, troweled and broom finished. Repair surface finish tolerance of +/- 3 mm was checked and confirmed.

Repair material was applied before scrub coat had setup. Entire material application in the repair area was completed within 2-3 hours.

Water-based curing compound was applied to the finished repair material surface.

Contractor's QC was on site to sample the repair mortar for QC Testing and record repair material placement information. Testing for compressive strength at 3, 7 and 28 day - one set of tests for every 10 sq.m. of repair.

Repair material was allowed to cure for a minimum 7 days at an ambient temperature > 5 deg. C.

Repair material surface abrasive blasting was completed after 7 days to achieve a CSP 4 surface profile and remove water-based curing compound.

Hold Point - RDN Engineer and Contractor QC to completed a review of the completed repair material installation and surface profiling prior to Gemite coating application. Repair material manufacturer to review completed repairs on first application area.

Hold Point - Representative from the coating manufacturer to completed a review of the completed repair material surface profiling of the first repair locations prior to Gemite coating application.

Supervisor:

Per:

Project Manager:

Per:

Nanaimo Pollution Control Center - Grit & Sedimentation Tank Refit (2026)		
Installation Location:	P1	owner/contractor/sub signoffs
Length / Area:	1.4	
Date Work Commenced:	2026-3-8	
Date Work Completed:		
Leveling Repair Mortar Surface Preparation and Resurfacing		
3mm x 3mm reglets were cut in the leveling repair mortar for each repair location.	AA	
50mm coverings were installed using cementitious repair mortar at all inside corners.	AA	
Any pin hole or bug hole on the repair material surface was filled with GEM PLAST TC and wet cured over night.	AA	
Leveling repair mortar surface was cleaned by 5000 psi pressure washing and brought to a SSD Condition by minimum 2 hours prior to installation	AA	
Project Engineer and Contractor QC reviewed the prepared repair mortar surface prior to resurfacing material application.	AA	
Product manufacturer WR Meadows representative reviewed the prepared surface and witnessed the start of the resurfacing material application.	AA	
Substrate and ambient temperatures were confirmed to be 4 deg. C. or higher. Protection was setup as required to protect the repair locations from rain and direct sunlight.	AA	
Areas where coving was installed and cracks had been previously identified, had a 10" strip of Fabric HD applied centered over the coving / crack using Cem-Kote Barrier Cote 100 (primer).	AA	
The first layer of Cem-Kote Barrier Cote 100 was mixed and applied to the prepared leveling repair mortar surface with a minimum thickness of 1 mm, in accordance with the manufacturer's requirements and the submitted installation procedure. After application, the surface was broomed to remove any pinhole.	AA	
Fabric HD was applied immediately over the wet BC100, making sure the fabric had no wrinkles and was tight against the waterproofing. If more than one piece of fabric was needed to cover the repair area, a 1-inch overlap was provided between the fabric pieces.	AA	
Additional BC100 was applied immediately over the fabric, ensuring that most of the fabric was embedded in the waterproofing material. The applied waterproofing material was then broomed to remove any pinholes.	AA	
The amount of BC100 applied to the repair locations was checked to confirm that there was adequate coverage to meet the minimum thickness requirement of 1.6 mm.	AA	
The top coat Cem-Kote Flex CR was mixed and applied to the stiffened, primed surface on the same day, using two application coats to achieve a minimum thickness of 1.6 mm, in accordance with the manufacturer's requirements and the submitted installation procedure	AA	
The top coat application was not applied on the same day as the primer, and the primer coat was allowed to cure for 1-2 days.	AA	
Primer coat was cleaned by pressure washing and allowed to dry before applying top coat material.	AA	
Primed substrate and ambient temperatures were confirmed to be 4 deg. C. or higher. Protection was setup as required to protect the repair locations from rain and direct sunlight.		
Top coat Cem-Kote Flex CR was mixed & applied to the cleaned primed surface utilizing two application coats to achieve a minimum thickness of 1.6 mm, in accordance with the product manufacturers requirements and the submitted installation procedure.		
Top coat was cured for 1-2 days before completing thickness checks. Thickness was confirmed to meet or exceed the minimum 1.6 mm requirement.		
Project Engineer and Contractors QC reviewed the completed resurfacing material application.	AA	
Product manufacturer WR Meadows representative reviewed the resurfacing material application.		
Bond Testing of the applied resurfacing material was completed, minimum cure time permitting.		
Notes:		

Supervisor:

Project Manager:

Per:

Per:

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APPENDIX B – CONCRETE pH TESTING USING PHENOLPHTHALEIN

The pH of new concrete is typically around 13. This high pH maintains the reinforcing steel in a passive state with respect to corrosion. As concrete ages, a natural process of carbonation takes place, where the concrete reacts with ambient carbon dioxide, slowly reducing the pH. Once the pH is reduced to a threshold value of around 9, the reinforcing steel is no longer passive and may begin to corrode, especially in the presence of chlorides or other chemicals. For concrete restoration to be successful, all concrete with a pH of less than 9, and preferably less than 10, must be removed and replaced with new concrete.

To test for depth of carbonation or other chemically induced pH reducing damage into a concrete structure, a solution of phenolphthalein indicator may be applied directly to the concrete. Phenolphthalein solution remains crystal clear below a pH of 8.3. However, above this value, it begins to change colour. Concrete with a pH greater than around 9 turns light pink when the test solution is applied. Concrete with a pH of 10 turns bright magenta when the test solution is applied.

The test solution comprises 1 gram of phenolphthalein powder dissolved in a solution of 70 ml ethanol and 30 ml of deionized water. This yields a 1% solution of phenolphthalein (solutions down to 0.2% are reported to perform acceptably). A small spray bottle may be used for application.

Note:

- The above test solution is flammable.
- For use in spot pH testing only (do not apply broadly to large surface areas).
- Phenolphthalein is a controlled product with special handling and use requirements, including personal protective equipment. Refer to the current product Safety Data Sheet for additional information.
- All containers of test solution must be clearly labelled as per Canadian WHMIS regulations.
- Phenolphthalein solution will turn clear again once pH exceeds around 12, so this indicator is not applicable for use on new, or recently cast concrete.