

PART 1 - GENERAL

1.1 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-O86-09, Engineering Design in Wood
 - .3 CSA O121-M1978(R2003), Douglas Fir Plywood.
 - .4 CSA O151-04, Canadian Softwood Plywood.
 - .5 CSA O153-M1980(R2003), Poplar Plywood.
 - .6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.
 - .7 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .8 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada

1.2 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86.
 - .2 Rigid insulation board: to CAN/ULC-S701.
 - Insulation 1 Min Compressive Strength 275 KPa.
 - Insulation 2 Min Compressive Strength 690 KPa.
- .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.

PART 3 - EXECUTION

3.1 FABRICATION AND
ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 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.
- .5 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .6 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections.
- .7 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 3 days for walls and sides of beams.
- .2 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

PART 1 - GENERAL

1.1 REFERENCES

- .1 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 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
- .2 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL 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 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement 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.
 - .1 Provide type tension lap splices unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.

- .4 Cold-drawn annealed steel wire ties: to ASTM A 82/A 82M.
- .5 Epoxy Coating of all reinforcement: to ASTM A 775/A 775M.
- .6 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 SP-66 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
 - .1 Ship epoxy coated bars in accordance with ASTM A 775A/A 775M.

PART 3 - EXECUTION

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .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 as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.
- .4 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

<u>3.3 FIELD TOUCH-UP</u>	.1	Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.
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PART 1 - GENERAL

1.1 REFERENCES

- .1 Abbreviations and Acronyms:
 - .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 - .1 Type GU, GUb and GUL - General use cement.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C 260/C 260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C 494/C 494M-10a, Standard Specification for Chemical Admixtures for Concrete.
 - .3 ASTM C 1017/C 1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .2 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.2 ADMINISTRATIVE
REQUIREMENTS

- .1 Pre-installation Meetings convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure key personnel, site supervisor, Departmental Representative Consultant speciality contractor - finishing, forming concrete producer testing laboratories attend.
 - .1 Verify project requirements.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 4 weeks prior to beginning Work, provide Departmental Representative with mix designs proposed

for use.

- .3 Provide testing inspection results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .4 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .5 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 60 minutes for concrete to be delivered to site of Work and discharged after batching.
- .6 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Departmental Representative 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .3 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .4 Sustainability Standards Certification:
 - .1 Construction Waste Management: provide copy of plan.
 - .2 Recycled Content: 25 %.
 - .1 Provide listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and pre-consumer content, and total cost of materials for project.
 - .2 When Supplementary Cementing Materials (SCMs) are used, provide evidence to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

1.5 DELIVERY,
STORAGE AND
HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 60 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative laboratory representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- .1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE
CRITERIA

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

- .1 Portland Cement: to CSA A3001, Type GU HS.
 - .1 Recycled content: 25%.
- .2 Supplementary cementing materials: with minimum 25% Type F CI CH fly ash replacement N GGBFS, by mass of total cementitious materials to CSA A3001.
- .3 Water: to CSA A23.1.
- .4 Aggregates: to CSA A23.1/A23.2.
- .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C 260.

.2 Chemical admixture: to ASTM C 494 ASTM C 1017.
Departmental Representative DCC Representative
Consultant to approve accelerating or set retarding
admixtures during cold and hot weather placing.

.3 Viscosity-modifying agent (VMA): to
manufacturers requirements. To be compatible with mix
requirements to produce self-consolidating concrete.

.6 Shrinkage compensating grout: premixed compound
consisting of non-metallic aggregate, Portland cement,
water reducing and plasticizing agents to CSA
A23.1/A23.2.

.1 Compressive strength: as per mix 3 and 4 below.

.2 Net shrinkage at 28 days: maximum 0 %.

2.4 MIXES

.1 Alternative 1 - Performance Method for specifying
concrete: to meet Departmental Representative
performance criteria to CSA A23.1/A23.2.

.1 Ensure concrete supplier meets performance
criteria as established below and provide verification
of compliance as in Quality Control Plan.

.2 Provide concrete mix to meet following
requirements:

Mix 1.

1. Structural concrete for manhole infill.
2. Class of exposure class C-1.
3. Cement type GU.
4. Minimum compressive strength at 28 days
35 Mpa.
5. Max w/c ratio .4
6. Coarse aggregate 20mm
7. Slump 50 mm to 100mm.
8. Air 5% to 8%.

Mix 2.

1. Concrete fill for bulk filling crawl
space.
2. Cement type GU.
3. Minimum compressive strength at 28 days
4 Mpa.
4. Self-consolidating mix.
5. Air 4% to 7%.
6. Pump able mix.

Mix 3.

1. Non shrink grout for filling void above
concrete fill.
2. Grout: non-shrink pave mixed compound
3. Aggregate & non metallic.
4. Minimum compressive strength at 28 days
4MPA.
5. Water reducing and plastic zinc agents
to provide a pourable, injectable
consistency.

Mix 4.

1. Non shrink grout for grouting dowels
2. Premixed, non-metallic, non-shrink pouring consistency MPH minimal compressive strength at 28 days 40 MPA.
3. Provide quality management plan to ensure verification of concrete quality to specified performance.
4. Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Inlet holes shall be situated at the lowest point of the repair patch or a horizontal face where applicable.
- .5 Pumping of concrete is permitted only after approval of equipment and mix.
- .6 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .7 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with shrinkage compensating grout to anchor and hold dowels in positions as indicated.

- .10 Do not place load upon new concrete until authorized by Departmental Representative.

3.2
Pressure Grouting

- .1 Grout produced shall be thixotropic with a minimum flow rate of twenty (20) seconds.
- .2 Base rate fill is to be clean, sound and water saturated prior to injection of grout material.
- .3 The non-shrink grout shall be mixed in a mortar mixture of appropriate capacity to produce the volumes required. Mixing should be allowed to continue at least five minutes after all ingredients are in the mixer. Comply with all manufacturer's written specifications.
- .4 Pump fluid grout into area through inlets provided until area is completely filled.
- .5 Pumping equipment to be able to produce pressure recommended by manufacturer.
- .6 Vibrate while pumping.

3.3
INSTALLATION/
APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Use 25 mm thick joint filler to separate concrete fill from vertical surfaces and extend joint filler from bottom to top of finished concrete surface unless indicated otherwise.

3.4 FIELD QUALITY
CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 7 and 28 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
- .3 Departmental Representative will pay for costs of tests.
- .4 Take additional test cylinders during cold weather

concreting. Cure cylinders on job site under same conditions as concrete which they represent.

- .5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .6 Inspection by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.