

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 03 72 50 – Pressure Grouting Repairs.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA O121-2008, Douglas Fir Plywood.
 - .3 CSA O151-09, Canadian Softwood Plywood.
 - .4 CSA O153-M1980(R2008), Poplar Plywood.
 - .5 CSA-O325-07, Construction Sheathing.
 - .6 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .7 CSA-O86-09, Engineering Design in Wood.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada

1.3 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA-O153.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .3 Form release agent: non-toxic, biodegradable, low VOC.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.

- .5 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Fabricate and erect falsework in accordance with CSA S269.1.
- .2 Refer to drawings for concrete members requiring architectural exposed finishes.
- .3 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .4 Align form joints and make watertight. Keep form joints to minimum.
- .5 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .6 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .7 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .8 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 Structural slab repairs: Three (3) days or the time it takes to reach 70% of the 28 day design strength, whichever is greater.
 - .2 Through-slab repairs: Three (3) days or the time it takes to reach 70% of the 28 day design strength, whichever is greater.
 - .3 Vertical grouting repairs: Two (2) days.
 - .4 Vertical Form and Pour repairs: Two (2) days.
 - .5 Miscellaneous curbs, pads, etc.: One (1) day.
- .2 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later.
- .3 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 03 71 10 – Concrete Topping Repairs.
- .4 Section 03 72 40 – Hand Patching Repairs.
- .5 Section 03 72 50 – Pressure Grouting Repairs.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .3 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .4 CAN/CSA-G164-M92(R2003)(withdrawn), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .5 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 MEASUREMENT PROCEDURES

- .1 Reinforcing steel will be measured in pounds of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA G30.18 for lengths and sizes of bars as indicated or authorized in writing by Contract Administrator.
- .2 Dowels will be measured individually and will include dowel drilling, cleaning, preparation, epoxy supply and placement, and bar insertion, but excluding steel costs which will be covered by the rate per pound unit prices. The Contract Administrator and the Contractor will count and agree upon the numbers and lengths of bars as well as the number of bar embedments. These agreed upon number will form the basis for payment.

- .3 These unit prices will only cover supplemental reinforcing steel in concrete repair areas or as designated by the Contract Administrator. All other reinforcing steel costs must be included in the fixed price portions of the work to which they correspond (i.e. corbel repairs, reinforcing in slab openings, etc.).

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
 - .1 Provide type B tension lap splices unless otherwise indicated.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.
- .3 Cold drawn annealed steel wire ties: to ASTM A82.
- .4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 All reinforcing is to be detailed in accordance with the latest edition of the Reinforcing Steel Institute of Canada - Manual of Standard Practice, except otherwise noted
- .3 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.
- .4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

- .1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
- .2 Upon request inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

3.3 DOWELING PROCEDURES

- .1 For bars that are indicated as being dowelled in, drill in and grout bars into slab as follows:
 - .1 10M bars, 6 inches
 - .2 15M bars, 8 inches
 - .3 20M bars, 12 inches
- .2 Use only approved adhesive to manufacturer's instructions. Acceptable product:
 - .1 Hilti HIT HY-150 MAX by Hilti Canada.
- .3 Clean hole thoroughly prior to application of epoxy. Use injection or caulking gun to ensure that the epoxy fills the bottom of the hole prior to embedment of bar.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
 - .3 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
- .2 American Concrete Institute (ACI)
 - .1 ACI 309R-96, Guide for the Consolidation of Concrete.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260-01, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C928-09, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this section for cast-in-place corbel repairs.
- .2 Include all costs for concrete required for concrete repairs in appropriate unit prices.

1.4 CERTIFICATES

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.5 QUALITY ASSURANCE

- .1 Minimum 1 (one) week prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on following items:
 - .1 Curing.
 - .2 Finishes.
 - .3 Formwork removal.
 - .4 Joints.

1.6 ABBREVIATIONS

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
- .2 SCM – Supplemental cementing materials.
- .3 SSD - Saturated surface dry.
- .4 WRA – Water reducing agent.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Contract Administrator.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 MATERIALS

- .1 The concrete constituents shall comply with the following standards:
 - .1 Cement: to CAN/CSA-A3001.
 - .2 Blended Hydraulic cement: to CAN/CSA-A3001.
 - .3 Supplementary cementing materials: to CAN/CSA-A3001.
 - .4 Water: To CSA-A23.1.
 - .5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
 - .6 Air entraining admixture: ASTM C260.
 - .7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

2.2 MIX REQUIREMENTS

- .1 Proportion normal density concrete in accordance with CSA-A23.1 to obtain properties as indicated on Drawings.

2.3 BONDING SLURRY

- .1 The bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of 0.40 in accordance with CSA-A23.1 and as follows:
 - .1 1.0 kg Type GU to CSA A3001.
 - .2 1.0 kg SSD concrete sand to CSA A23.1.
 - .3 0.40 kg Water to CSA A23.1.
 - .4 High range water reducing agent to ASTM C494/C494M as required and approved by Contract Administrator.
 - .5 Volume batching will be permitted provided the volumes are calibrated by weight prior to batching. The measuring containers shall be clearly labelled, indicating material type, calibrated weight of material, and calibrated volume. The Contract Administrator reserves the right to randomly check batch weights.
 - .6 Shovel batching is strictly prohibited.
- .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

2.4 ACCESSORIES

- .1 Evaporation retardant: Acceptable Product:
 - .1 Confilm by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .2 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 by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .3 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34.

Part 3 Execution

3.1 PREPARATION

- .1 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .2 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .3 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated. Refer to Section 03 20 00.
- .4 Do not place load upon new concrete until authorized by Contract Administrator.
- .5 Provide formwork and falsework to Section 03 10 00 - Concrete Forms and Accessories.
- .6 Place reinforcing steel and install dowels to Section 03 20 00 - Concrete Reinforcement. Provide dowels at locations shown on the drawings.

- .7 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .8 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .9 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.

3.2 MIX PRODUCTION

- .1 Concrete to be mixed, delivered and placed in accordance with CSA A23.1.
- .2 Concrete to be batched and mixed at a ready mix plant and delivered to site in ready to place form.
- .3 Control of slump on the job site to be in accordance with CSA-A23.1 except as otherwise specified below:
 - .1 The addition of water to increase slump is strictly prohibited unless prior written permission from concrete supplier is obtained.
 - .2 The use of WRA may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections.
 - .3 WRA addition shall occur at the batch plant or on site. For site addition, concrete supplier to provide written notice minimum 2 weeks prior to commencement of concrete work, indicating recommended dosages based on slump at point of discharge.
 - .4 Site addition WRA will be the responsibility of the concrete supplier.
- .4 Slump and air must be measured both before and after addition of WRA.
- .5 The addition of water to the concrete to increase slump and aid in pumping is strictly forbidden

3.3 PLACEMENT

- .1 Place concrete work in accordance with CSA-A23.1.
- .2 Concrete shall be transported to placement location by pump or trolley. Note that regard to load limitations on the deck must be maintained to avoid overstressing the structural members.
 - .1 The live load capacity of the structural slab in the garage is 100 psf.
- .3 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.
- .4 Ensure high points and slopes to drains as shown on drawings are maintained.
- .5 Protect freshly placed concrete from exposure to dust, debris and precipitation.
- .6 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through concrete members except where indicated or approved by Contract Administrator.

- .2 Electrical conduits, junction and fixture boxes shall not be embedded within concrete members.
- .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Contract Administrator.
- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
- .5 Check locations and sizes of sleeves and openings shown on drawings.
- .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

3.4 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1/A23.2.
- .2 Consolidate concrete in accordance with CSA A23.1 and ACI 309.
- .3 Immediately after final finishing apply approved evaporation retardant at indicated coverage rate. Evaporation retardant is not to be applied during finishing operations nor should it be worked into the surface.
- .4 Unless otherwise indicated round edges of formed joints in pavements with a 10 mm radius edging tool.
- .5 Vertical Formed Surface
 - .1 Where applicable finishing of formed surfaces shall commence immediately after stripping the forms.
 - .2 All form ties and other metal items shall be removed or cut back to a depth of at least 20 mm from the surface of the concrete.
 - .3 Patch surface defects as directed by Contract Administrator.
 - .4 Unless otherwise indicated in the Schedule of Finishes all formed surfaces shall receive a smooth-form finish in accordance with CSA-A23.1.
 - .5 Vertical surfaces of curbs, walls, upstands, etc. shall receive a smooth-rubbed finish in accordance with CSA A23.1.
 - .6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .6 Schedule of finishes:
 - .1 Concrete paving slabs, slabs-on-grade, sidewalks, and exposed curbs subject to foot or vehicular traffic:
 - .1 Class A to CSA A23.1.
 - .2 Texture: Non-slip broomed.
 - .2 Pressure grouting repairs: to Section 03 75 00.

3.5 CURING

- .1 Cure and protect concrete in accordance with requirements CSA A23.1.
- .2 Concrete surfaces to be cured at a minimum temperature of 10°C for the entire curing period.
- .3 Curing methods shall be in accordance with CSA A23.1 unless otherwise indicated.

- .1 Basic curing methods shall consist of one of the following:
 - .1 polyethylene sheet;
 - .2 forms in contact with concrete surface; or
 - .3 curing compounds to ASTM C309 at manufacturer's specified applications rates, when approved by Contract Administrator.
- .2 Requirements for wet-curing:
 - .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or evaporation reducer, until the concrete has enough strength to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.
 - .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
 - .3 Commence wet curing with burlap and water 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 75 mm and be securely held in place without marring the concrete surface.
 - .4 Wet curing with burlap and water must be maintained for the periods indicated. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.
- .4 Curing Schedule:
 - .1 Structural concrete work, curbs, etc.
 - .1 7d at $\geq 10^{\circ}\text{C}$ and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 4d**.
 - .2 Pressure grouting repairs: to Section 03 75 00.
- .5 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. Refer to related sections for curing of concrete repair materials.

3.6 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 01450 - Quality Control and as described herein.
 - .1 Testing laboratory to be certified in accordance with CSA A283.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 21 00 - Allowances.
- .3 Frequency and Number of Tests:
 - .1 Not less than one test for each class of concrete placed on any one day.
 - .2 Slump and air measurements will be completed on each load of concrete.
- .4 Contract Administrator may take additional test cylinders when concrete quality is suspect. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.

- .6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.7 DEFECTIVE CONCRETE

- .1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, 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.
- .4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.
- .5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.
- .6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This section specifies the materials, mixes, preparation, and construction for the top surface concrete repairs to existing structural slabs.
- .2 All delaminated or deteriorated concrete on the top surface must be removed down to sound concrete. The reinforcing may have to be exposed at these locations by removing additional concrete, if there is any sign of corrosion. All concrete and exposed reinforcing shall be cleaned of all corrosion by mechanical means.
- .3 Upon removal of the deteriorated concrete and preparation of the surface, the area shall be infilled with concrete to the same elevation and profile as adjacent areas. The Contractor must follow the outlined methods, materials, and equipment.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forms and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcement.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-A3000-03, Cementitious Materials Compendium
 - .2 CSA-A3001-03, Cementitious Materials for Use in Concrete
 - .3 CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .4 CSA-A23.2-04, Methods of Test for Concrete.
 - .5 CSA- S448.1-93 (R2005), Repair of Reinforced Concrete in Buildings.
- .2 American Concrete Institute (ACI)
 - .1 ACI 309R-96, Guide for the Consolidation of Concrete.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM C260-01, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM A820/A820M-04, Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
- .4 International Concrete Repair Institute
 - .1 Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - .2 Guideline No. 03735, Guide for Methods of Measurement and Contract Types of Concrete Repair Work

1.4 MEASUREMENT PROCEDURES

- .1 The repair areas will be identified by the Contract Administrator on-site by a chain drag sounding survey which will be completed in the presence of, and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work. These measurements will form the basis of payment for the area.
- .2 Unit prices must include all supervision, labour and materials, and equipment.
- .3 The unit price submitted will apply to removal depths of up to 3.0 inches and at no point less than 2.25 inches in depth into the structural slab. A second unit price must also be submitted which will apply to removal depths of up to a 6.0 inch depth and at no point less than 3.0 inches in depth. Repair areas exceeding 6.0 inches in depth shall be repaired via through-slab removal and replacement.
- .4 Minimum payment for repair areas will be one square foot.
- .5 The Contractor is to note that if he increases the area of the repair over that originally measured of his own accord and without consultation with the Contract Administrator, he will not be paid for the increased area.

1.5 SUBMITTALS

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.6 QUALITY ASSURANCE

- .1 Perform cast-in-place concrete work in accordance with CSA-A23.1 unless specified otherwise in this section.
- .2 Acquire cement and aggregate from same source for all work. All products and materials must conform to CSA-A23.1 requirements.

Part 2 MATERIALS

2.1 MATERIALS

- .1 The concrete constituents shall comply with the following standards:
 - .1 Hydraulic cement: to CAN/CSA-A3001.
 - .2 Blended Hydraulic cement: to CAN/CSA-A3001.
 - .3 Supplementary cementing materials: to CAN/CSA-A3001.
 - .4 Water: To CSA-A23.1.
 - .5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
 - .6 Air entraining admixture: ASTM C260.

- .7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

2.2 MIX REQUIREMENTS

- .1 Proportion normal density concrete in accordance with CSA-A23.1, Table 5, Alternative 1 to obtain the following performance:
 - .1 Minimum compressive strength at 28 days: 35 MPa.
 - .2 Class of exposure: C-1
 - .3 Air category: 1 (5 to 8%)
 - .4 Supplemental Cementing Materials (SCM): Class CI Fly-Ash.
 - .5 Volume of SCM: Normal.
 - .6 Nominal size of coarse aggregate: 14 mm.
 - .7 Slump at point of discharge: consistent with placement and consolidation methods, equipment, and site conditions and as approved by Contract Administrator.

2.3 BONDING SLURRY

- .1 The bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of 0.40 in accordance with CSA-A23.1 and as follows:
 - .1 1.0 kg Type GU to CSA A3001.
 - .2 1.0 kg SSD concrete sand to CSA A23.1.
 - .3 0.40 kg Water to CSA A23.1.
 - .4 MRWRA or HRWRA to ASTM C494/C494M as required and approved by Contract Administrator.
 - .5 Volume batching will be permitted provided the volumes are calibrated by weight prior to batching. The measuring containers shall be clearly labeled, indicating material type, calibrated weight of material, and calibrated volume. The Contract Administrator reserves the right to randomly check batch weights.
 - .6 Shovel batching is strictly prohibited.
- .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

2.4 ACCESSORIES

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

Part 3 EXECUTION

3.1 PREPARATION

- .1 Concrete to be mixed, delivered and placed in accordance with CSA-A23.1.
- .2 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

- .3 Concrete shall be transported to placement location by pump or trolley. Note that regard to load limitations on the deck must be maintained to avoid overstressing the structural members.
- .4 Prior to placing concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing. Special provisions for hot and cold weather concrete placement shall be in accordance with CSA A23.1 unless specifically noted otherwise.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

3.2 CONCRETE DELAMINATION REMOVAL

- .1 The perimeter of the areas marked as delaminated are to be sawcut to a depth of 0.5 inches. If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly. Wet cutting is the only acceptable method. All slurry and water from the cutting process must be vacuumed. Slurry must not be allowed to flow to adjacent areas or to space below.
- .2 The entire area within the sawcut must have a minimum of 2.25 inches of concrete removed from the top surface using a maximum 25 lb. electric/pneumatic hammer (or equivalent).
- .3 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.
- .4 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.
- .5 Provide a clean vertical edge along the patch perimeter.
- .6 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused the periphery of a bar to be exposed for a distance of 6 inches (150 mm) or more, the concrete adjacent to the bar shall be removed by handchipping or with the use of short stroke electric chipping hammers to a depth that will permit new concrete to bond to the entire periphery of the bar so exposed and a minimum of 1.0 inch clearance all around.
- .7 Chain drag the areas to determine if any further unsound or delaminated concrete is present, which must be removed.
- .8 After all delaminated, unsound, or loose material is removed from the slab surface, the Contractor shall request an inspection from the Contract Administrator. This inspection is to be done in the presence of the Contractor and if any further work is required, the Contractor is to complete it immediately. The purpose of this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

3.3 CONCRETE SUBSTRATE PREPARATION

- .1 Within 24 hours prior to infilling, sandblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond

of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.

- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust.
- .4 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .5 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.
- .6 Waterblast substrate at minimum 3,000 psi to remove any residual dust and dirt. Maintain substrate in a saturated condition for a period of not less than six (6) hours prior to concrete placement. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .7 The cleaned and prepared surface should be thoroughly wetted and maintained in a saturated condition for a period of not less than 8 hours prior to concrete placement. Do not allow the concrete surface to dry.

3.4 FORMING

- .1 Form through-slab repairs to match existing profile in accordance with Section 03100. Costs of forming to be included in unit price.
- .2 After steel reinforcing has been placed, the area must be formed to match the existing surface and soffit profile. Support for the formwork must be adequate to support the wet weight of the concrete as well as all construction and live loads placed upon the area.

3.5 BONDING SLURRY APPLICATION

- .1 Apply the bonding slurry 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 concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the concrete.
- .3 Place concrete 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 surface will then be cleaned and prepared in accordance with the requirements described in the previous sections.

3.6 INFILL PROCEDURE

- .1 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.

- .2 Ensure reinforcement, floor drains, inserts, etc. are not disturbed during concrete placement.
- .3 Place concrete in its final position as soon as possible after mixing. A maximum time limit of 120 minutes from the time of initial mixing to complete discharge shall be observed. Do not use any concrete more than 120 minutes from initial mixing or having a partial set before placing.
- .4 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.
- .5 The addition of water to increase slump is strictly prohibited. The use of a high range water reducing agent (HRWRA) may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections. Site addition HRWRA will be the responsibility of the concrete supplier.
- .6 Immediately place concrete, into the prepared area from one side to the other. Work the material firmly into the bottom and sides of the patch, and underneath reinforcing steel, to assure good bond.
- .7 The concrete must be internally vibrated by means of standard immersion "pencil" vibrators meeting the requirements of ACI 309R. Pencil vibrators must be used in all delamination and through slab repair areas.
- .8 Continuously consolidate and finish to matching elevations, ensuring patch thickness and required elevations are maintained.
- .9 Apply approved 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.
- .10 Protect freshly placed concrete from exposure to dust, debris and precipitation.

3.7 CURING

- .1 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.
- .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
- .3 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.
- .4 Wet curing with burlap and water must be maintained for a minimum period of 7 days. Wet curing with burlap and water must be maintained for a period of 3 days for repairs infilled with rapid setting repair mortar.
- .5 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.

3.8 JOINTS

- .1 Following a minimum 28 day cure, re cut perimeter joints to 1/8" wide x 1/8" deep. Clean joints, and infill with approved epoxy resin in accordance with manufacturer's recommendations. Costs for sealing of patch edges to be included in unit price.

3.9 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a CSA Certified Testing Laboratory approved by the City of Winnipeg in accordance with CSA A23.1 and as described herein.
- .2 One concrete test will be required for each day of casting. Slump, air measurements, and three cylinders shall be obtained at point of discharge. The Contractor will pay for costs of tests under Cash Allowance.
- .3 Testing agency to submit copies of concrete test reports directly to City of Winnipeg and Contract Administrator.
- .4 The minimum acceptable bond strength between the overlay and substrate is 1.0 MPa at 28 days. If the bond strength is suspected of being below 1.0 MPa, the Contract Administrator may require a bond strength test in accordance with CSA-A23.2-6B.

3.10 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

Part 1 General

1.1 SUMMARY

- .1 Concrete walls exhibiting extensive spalling and/or delamination requiring localized repairs less than 2" in depth will be repaired by removing the deteriorated concrete, cleaning and preparing the substrate, and patching the area with a cementitious patching material.

1.2 RELATED SECTIONS

- .1 Section 03 72 50 – Pressure Grouting Repairs.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-05, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars Using 2-in. Cube Specimens).
 - .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C882-05, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
 - .4 ASTM C928-05, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .2 International Concrete Repair Institute
 - .1 Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - .2 Guideline No. 03735, Guide for Methods of Measurement and Contract Types of Concrete Repair Work.

1.4 MEASUREMENT PROCEDURES

- .1 The areas of repair will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work.
- .2 Unit prices must include all supervision, labour and materials, and equipment.
- .3 The unit price submitted will apply to removal depths of up to 2.0 inches and at no point less than 0.5 inches in depth. Repairs over 2.0 inches in depth will be repaired via pressure grouting in accordance with Section 03 75 00.
- .4 The minimum area of payment will be 0.5 square foot.
- .5 The Contractor is to note that if he increases the area of the repair over that originally measured of his own accord and without consultation with the Contract Administrator, he will not be paid for the increased area.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver the specified product in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.
- .2 Store and condition the specified product as recommended by the manufacturer.
- .3 Environmental conditions: Do not apply material if temperature or ambient conditions may affect performance of grout.
- .4 Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified repair material.
- .5 Immediately remove any spilled or splashed grout from work area. Leave work area in neat, clean condition without evidence of any spillovers.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Patching Mortar: Infilling with a one-component, thixotropic, rheoplastic, cement-based, fiber-reinforced, shrinkage-compensated, sulfate-resistant structural repair mortar.
 - .1 Modulus of elasticity to ASTM C469:
 - .1 34.5 ± 5 GPa.
 - .2 Rapid chloride permeability to ASTM C1202 / AASHTO T277:
 - .1 less than 900 coulombs at 28 days
 - .3 Freeze/Thaw Resistance to ASTM C 666, Procedure A:
 - .1 96.0% RDM at 300 cycles.
 - .4 Salt Scale Resistance to ASTM C672:
 - .1 None at 50 cycles.
 - .5 Slant Shear Strength to ASTM C882, modified (no epoxy-bonding agent used):
 - .1 Minimum 10 MPa at 1 day.
 - .2 Minimum 17 MPa at 7 days.
 - .3 Minimum 20 MPa at 28 days.
 - .6 Compressive Strength to ASTM C109:
 - .1 Minimum 15 MPa at 1 day.
 - .2 Minimum 25 MPa at 7 days.
 - .3 Minimum 30 MPa at 28 days.
 - .7 Drying shrinkage to ASTM C157:
 - .1 less than 0.10% at 28 days.
- .2 Acceptable product(s):
 - .1 Emaco S88 CI by Degussa Building Systems.
 - .2 Meadow-Crete OV by W.R. Meadows Inc.

2.2 ACCESSORIES

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

2.3 FINISHES

- .1 Materials
 - .1 Paint materials for each coating formulae to be products of a single manufacturer.
 - .2 Provide specified, approved paint, finish materials.
 - .3 Provide linseed oils, shellacs, turpentine, etc. of pure grade, highest quality.
- .2 Acceptable Products
 - .1 Specified manufacture: Sherwin Williams.
 - .2 Acceptable manufacturers, using equal quality, performance products subject to Contract Administrator approval:
 - .1 Pratt & Lambert Inc.
 - .2 Glidden Paint Co.
 - .3 Canadian Pittsburgh Industries.
- .3 Acceptable Systems
 - .1 Surface preparation: in accordance with manufacturer's recommendations.
 - .2 Acceptable materials: S-W Duration Exterior Latex Acrylic Satin Coating
 - .3 Colour by: to match existing.

Part 3 EXECUTION

3.1 CONCRETE DELAMINATION REMOVAL

- .1 The perimeter of the areas marked as delaminated are to be sawcut to a depth of 0.5 inches (12 mm). If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly.
- .2 The entire area within the sawcut must have a minimum of 0.5 inches of concrete removed from the top surface using a maximum 15 lb. electric chipping hammer.
- .3 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.
- .4 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.
- .5 Provide a clean vertical edge along the patch perimeter.
- .6 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused the periphery of a bar to be exposed for a distance of 6 inches (150

mm) or more, the concrete adjacent to the bar shall be removed by handchipping or with the use of short stroke electric chipping hammers to a depth that will permit new concrete to bond to the entire periphery of the bar so exposed and a minimum of 0.5 inches (12 mm) clearance all around.

- .7 Hammer sound the areas to determine if any further unsound or delaminated concrete is present, which must be removed.
- .8 After all delaminated, unsound, or loose material is removed from the slab surface, the Contractor shall request an inspection from the Contract Administrator. This inspection is to be done in the presence of the Contractor and if any further work is required, the Contractor is to complete it immediately. The purpose of this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

3.2 CONCRETE SUBSTRATE PREPARATION

- .1 Within 24 hours prior to infilling, sandblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.
- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust.
- .4 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .5 Maintain substrate in a clean condition until the area is ready to be infilled. If the concrete surface area within the patch becomes wet and subsequently dries, the sandblasting and cleaning procedure must be repeated.
- .6 Waterblast substrate at minimum 3,000 psi to remove any residual dust and dirt. Maintain substrate in a saturated condition for a period of not less than six (6) hours prior to concrete placement. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .7 The cleaned and prepared surface should be thoroughly wetted and maintained in a saturated condition prior infilling. Do not allow the concrete surface to dry.

3.3 APPLICATION PROCEDURES

- .1 The patch material must be installed and cured in strict accordance with manufacturer's specifications.
- .2 Apply repair 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.
- .3 For hand applications, apply a bond slurry, consisting of neat patching mortar, to the prepared surface. Thoroughly scrub a thin layer of normal consistency mortar into the saturated surface with a stiff bristle brush to produce a uniform thickness of approximately 1/8" over entire area.

- .4 Apply repair mortar by low pressure wet spraying or hand troweling on vertical or overhead surfaces in depths ranging from 3/4" to 2".
 - .1 Vertical Applications: Repair mortar can be applied on vertical applications up to a 2" depth per lift.
 - .2 Multiple Passes: Place succeeding lifts after repair mortar has developed initial set. Scarify the surface of the first lift to ensure integral bond between successive layers.

3.4 FINISHING

- .1 Level surface of repair mortar using a float or screed.
- .2 Apply final finish when mortar has begun to stiffen using a wooden, plastic, or synthetic sponge float or trowel.
- .3 Spray apply undiluted evaporation reducer lightly to aid in finishing.

3.5 CURING

- .1 Protect fresh mortar from premature evaporation.
- .2 Apply two coats of approved curing compound in accordance with manufacturers specifications. Apply the first coat immediately after completing finishing operations. Apply the second coat about 24 hours later.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Concrete pit 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 pourable or pumpable grout.
- .2 All spalling and/or delaminated concrete must be removed down to sound concrete. The reinforcing steel may have to be exposed at these locations if there is any sign of corrosion. All exposed reinforcing and concrete shall be cleaned by sandblasting the substrate.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 72 40 - Hand Patching Repairs.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-05, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
 - .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C882-05, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
 - .4 ASTM C928-05, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .2 International Concrete Repair Institute
 - .1 Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - .2 Guideline No. 03735, Guide for Methods of Measurement and Contract Types of Concrete Repair Work.

1.4 MEASUREMENT PROCEDURES

- .1 The areas of repair will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work.
- .2 Unit prices must include all supervision, labour and materials, and equipment.

- .3 The unit price submitted will apply to removal depths of up to 3.0 inches and at no point less than 1.0 inch in depth. A second unit price must also be submitted which will apply to removal depths of up to a 6.0 inch depth and at no point less than 3.0 inches in depth.
- .4 The minimum area of payment will be 0.5 square foot.
- .5 The Contractor is to note that if he increases the area of the repair over that originally measured of his own accord and without consultation with the Contract Administrator, he will not be paid for the increased area.

1.5 DESIGN CONSIDERATION

- .1 The Contractor will be required to furnish all materials, labour, tools, and equipment for the repair of the deteriorated areas as designated by the engineer.
- .2 The Contractor shall provide a minimum of three (3) local references exhibiting successful performance in grouting repairs with the specified product.
- .3 The Contractor shall provide a two (2) year unconditional warranty against delamination or spalling of the structural repair.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver the specified product in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.
- .2 Store and condition the specified product as recommended by the manufacturer.
- .3 Environmental conditions: Do not apply material if temperature or ambient conditions may affect performance of grout.
- .4 Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified repair material.
- .5 Immediately remove any spilled or splashed grout from work area. Leave work area in neat, clean condition without evidence of any spillovers.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 The grout shall be Portland Cement based non-shrink, non-metallic composition and should meet the following requirements:
 - .1 The grout shall not exhibit bleeding or segregation at pumpable consistency.
 - .2 The grout shall not produce a vapour barrier.
 - .3 Compressive Strength to ASTM C109: minimum 25 MPa at 24 hours .
 - .4 Slant Shear Strength to ASTM C 882: minimum 13 MPa at 28 days.
 - .5 Positive expansion confirmed by ASTM C827.
- .2 Acceptable products are one of the following only

- .1 Sika Grout 212 by Sika Canada Inc.
- .2 M-Bed by Sika Canada Inc..

2.2 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 by BASF Building Systems at a minimum application rate of 4.9 m²/L.

2.3 FINISHES

- .1 Materials
 - .1 Paint materials for each coating formulae to be products of a single manufacturer.
 - .2 Provide specified, approved paint, finish materials.
 - .3 Provide linseed oils, shellacs, turpentine, etc. of pure grade, highest quality.
- .2 Acceptable Products
 - .1 Specified manufacture: Sherwin Williams.
 - .2 Acceptable manufacturers, using equal quality, performance products subject to Contract Administrator approval:
 - .1 Pratt & Lambert Inc.
 - .2 Glidden Paint Co.
 - .3 Canadian Pittsburgh Industries.
- .3 Acceptable Systems
 - .1 Surface preparation: in accordance with manufacturer's recommendations.
 - .2 Acceptable materials: S-W Duration Exterior Latex Acrylic Satin Coating
- .4 Colour by: to match existing.

Part 3 EXECUTION

3.1 CONCRETE DELAMINATION REMOVAL

- .1 The perimeter of the areas marked as delaminated are to be sawcut to a depth of 0.5 inches (12 mm). If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly. Wet cutting is the only acceptable method. All slurry and water from the cutting process must be vacuumed. Slurry must not be allowed to flow to adjacent areas or to space below.
- .2 The entire area within the sawcut must have a minimum of 1.0 inches of concrete removed from the top surface using a maximum 15 lb. electric chipping hammer (or equivalent).
- .3 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.
- .4 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.

- .5 Provide a clean vertical edge along the patch perimeter.
- .6 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused the periphery of a bar to be exposed for a distance of 6 inches (150 mm) or more, the concrete adjacent to the bar shall be removed by handchipping or with the use of short stroke electric chipping hammers to a depth that will permit new concrete to bond to the entire periphery of the bar so exposed and a minimum of 1.0 inch clearance all around.
- .7 Chain drag the areas to determine if any further unsound or delaminated concrete is present, which must be removed.
- .8 After all delaminated, unsound, or loose material is removed from the slab surface, the Contractor shall request an inspection from the Contract Administrator. This inspection is to be done in the presence of the Contractor and if any further work is required, the Contractor is to complete it immediately. The purpose of this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

3.2 CONCRETE SUBSTRATE PREPARATION

- .1 Within 24 hours prior to infilling, sandblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.
- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust.
- .4 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .5 Maintain substrate in a clean condition until the area is ready to be infilled. If the concrete surface area within the patch becomes wet and subsequently dries, the sandblasting and cleaning procedure must be repeated.
- .6 The cleaned and prepared surface should be thoroughly wetted and maintained in a saturated condition prior infilling. Do not allow the concrete surface to dry.

3.3 FORMS

- .1 Provide plywood form work 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 Seal around edge of formwork with sealant to prevent leakage during grouting.
- .4 Securely anchor formwork to substrate. Anchors to be sized and space to prevent deflection of the forms during pressure grouting.

- .5 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.
- .6 A minimum of 20 mm 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.
- .7 Within two (2) hours immediately prior to grouting, pressure test formwork to determine watertightness. Completely fill formwork with 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.

3.4 INFILLING PROCEDURES

- .1 Ensure that all manufacturer requirements, limitations and specifications are adhered to for installation of the grout.
- .2 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.
- .3 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .4 Mixing the Portland Cement grout: Mix manually or mechanically. Manually mix in a wheelbarrow or mortar box. Mechanically mix with a low-speed (400-600rpm) drill and jiffy paddle or in an appropriate sized mortar mixer. Add an appropriate quantity of water to the mixing container to achieve the desired consistency. **DO NOT OVER WATER.** While mixing, the bag of powder is slowly added to the mixer. Mix to a uniform consistency for a minimum of 2 minutes. Mix temperature should be maintained at 20 - 25°C, using cold or warm water accordingly.
- .5 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. 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. After the grout has achieved its final set, remove any forms and trim or shape to the desired profile if required.

3.5 CURING

- .1 Upon removal of forms, apply two coats of approved curing compound in accordance with manufacturer's specifications. Apply the first coat immediately after completing finishing operations. Apply the second coat about 24 hours later.

3.6 FINISHING

- .1 Prepare surface and paint to match existing.

3.7 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 01450 - Quality Control and as described herein.
 - .1 Testing laboratory to be certified in accordance with CSA A283.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 21 00 - Allowances.
- .3 Not less than one test will be required for each day of placement.
 - .1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.
- .4 Testing agency to submit copies of concrete test reports directly to City of Winnipeg and Contract Administrator.
- .5 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

END OF SECTION

1. GENERAL

1.1 Section Includes

- .1 This section covers the removal and replacement of scaled surface areas the structural deck.
- .2 The scaling will be removed with a bush hammer and subsequently infilled with thin patching compound.

1.2 Related Sections

- .1 Section 03 71 00 - Top Surface Concrete Repairs.

1.3 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-07, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50-mm Cube Specimens).
 - .2 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C928-05, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .2 International Concrete Repair Institute
 - .1 Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - .2 Guideline No. 03735, Guide for Methods of Measurement and Contract Types of Concrete Repair Work.

1.4 Measurement Procedures

- .1 Scaling repairs completed under this Section will be measured in square feet for repair depths of up to 1.0 inch. Unit prices must include all supervision, labour and materials, and equipment.
- .2 Minimum payment for repair areas will be one square foot.
- .3 The repair areas will be identified by the Contract Administrator on-site by a chain drag sounding survey to be completed in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work. These measurements will form the basis of payment for the area.
- .4 The Contractor is to note that if he increases the area of the repair over that originally measured of his own accord and without consultation with the Contract Administrator, he will not be paid for the increased area.

2. PRODUCTS

2.1 Materials

- .1 One-component high-performance, cementitious mortar that produces high-early strength and contains modified cement, aggregate, and additives meeting the following performance requirements:
 - .1 Complies with ASTM C928.
 - .2 Compressive Strength, ASTM C109:
 - .1 3 Hour: minimum 6 MPa
 - .2 1 Day: minimum 30 MPa.
 - .3 7 Days: minimum 50 MPa.

- .3 Set Time, ASTM C266, minimum 21°C):
 - .1 Initial: 75 minutes or less
 - .2 Final: 90 minutes or less.
 - .4 Flexural Strength, ASTM C348:
 - .1 1 Day: minimum 4 MPa.
 - .2 7 Days: minimum 6 MPa.
 - .5 Modulus of Elasticity at 28 days, ASTM C469: 35 ± 5 GPa.
 - .6 Splitting Tensile Strength, ASTM C496:
 - .1 1 Day: minimum 3.5 MPa.
 - .2 7 Days: minimum 7.5 MPa.
 - .7 Slant Shear Bond Strength, ASTM C882 Modified:
 - .1 1 Day: minimum 12 MPa.
 - .2 7 Days: minimum 20 MPa.
 - .8 Rapid chloride permeability, AASHTO-T277/ASTM C1202: less than 1,000 coulombs.
 - .9 Scaling Resistance (weight loss, lb/ft²), ASTM C672:
 - .1 25 cycles: CaCl₂: 0.003, NaCl: 0.067
 - .2 50 cycles: CaCl₂: 0.005, NaCl: 0.084
 - .10 Freeze-Thaw Resistance, ASTM C666, (Procedure A) 100% Relative Dynamic Modulus at 300 cycles: 98.5.
- .2 Acceptable product:
 - .1 Emaco T-430 by BASF Building Systems.
 - .3 Water: Clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious material to the latest edition of CSA A23.1.

2.2 Accessories

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

3. EXECUTION

3.1 Scaling Removal Procedures

- .1 The Contract Administrator will mark out the perimeter of the scaled or debonded areas, which are to be removed as specified herein.
- .2 The Contractor must saw-cut the perimeter of the scaled repair area to ¼" [using wet cut methods]. Removal of the scaled material shall be accomplished by the use of a short stroke electric chipping hammer with a sharp bush hammer bit to remove the surface scaling within the marked-out areas.
- .3 Minimum depth of removal will be ¼", and maximum depth will be 1" for scaling repairs.
- .4 Once the areas have been bush hammered, the Contractor must chain drag all areas to determine if any further unsound material is present, which must be removed.
- .5 Once the areas are determined by the Contractor to be sound, request a final inspection from the Contract Administrator. This inspection shall be done in the presence of the Contractor, who shall complete any further work at the time of the inspection.
- .6 Within 24 hours prior to infilling, sandblast or shotblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere

with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.

- .7 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .8 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.
- .9 Waterblast substrate at minimum 3,000 psi to remove any residual dust and dirt. Maintain substrate in a saturated condition for a period of not less than two (2) hours prior to concrete placement. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .10 The cleaned and prepared surface should be thoroughly wetted and maintained in a saturated condition for a period of not less than 4 hours prior to concrete placement. Do not allow the concrete surface to dry.

3.2 Infill Procedure

- .1 The area shall then be well soaked prior to placing the material but water should not be allowed to stand in the area and the surface dry to the touch. The surface must be surface saturated dry (SSD) with no standing water, and concrete that is turning from dark to light. Remove standing water by vacuuming.
- .2 The patch material must be installed and cured in strict accordance with manufacturer's specifications. Scaling repairs shall be completed using neat material.
- .3 Mechanically mix product with specified water content for a maximum of 3 minutes. Do not over water.
- .4 Pour a limited amount of material into patch area and scrub into substrate to create a bonding slurry. Scrub into substrate with stiff bristled broom or brush to produce a uniform coat over the entire area.
- .5 Place patch material while the bonding slurry is still plastic. Do not apply more slurry than can be covered before it dries. Do not re-temper. If the bond slurry dries prior to placement of the concrete, removal of the dried slurry will be required. The concrete surface will then be cleaned and prepared in accordance with the requirements described in the previous sections.
- .6 Place material, consolidate, and float finish to provide a uniform surface.
- .7 Following consolidation and screeding, the surface shall be immediately floated to close and smooth the surface. Match existing adjacent surface textures.
- .8 Apply approved 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.
- .9 Protect freshly placed patch material from exposure to dust, debris and precipitation.

3.3 Curing

- .1 Immediately after final finishing apply evaporation retardant to protect exposed surface against plastic shrinkage until the patch material has enough strength to support the placement of the wetted burlap.
- .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.

- .3 Commence wet curing with burlap and water 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.
- .4 Wet curing with burlap and water must be maintained for 48 hours. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.
- .5 Upon removal of the burlap apply curing and sealing compound.

3.4 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.
 - .1 Testing laboratory to be certified in accordance with CSA A283.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 21 00 - Allowances.
- .3 Not less than one strength test per day of placement.
 - .1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.
- .4 Testing agency to submit copies of concrete test reports directly to City of Winnipeg and Contract Administrator.
- .5 The minimum acceptable bond strength between the patch material and substrate is 1.0 MPa at 3 days.
 - .1 If the bond strength is suspected of being below 1.0 MPa, the Contract Administrator may require a bond strength test in accordance with CSA-A23.2-6B.
- .6 Chain drag soundings on the patches will be completed prior to application of the membrane and within 14 days following placement. Any areas identified to be unbonded shall be removed and replaced at the Contractor's expense.
- .7 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.
- .8 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.5 Defective Concrete

- .1 Defective concrete: bond strengths below 1.0 MPa, 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