

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction.
- .2 CSA-A23.1-04/A23.2-04, Methods of Test for Concrete.

1.3 SAMPLES

- .1 At least 4 weeks prior to commencing work, inform Departmental Representative of proposed source of aggregates and provide access for sampling.

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/A23.2.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1/A23.2.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with the Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Use trigger operated spray nozzles for water hoses.
 - .3 Designate a cleaning area for tools to limit water use and runoff.
 - .4 Carefully coordinate the specified concrete work with weather conditions.
 - .5 Ensure emptied containers are sealed and stored safely for disposal away from
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children.

- .6 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
- .7 Choose least harmful, appropriate cleaning method which will perform adequately.

1.6 DESIGN REQUIREMENTS

- .1 Alternative 1 - performance; in accordance with CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

1.7 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 4 weeks prior to commencing work, inform Departmental Representative of proposed source of aggregates and provide access for sampling.

1.8 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 – Testing and Quality Control.
 - .2 Submit to Departmental Representative, minimum four weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
 - .3 Minimum 4 weeks prior to starting concrete work, submit 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.
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- .4 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .5 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.9 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 Departmental 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Portland cement: Type GU to CSA-A23.1/A23.2.
 - .2 Supplementary cementing materials: with minimum 25% Type F fly ash replacement by mass of total cementitious material to CAN/CSA A3001.
 - .3 Water: to CSA-A23.1/A23.2.
 - .4 Aggregates: to CSA-A23.1/A23.2.
 - .5 Air entraining admixture: to CSA-A23.1/A23.2. Add air entraining agent to all mixes as indicated.
 - .6 Chemical admixtures: to CSA-A23.1/A23.2, clause 6.3. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
 - .7 Concrete shall have a unit weight of 2350 kg/m³.
 - .8 Concrete retarder: to ASTM C494/C494M-08. Do not allow moisture of any kind to come in contact with the retarder film.
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- .9 Joint Sealant: acceptable products include:
 - .1 For Horizontal Joints: self-leveling sealant.
 - .2 for Vertical Joints: non-sag elastomeric sealant.
- .10 Concrete floor sealer: as per Section 03 35 00 - Concrete Finishing.
- .11 Saw cut joint filler: light reflective, two component, semi-rigid epoxy-only filler with a shore A hardness at 28 days of greater than or equal to 90, per ASTM D22.40.
- .12 Curing compound: to CSA-A23.1/A23.2 white.
 - .1 Curing compound to be compatible with applied finish on concrete.
 - .2 Select low VOC, water-based curing compounds.
- .13 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .14 Premoulded joint fillers:
 - .1 Bituminous impregnated fiberboard: to ASTM D1751.

2.2 MIXES

- .1 Proportion normal density concrete in accordance with. CSA-A23.1/A23.2.
- .2 All concrete shall conform to the following requirements unless noted otherwise herein.
 - .1 Mix 1 for footings, foundation walls and slab on grade.
 - .1 Type GU Portland cement.
 - .2 Minimum compressive strength at 28 days, 30 MPa.
 - .3 Exposure classification: F-2.
 - .4 Nominal size of coarse aggregate 20mm.
 - .5 Slump at time and point of discharge: to CSA-A23.1-04/A23.2-04, not to exceed 80 mm before addition of plasticizer. Add plasticizer as required to achieve workability for ease of concrete placement.
 - .6 Air content: maximum 3% for concrete involving hardener as per floor hardener manufacturer and 4 to 7% otherwise.
 - .7 Chemical admixtures: in accordance with CAN3-A266.4.
 - .8 Super plasticizing admixture shall not be used without prior authorization of Departmental Representative.
 - .2 Mix 2 for exterior sidewalks, exterior transformer pad, aprons and concrete pavement.
 - .1 Type GU Portland cement.
 - .2 Minimum compressive strength at 28 days, 35 MPa.
 - .3 Exposure classification: C-1.
 - .4 Nominal size of course aggregate 20mm.

- .5 Slump at time and point of discharge: to CSA-A23.1-04/A23.2-04, not to exceed 80mm.
 - .6 Air content: 5 to 8%.
 - .7 Chemical admixtures: in accordance with CAN3-A266.4.
- .3 In sufficient time before placement, the Contractor shall submit the concrete mix designs to the Departmental Representative for approval. No concrete shall be placed before the design is approved.
 - .4 Obtain the Departmental Representative's approval before using chemical admixtures other than those specified.
 - .5 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .6 Use of Calcium Chloride not permitted.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
 - .2 Pumping of concrete is permitted only after approval of equipment and mix.
 - .3 Secure in position reinforcing steel, embedded parts, dowels etc. prior to placing concrete and ensure these are not disturbed during concrete placement.
 - .4 Do not place slab on grade concrete until all buried services have been installed, tested, and their locations documented.
 - .5 Secure in position anchor bolts and dowels during placement of concrete. Place anchor bolts with templates.
 - .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 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
 - .8 Do not place load upon new concrete until authorized by Departmental Representative.
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- .9 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilities placing with minimum of rehandling, and without damage to existing structure or work.
- .10 Ensure that reinforcement and formwork are thoroughly clean before placing.
- .11 Place concrete in the dry.
- .12 Place footings on undisturbed soil or engineered fill or bedrock having a minimum bearing capacity of 225 kPa (ULS) and 150 kPa (SLS) with an allowable settlement under SLS of 25mm. A Geotechnical Engineer registered or licensed to practice in the Province of Newfoundland and Labrador shall confirm bearing capacity in writing prior to the placement of concrete.
- .13 All dowels shall be placed before concrete footings are poured.
- .14 All exterior footings shall be founded minimum 1.2 m below finished exterior grade. Footings founded on bedrock may be located less than 1.2m below finished grade at a depth determined by and under the direction of a Geotechnical Engineer registered or licensed to practice in the Province of Newfoundland and Labrador.
- .15 Maintain adequate frost protection to all soils under footings and slab on grade for entire duration of work.
- .16 Protect previous work from staining.
- .17 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with. CSA-A23.1/A23.2.
 - .2 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through wall and pilasters, 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. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Departmental Representative.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If
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- inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.
- .4 Check locations and sizes of sleeves and openings shown on drawings.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Saw cut control joints.
- .1 Saw cut by soft-cut method as early as practicable or alternatively use the wet method, no sooner than twelve (12) hours and no later than twenty-four (24) hours after concrete placement. Ensure that reinforcements and work of other sections are located below cutting line.
 - .2 Chalk used for chalk-lining sawcuts shall not be red, blue or any colour with a dye that would stain the floor. Use white or light grey chalk only.
- .4 Joint fillers.
- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .2 Locate and form isolation, construction, expansion joints as indicated. Install joint filler.
 - .3 Use joint filler to separate slab-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise. Fill top 12 mm with joint sealant as specified.
 - .4 Saw cut joint filler. All interior control and construction joints in slab on grade joint filler as specified in Part 2 - Materials. Wait as long as possible after placing slab on grade to fill saw cut joints prior to occupancy. Clean all dust and debris from the saw cuts and the immediate area. Over fill saw cuts full depth with the specified joint filler. Once the joint filler has hardened sufficiently, cut joint filler flush with slab surface.
- .5 Dampproof membrane.
- .1 Install dampproof membrane under concrete slab-on-grade inside building.
 - .2 Lap dampproof membrane minimum 150 mm at joints and seal.
 - .3 Seal punctures in dampproof membrane before placing concrete. Use patching material at least 150 mm larger than puncture and seal.
 - .4 Seal all pipe and conduit penetrations through the membrane.
 - .5 Seal to inside of concrete foundation walls and concrete pits.
- .6 Anchor bolts.
- .1 Install anchor bolts, as detailed on the structural drawings, complete with nuts, washers and bolts.
 - .2 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
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- .7 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .8 Concrete shall not be placed on or against any surface (including rebar) that is at a temperature below 5°C.
- .9 Concrete at time of deposit shall be between 10°C and 30°C.
- .10 Pour concrete continuously between predetermined construction and control joints.
- .11 Locate construction joints in wall and footings so as to least impair the strength of the structure and to the Departmental Representative's approval. Construction joints shall be keyed and 15 M dowels x 1070 long at 600 c/c shall be added. Reinforcing shall not be interrupted.
- .12 Carry out winter concreting in strict accordance with. CSA-A23.1/A23.2.

3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Departmental Representative in accordance with CSA-A23.1/A23.2. The cost of the inspection and testing to be borne by Departmental Representative.
- .2 For compressive strength testing of concrete a minimum of 3 cylinders and 2 field cured cylinders are required for:
 - .1 Each day's pour.
 - .2 Each type of grade of concrete.
 - .3 Each change of supplier.
 - .4 Each 40 cubic meter or fraction thereof for footings and foundation walls.
 - .5 Additional test specimen shall be taken whenever requested by the Departmental Representative to verify the concrete quality.
- .3 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.1/A23.2.
- .4 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for Departmental Representative's approval.
 - .1 Uniform finishes.
 - .2 Cold weather concreting.
 - .3 Hot weather protection.
 - .4 Curing.
 - .5 Concrete finishing for slab-on-grade.

3.4 CONCRETE COVER OVER REINFORCEMENT

- .1 Ensure reinforcement steel is placed to specified tolerances.
- .2 Concrete cover around reinforcing steel shall be as follows unless noted on drawings:
 - .1 Surfaces placed against soil 75 mm.
 - .2 Pilasters (to vertical bars) 50 mm.
 - .3 Walls and grade beams 40 mm.
 - .4 Suspended slab: top = 20 mm. Bottom = 25 mm.
 - .5 Slab on grade, top = 75 mm. Bottom = 40 mm.
- .3 The preceding clear covers to be maintained within 5 mm.
- .4 Provide continuous supervision during the placement of concrete to ensure that the reinforcing steel is maintained in its correct position.

3.5 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1/A23.2.
- .2 Finish concrete in accordance with Section 03 35 00 - Concrete Finishing, concrete finishing to tolerances specified therein.

3.6 CURING

- .1 Cure concrete in accordance with CSA-A23.1/A23.2.
- .2 Ensure that freshly placed concrete is protected from freezing, dehydration, mechanical shock and contact with injurious substances.
- .3 Use curing compounds compatible with applied finish on concrete.
- .4 The concrete shall be protected from premature drying and extremes of temperature, and shall be cured at a temperature of at least 10°C for a minimum period of 3 days.
- .5 Concrete slab-on-grade shall undergo a five (5) day water cure. Water cure shall be done in accordance with CSA-A23.1/A23.2 and shall be done by:
 - .1 Non-staining absorptive mat or fabric keep continuously wet.
 - .2 Additionally, curing mats shall be thoroughly wet when applied and kept continuously wet in intimate contact with the concrete surface for the duration of the moist curing period. Mats shall be long enough to cover the entire width and edges of the concrete and lapped at joint to prevent

- drying between adjacent sheets. Mats shall be applied to concrete immediately after disappearance of surface water sheen after the final finishing pass.
- .3 End laps shall be at least 75 mm (3") and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - .4 Remove curing cover and allow concrete to air dry for at least twelve (12) hours prior to applying liquid densifier/ sealer.
 - .6 Foot traffic shall be kept off curing concrete for 1 day.
 - .7 Vehicles shall be kept off concrete for 7 days.
 - .8 Do not use curing compounds that would have a detrimental effect on bonding, adhesion, curing, appearance, or similar qualities of materials applied to concrete surfaces. Use only moisture curing for surfaces where finishes are incompatible with curing compound.
 - .9 Apply floor sealer as per Section 03 35 00 - Concrete Finishing.

3.7 DEFECTIVE WORK

- .1 Repairs and classification of unacceptable concrete to be in accordance with CSA-A23.1/A23.2.
 - .2 Remove defective concrete and embedded debris and repair as directed by Departmental Representative.
 - .3 Excessive honeycomb or embedded debris in any concrete shall deem it defective. Remove and replace defective concrete.
 - .4 Remove to bare concrete curing compounds detrimental to application of specified finishes.
 - .5 Concrete to be supplied at the minimum strength requirement at 28 days. Tests indicating strengths lower than specified will necessitate further testing as required by the Departmental Representative. Cost for such testing to be at the Contractor's expense. Should further tests confirm low values, the Departmental Representative has the right to require strengthening of the affected area or removal and replacing of the weak concrete all to the Contractor's expense.
 - .6 Repair all shrinkage cracks in the completed slabs-on-grade employing a suitable epoxy injection technique acceptable to Departmental Representative to
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completely seal all such cracks.

3.8 TOLERANCES

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2.
- .2 Concrete floor tolerances as per Section 03 35 00 - Concrete Finishing.