

Part 1 General

1.1 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/C260M-10a, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C494/C494M-10a Standard Specification for Chemical Admixtures for Concrete.

1.2 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.

1.3 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.

1.4 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, Table 5, Alternative 1 to obtain the following performance:
 - .1 Bonded Concrete Overlay.
 - .1 Class of exposure: N
 - .2 Minimum compressive strength at 28 days: 32 MPa.
 - .3 Water:cementitious ratio: max. 0.45
 - .4 Air category: None
 - .5 Supplemental Cementing Materials (SCM): Class CI Fly-Ash.
 - .6 Volume of SCM: Normal (less than 30% replacement).
 - .7 Nominal size of coarse aggregate: 20 mm.
 - .8 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 0.45 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" (3 mm) over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

2.4 ACCESSORIES

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

2.5 REINFORCEMENT

- .1 Reinforcing Mesh: as per drawings.
- .2 Provide chairs of suitable height to hold mesh in centre of new overlay. Chair spacing not to exceed 18" on-centre in each direction or as required to support the weight of placing personnel with minimal deflection.

Part 3 Execution

3.1 CONCRETE SURFACE PREPARATION

- .1 Within 24 hours prior to placement, shot blast the substrate to texture the concrete and remove loose 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 surfaces to which the concrete is to bond.
- .3 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .4 After all surface preparation is complete the Contractor shall request an inspection from the Contract Administrator to review the substrate.
- .5 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.
- .6 Saturate substrate for a period of not less than 6 hours prior to infilling. Do not allow the concrete surface to dry. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .7 Final cleaning: High pressure waterblast substrate at minimum 4,000 psi to remove any residual dust, dirt, debris, or other materials which could reduce bond.
- .8 Prior to placement remove standing water from all depressions and allow substrate to become saturated, surface-dry (SSD) with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove any standing water by vacuuming.

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. Site addition of 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 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.
- .3 Bonding Slurry Application:
 - .1 Apply the specified bonding slurry to a SSD substrate.
 - .2 Scrub plastic slurry into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" (3 mm) over entire area. Collect and remove all coarse aggregate prior to placement of the concrete.
- .4 Place concrete while the slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not retemper. If the bonding slurry dries prior to placement of the repair material, removal of the dried slurry will be required. The concrete substrate will then be cleaned and prepared in accordance with the requirements described in the previous sections.
- .5 Place concrete work in accordance with CSA-A23.1.
- .6 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.
- .7 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.
- .8 Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Install a construction dam or bulkhead in case of a delay longer than 60 minutes. During delays between 5 and 60 minutes, protect the end of the placement with damp burlap.
- .9 The concrete must be internally vibrated by use of a floating vibratory screed to consolidate the top surface. Move vibrating screed forward as rapidly as possible while allowing proper consolidation and finishing of the concrete surface. Extended use of a vibratory screed may result in segregation of the concrete producing excessive mortar at the surface which can result in a weak surface layer.
- .10 Continuously consolidate and finish to specified elevations.
- .11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .12 Protect freshly placed concrete from exposure to dust, debris and precipitation.

3.4 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1.
- .2 Finishing:

- .1 Immediately after concrete has been placed and consolidated, bull-float slab surface to a smooth uniform surface.
- .2 Use of hand trowels will be required to hand finish areas the finishing machine cannot reach.
- .3 Surface free of all trowel marks and ridges.

3.5 CURING

- .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or application of an 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 Bonded concrete overlays to be wet cured with burlap for a minimum of 7 days at 10°C. Provide supplemental heat and hoarding as required throughout curing period.
- .3 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
- .4 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" (75 mm) and be securely held in place without marring the concrete surface.
 - .1 Days 1 through 6: Maintain burlap in a continuously wet condition throughout the curing period. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.
 - .2 Day 7: Discontinue re-wetting procedures allowing burlap to dry naturally.
- .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.

3.6 JOINTS

- .1 Control joints and construction joints where noted on drawings shall be formed, tooled, or sawcut via specialized dry-process cutting (eg. "Soff-Cut"). Sawcutting 24 hours following placement will not be permitted.
 - .1 Sawcut to a minimum of one 1 1/2" (38 mm) or one-quarter of the depth of the slab, whichever is greater, following initial set of concrete.
 - .2 Timing of the saw cutting will vary with weather conditions however are typically completed within 1 to 4 hours after final finishing. Timing of the saw cutting will be the responsibility of the Contractor.
- .2 Location and frequency of control joints to be site determined.

3.7 FIELD QUALITY CONTROL

- .1 Concrete tests consisting of slump, air, and 3 cylinders for compressive strength to be completed at not less than one test per 50 cubic metres of concrete placed and not less than one test for each day of placement.
- .2 The bond strength between the overlay and substrate will be measured in accordance with CSA-A23.2-6B. The minimum acceptable bond strength between the overlay and substrate is 1.0 MPa at 28 days
- .3 Direct pull-out tensile tests to determine bond strength will be completed as follows:
 - .1 Minimum (3) tests will be completed within the first phase of repairs.

- .2 Not less than one (1) bond test will be completed in each subsequent phase.
- .3 Infilling of the core hole will be the responsibility of the General Contractor. Unless otherwise directed by the Contract Administrator, repair in accordance with this Section.
- .4 Testing agency to submit copies of concrete test reports directly to the 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.

3.8 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