

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 30 00 – Cast-In-Place Concrete

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-O86S1-09 Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121-08, Douglas Fir Plywood.
 - .4 CSA O151-09, Canadian Softwood Plywood.
 - .5 CSA O153-M1980(R2008), Poplar Plywood.
 - .6 CAN/CSA-O325-07, Construction Sheathing.
 - .7 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .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, CSA O437 Series, and CSA-O153.
- .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.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 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.
- .2 Align form joints and make watertight. Keep form joints to minimum.
- .3 Use 1 inch (25 mm) chamfer strips on external corners.
- .4 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .5 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 List of significant generic types of products, work, or requirements specified. This listing should not include procedures, process, preparatory work, accessories, components, secondary products, or final cleaning.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 30 00 – Cast-In-Place Concrete

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- .2 CSA International
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-04(R2010), Design of Concrete Structures.
- .3 Reinforcing Steel Institute of Canada (RSIC)
- .4 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba.
 - .1 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.
 - .2 Detail lap lengths and bar development lengths to CAN/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 Consultant.
- .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 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .1 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2. All accessories to be non-corroding.

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 Obtain Consultant's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to beginning reinforcing work.
- .2 Upon request inform Consultant of proposed source of material to be supplied.

Part 3 Execution

3.1 PLACING REINFORCEMENT

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

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/C260M-10a, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-10a Standard Specification for Chemical Admixtures for Concrete.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 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.

1.4 QUALITY ASSURANCE

- .1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Consultant if requested on following items:

- .1 Hot weather concrete.
- .2 Cold weather concrete.
- .3 Curing.
- .4 Finishes.
- .5 Joints.

1.5 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.

1.6 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 Consultant and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Consultant.
- .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. Consultant 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 Type 1: Pavement Slab & Curbs
 - .1 Class of exposure: C-2
 - .2 Minimum compressive strength at 28 days: 32 MPa.
 - .3 Air category: 1 (5 to 8%)
 - .4 Nominal size of coarse aggregate: 20 mm.
 - .5 Slump at point of discharge: consistent with placement and consolidation methods, equipment, and site conditions and as approved by Consultant.

2.3 Accessories

- .1 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34.

2.4 Granular Base

- .1 Comply with Section 32 11 23 - Aggregate Base Courses.

Part 3 Execution

3.1 Preparation

- .1 Obtain Consultant's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .3 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .5 Do not place load upon new concrete until authorized by Consultant.
- .6 Provide formwork to Section 03 10 00 - Concrete Forms and Accessories.
- .7 Place reinforcing steel to Section 03 20 00 - Concrete Reinforcement.
- .8 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather. Protection and curing must comply with the hot weather and cold weather requirements of CSA-A23.1.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.
- .11 Do not place concrete until screed rails for hand operated strike-off devices are in place and firmly secured.
 - .1 Rails to be of type, and so installed, that no springing or deflection will occur due to weight of finishing equipment.
 - .2 Set rails or headers to elevations to produce deck true to required grade and cross section.

- .3 Use polyethylene film or plastic coated tape if necessary to prevent concrete from bonding to rails.
- .4 Do not treat rails with release agents or parting compounds.
- .5 Subject to approval of the Consultant, screed rail anchors which remain in the concrete may be used provided they are non-corroding and sit a minimum of 30 mm below the finished surface of the concrete.

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.
 - .5 Slump and air must be measured both before and after addition of WRA.

3.3 Placement

- .1 Ensure high points and slopes to drains as shown on drawings are maintained.
- .2 Protect freshly placed concrete from exposure to dust, debris and precipitation.
- .3 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through concrete members except where indicated or approved by Consultant.
 - .2 Electrical conduits, junction and fixture boxes shall not be embedded within concrete members unless approved by consultant.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Consultant.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Consultant before placing of 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 Under adverse conditions only, excess bleed water may be removed from the surface using procedures acceptable to Consultant and those noted in CSA-A23.1. Ensure surface is not damaged.
- .4 Unless otherwise indicated round edges of formed joints in pavements with a 10 mm radius edging tool.
- .5 Flatwork:
 - .1 Continuously consolidate and finish to specified elevations, ensuring thickness and required elevations are maintained.
 - .2 Use of a floating vibratory screed to consolidate the top surface of the concrete will be mandatory.
 - .1 The use of screed rails may be required to meet required surface tolerances.
 - .2 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.
 - .3 Immediately after concrete has been placed and consolidated, bull-float slab surface to a smooth uniform surface.
 - .4 Use of hand trowels will be required to hand finish edges.
 - .5 Provide surface free of all trowel marks and ridges.
- .6 Schedule of finishes:
 - .1 Concrete pavement, and exposed curbs subject to foot or vehicular traffic:
 - .1 Class A to CSA A23.1.
 - .2 Texture: Non-slip broomed.

3.5 Joints

- .1 Install control joints at locations shown on the drawings. Joints shall correspond to location of slip dowels.
- .2 Location of control and construction joints as shown on drawings:
- .3 Control joints shall be formed or tooled at locations shown. Refer to Drawings for paving patterns and joint locations.
 - .1 All joints to be sawcut via specialized dry-process cutting.
 - .1 Sawcut to a minimum of one 1.5" 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. Sawcutting 24 hours following placement will not be permitted.
- .4 Where paving abuts curbs, walls and other vertical surfaces use 12 mm asphalt impregnated fibre board, unless noted on drawings.
- .5 Unless otherwise indicated, all control and construction joints to be filled with a flexible joint sealant.

3.6 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 Consultant.
 - .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 Consultant may be necessary.
- .4 Curing Schedule:
 - .1 Concrete paving slabs, slabs-on-grade, sidewalks, and exposed curbs subject to foot or vehicular traffic:
 - .1 7d at e 10°C and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 3d** followed by the application of a cure and sealing compound.
- .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.

3.7 Field Quality Control

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Consultant 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 Frequency and Number of Tests:
 - .1 Not less than one strength test.

- .2 Slump and air measurements will be completed on each load of concrete to ensure satisfactory control of the air content is established.
- .3 Consultant may take additional test cylinders during cold weather concreting or when concrete quality is suspect. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.
- .5 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.8 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 Consultant, 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 consultant 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 Consultant of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Consultant.

END OF SECTION