

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 Fly ash:
 - .1 Type F - with CaO content less than 15%.
 - .2 Type CI - with CaO content ranging from 15 to 20%.
 - .3 Type CH - with CaO greater than 20%.
 - .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C 260/C 260M Rev. A-10(R2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C 309-11(R2015), Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C 494/C 494M-16, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C 1017/C 1017M-1307R, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM D 412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .6 ASTM D 624-00(R2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .3 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
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| <u>1.1 REFERENCES
(Cont'd)</u> | .2 | Reference Standards: (Cont'd) |
| | .4 | CSA International |
| | .1 | CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete. |
| | .2 | CSA A283-06 (R2016), Qualification Code for Concrete Testing Laboratories. |
| | .3 | CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005). |
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<u>1.2 ADMINISTRATIVE REQUIREMENTS</u> |
.1 |
Pre-installation Meetings: in accordance with Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart, convene pre-installation meeting one week prior to beginning concrete works. |
| | .1 | Ensure key personnel, site supervisor, Departmental Representative speciality contractor - finishing, forming, concrete producer and testing laboratories attend. |
| | .1 | Verify project requirements. |
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<u>1.3 ACTION AND INFORMATIONAL SUBMITTALS</u> |
.1 |
Provide submittals in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Provide testing and 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. |
| | .3 | 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. |
| | .4 | Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching. |
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1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .5 Sustainable Design Submittals:
 - .1 LEED Canada-NC Version 1.0 Submittals:
in accordance with Section 01 35 21 - LEED
Requirements.
- .6 Provide two copies of WHMIS MSDS in
accordance with Section 01 35 29.06 - Health
and Safety Requirements and Section 01 35 43
- Environmental Procedures.

1.4 QUALITY
ASSURANCE

- .1 Quality Assurance: in accordance with Section
01 45 00 - Quality Control.
- .2 Provide Departmental Representative, minimum
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 Minimum 4 weeks prior to starting concrete
work, provide proposed quality control
procedures for review by Departmental
Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
 - .8 Fly ash.
- .4 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.
- .5 Sustainability Standards Certification:
 - .1 Construction Waste Management: provide
copy of plan.
 - .2 Recycled Content: 10%.
 - .1 Provide listing of recycled content
products used, including details of

1.4 QUALITY
ASSURANCE
(Cont'd)

.5 (Cont'd)

.2 Recycled Content: (Cont'd)

.1 (Cont'd)

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 120 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 Deviations to be submitted for review by Departmental Representative.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.2 Packaging Waste Management: remove for reuse or return of pallets, crates, padding, banding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.

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.
.1 Recycled content: 10% in accordance with Section 01 35 21 - LEED Requirements.
.2 Reduction in cement from Base Mix to Actual Supplementary Cementing Materials (SCMs) Mix, as percentage.
- .2 Blended hydraulic cement: Type GUb to CSA A3001.
- .3 Portland-limestone cement: Type GUL to CSA A23.1.
- .4 Supplementary cementing materials: minimum 20% fly ash by mass of cementitious materials to CSA A3001:
.1 Type F fly ash for freeze/thaw application.
.2 Type C fly ash for interior application.
- .5 Water: to CSA A23.1.
- .6 Aggregates: to CSA A23.1/A23.2.
- .7 Admixtures:
.1 Air entraining admixture: to ASTM C 260.
.2 Chemical admixture: to ASTM C 494 and ASTM C 1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.3 MATERIALS
(Cont'd)

- .8 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 40 MPa at 28 days.
- .9 Curing compound: to CSA A23.1/A23.2 white and ASTM C 309, Type 1-chlorinated rubber Typel-D with fugitive dye.
- .10 Hydrophilic waterstops: bentonite strip applied complete with adhesive. Install as per manufacturer's instructions. Submit product data for review.
- .11 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D 1751.
- .12 Polyethylene film: 6 mil thickness to CAN/CGSB-51.34.

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 plastic state requirements:
 - .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure:
 - .1 N for footings and interior exposure.
 - .2 F-2 for all exposed to exterior.
 - .2 Compressive strength at 28 day age: 30 Mpa minimum.
 - .3 Aggregate size 20 mm maximum.
 - .4 Minimum 20% fly ash:
 - .1 Type F for freeze/thaw applications.
 - .2 Type C for interior applications.

- 2.4 MIXES
(Cont'd)
- .1 (Cont'd)
 - .3 (Cont'd)
 - .5 Maximum water to cement ratio:
0.45.
 - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .5 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 Pumping of concrete is permitted only after approval of equipment and mix.
 - .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
 - .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
 - .7 Protect previous Work from staining.
 - .8 Clean and remove stains prior to application for concrete finishes.
 - .9 Maintain accurate records of poured concrete items to indicate date, location of pour,

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- 3.1 PREPARATION .9 (Cont'd)
(Cont'd)
- .10 Do not place load upon new concrete until authorized by Departmental Representative.
- 3.2 INSTALLATION/ .1 Do cast-in-place concrete work to CSA
APPLICATION A23.1/A23.2.
- .2 Sleeves and inserts:
- .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
- .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
- .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
- .5 Confirm 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 Anchor bolts:
- .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
- .2 Grout anchor bolts in preformed holes after receipt of written approval from Departmental Representative.
- .1 Formed holes: 100 mm minimum diameter.
- .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
- .4 Set bolts and fill holes with shrinkage compensating grout.
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3.2 INSTALLATION/
APPLICATION
(Cont'd)

- .3 Anchor bolts: (Cont'd)
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
 - .4 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
 - .5 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
 - .4 Wet cure using polyethylene sheets placed over sufficiently hardened concrete to prevent damage. Overlap adjacent edges 150 mm and tightly seal. Weigh sheets down to maintain close contact with concrete during the entire curing period.
 - .5 Finish concrete floor to CSA A23.1/A23.2 and Section 03 35 05 - Concrete Floor Hardner. Saw cut control joints to CAN/CSA A23.1, 24 hours maximum after placing. Control joint locations as indicated on the drawings.
 - .6 Waterstops:
 - .1 Install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in way as to hamper performance.
 - .3 Do not displace reinforcement when installing waterstops.
 - .4 Use equipment to manufacturer's requirements to field splice waterstops.
 - .5 Tie waterstops rigidly in place.
 - .6 Use only straight heat sealed butt joints in field.
 - .7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.
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3.2 INSTALLATION/
APPLICATION
(Cont'd)

- .7 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form isolation and construction joints as indicated.
 - .4 Install joint filler.
 - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .8 Under slab vapour retarder: to Section 07 26 00 - Vapour Retarders.

3.3 SURFACE
TOLERANCE

- .1 Concrete tolerance to CSA A23.1 Straightedge Method, FF =25: FL = 20.

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 approved by Departmental Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.

- 3.4 FIELD QUALITY CONTROL
(Cont'd)
- .4 Contractor will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
 - .5 Contractor will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
 - .6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
 - .7 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
- 3.5 CLEANING
- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.
 - .1 Materials and Resources Credit MRc2.2 Construction Waste Management: Divert 75% from Landfill: prepare Construction Waste Management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
 - .3 Provide appropriate area on job site where concrete trucks and be safely washed.
 - .4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.
 - .5 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
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3.5 CLEANING
(Cont'd)

- .2 Waste Management: (Cont'd)
- .6 Prevent admixtures and additive materials from entering drinking water supplies or streams.
 - .7 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.
 - .8 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.