This specification outlines the requirements for the supply and placement of cast-in-place concrete.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

C260/260M	Standard Specification for Air-Entraining Admixtures for Concrete
C332	Standard Specification for Lightweight Aggregates for Insulating Concrete
C494/C494M	Standard Specification for Chemical Admixtures for Concrete
D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension, Die “C” Method
D624	Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers, Die “B” Method
D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D1752	Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

Canadian General Standards Board (CGSB)

37.2	Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings
51.34	Vapour Barrier, Polyethylene Sheet for Use in Building Construction

CSA Group

A23.1/A23.2	Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete
~~A283~~	~~Qualification Code for Concrete Testing Laboratories~~
A3001	Cementitious Materials for Use in Concrete

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Others

Atlantic Concrete Association (ACA)

PART 2 GENERAL

2.1 ADMINISTRATIVE REQUIREMENTS

.1 Preinstallation Meetings: in accordance with Section 01200 - Project Meetings, convene preinstallation meeting one (1) week before beginning concrete works.

.1 Ensure key personnel, site supervisor, the Owner, the Owner's Representative, and any required specialty contractor – finishing or forming attend.

.1 Verify project requirements.

~~2.1~~2.2 SUBMITTALS

.1 At least four (4) weeks prior to commencing work, inform Owner of proposed source of aggregates and provide access for sampling.

.2 Submit testing results and reports for review by Owner and do not proceed without written approval when deviations from mix design or parameters are found.

.3 Certificates:

.1 Minimum four (4) weeks prior to starting concrete work submit to Owner manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:

.1 Portland cement.
.2 Blended hydraulic cement.
.3 Supplementary cementing materials.
.4 Grout.
.5 Admixtures.
.6 Aggregates.
.7 Water.
.8 Waterstops.
.9 Waterstop joints.
.10 Joint filler.

.2 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.

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

.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 Field Quality Control of this specification section.

.5 Concrete hauling time: provide for review by Owner deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.

~~2.2~~2.3 SOURCE QUALITY CONTROL

.1 Have all concrete produced and delivered by a ready-mix plant that is a member of the Atlantic Concrete Association (ACA) and holds a current "Certificate of Ready Mixed Concrete Production Facilities" issued by the Association. Submit a copy of this certificate to the Owner for approval.

~~2.3~~2.4 QUALITY ASSURANCE

.1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 01400 – Quality Control & Testing Laboratory Services for Owner approval of the ~~for~~ following items:

.1 Falsework erection.
.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.

~~2.4~~2.5 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 Owner and concrete producer as described in CSA A23.1/A23.2.
.2 Deviations to be submitted for review by Owner.
.3 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.2 Waste Management and Disposal:

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.1 Divert unused concrete materials from landfill to local facility approved by Owner.
.2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
.3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Owner.
.4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
.5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial and National regulations.

~~2.5~~2.6 SITE CONDITIONS

.1 Placing concrete during rain or weather events that could damage concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.
.2 Use such equipment when ambient temperature below 5 °C, or when temperature may fall below 5 °C before concrete cured.
.3 Placing concrete upon or against surface at temperature below 5 °C is prohibited.

.4 Hot weather protection:

.1 Protect concrete from direct sunlight when ambient temperature above 27 °C.
.2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.

.5 Protect from drying.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Portland cement in accordance with CSA A3001.

.2 Blended hydraulic cement in accordance with CSA A3001.

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.3 Portland-limestone cement in accordance with CSA A3001

.4 Cementitious hydraulic slag as a Supplementary Cementitious Material (SCM) in accordance with CSA A3001.

.5 Water in accordance with CSA A23.1.

.6 Aggregates in accordance with CSA A23.1/A23.2.

.7 Coarse aggregates to be normal density to CSA A23.1/A23.2.

.8 Low density aggregate for insulating concrete in accordance with CSA A23.1/A23.2 and ASTM C332 group I or group II.

.9 Air entraining admixture in accordance with ASTM C260/260M.

.10 Chemical admixtures in accordance with ASTM C494/494M water reducing type WRA. The Owner to approve accelerating or set retarding admixtures during cold and hot weather placing.

.11 Superplasticing admixtures in accordance with ASTM C494/494M.

.12 Shrinkage compensating grout: premixed compound consisting of metallic or non-metallic aggregate as specified, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2, of pouring consistency, capable of developing compressive strength as specified and with~~,~~ net shrinkage as specified.

.13 Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compression strength as specified.

.14 Post-Tensioning ducts in accordance with CSA A23.1/A23.2.

.15 Curing compound in accordance with CSA A23.1/A23.2.

.16 Ribbed water stops: extruded PVC of sizes indicated with shop welded corner and intersecting pieces with legs not less than 500 mm long.

.1 Tensile strength: to ASTM D412 Die "C" method, minimum 11.4 MPa.

.2 Elongation: to ASTM D412, Die "C" method, minimum 275 %.

.3 Tear resistance: to ASTM D624, Die "B" method, minimum 48 kN/m.

.17 Labyrinth waterstops: extruded PVC of sizes indicated with shop welded corner and intersecting pieces with legs not less than 500 mm long:

.1 Tensile strength in accordance with ASTM D412, Die "C" method, minimum 8.3 MPa.

.2 Elongation in accordance with ASTM D412, Die "C" method, minimum 250 %.

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.3 Tear resistance in accordance with ASTM D624, Die "B" method, minimum 30 kN/m.

.18 Pre-moulded joint fillers:

.1 Bituminous impregnated fibreboard in accordance with ASTM D1751.
.2 Sponge rubber in accordance with ASTM D1752, Type I.

.19 Weep hole tubes: purpose made plastic.

.20 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.

.21 Membrane adhesive: as recommended by membrane manufacturer.

.22 Dampproof membrane:

.1 Kraft/polyethylene membrane:

.1 Plain: polyethylene film of specified thickness, bonded to asphalt treated creped kraft.
.2 Reinforced: two polyethylene films of specified thickness, bonded each side of asphalt treated creped kraft paper, reinforced with 13 x 13 mm fibreglass scrim.
.3 Membrane adhesive: as recommended by membrane manufacturer.

.2 Bitumen impregnated protection board as specified.
.3 Cavity drainage board as specified.

.23 Damp proofing: emulsified asphalt, mineral colloid type, unfilled in accordance with CGSB 37.2.

.24 Polyethylene film in accordance with CGSB 51.34 and to thickness specified.

.25 Concrete Bonding Agents as specified.

3.2 MIXES

.1 Proportion normal density concrete in accordance with CSA-A23.1/A23.2.

.1 Cement:

.1 Type GU Portland cement.
.2 Minimum compressive strength at 28 days: for structural design.
.3 Minimum cement content: 300 kg/m3 of concrete.
.4 Class of exposure: N.
.5 Nominal size of coarse aggregate: 20 mm.
.6 Slump at time and point of discharge: 75 to 100 mm.

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.7 Air content: 5 to 8 % except for pile concrete, levelling, mass and tremie concrete which shall be 4 to 7%.

.8 Chemical admixtures: admixtures in accordance with ASTM C494/C494M.

.9 Cast-in-place concrete exposed to de-icing chemicals or sea water shall be in accordance with the appropriate exposure conditions of Table 8, CSA A23.1/A23.2

PART 4 EXECUTION

4.1 PREPARATION

.1 Obtain the Owner's approval before placing concrete. The Contractor should provide a minimum of 24 hours notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 3200 – Concrete Reinforcement.

~~.2~~.3 Install polyethylene film as indicated and per manufacturer's instructions.

~~.3~~.4 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitate placing with minimum of re-handling, and without damage to existing structure or Work.

~~.4~~.5 Pumping of concrete is permitted only after approval of equipment and mix.

~~.5~~.6 Ensure reinforcement and inserts are not disturbed during concrete placement.

~~.6~~.7 Prior to placing of concrete obtain the Owner's approval of proposed method for protection of concrete during placing and curing in adverse weather.

~~.7~~.8 Protect previous Work from staining.

~~.8~~.9 Clean and remove stains prior to application for concrete finishes.

~~.9~~.10 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air content, temperature and test samples taken.

~~.10~~.11 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels and pack solidly with non-shrink grout to positively position and anchor dowels.

~~.11~~.12 Do not place load upon new concrete until the specified compressive strength is attained and as authorized by the Owner.

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4.2 INSTALLATION / APPLICATION

.1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2

.2 Sleeves and inserts:

.1 Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated on structural or civil drawings must be approved by the Owner.

.2 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where expressly detailed on structural or civil drawings or approved by the Owner.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Owner before placing of concrete.

.4 Check locations and sizes of sleeves and openings shown on structural and civil drawings with architectural, mechanical and electrical drawings.

.5 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 under supervision of appropriate trade prior to placing concrete.

.2 With the Owner's approval, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used or to manufacturer’s recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with non-shrink grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to temperature at time of erection.

.4 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03100 – Concrete Formwork and Falsework. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Dovetail anchor slots:

.1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.

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.2 Install continuous vertical anchor slots at 800 mm o.c. where concrete walls are masonry faced.

.6 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

~~.6~~.7 Grout underside of steel column and beam bearing plates with non-shrinking grout to manufacturer's instructions or dry packing. Place grout to cover steel shims left in place.

~~.7~~.8 Finishing and curing:

.1 Finish concrete in accordance with CSA A23.1/A23.2.

.2 Use procedures noted in CSA A23.1/A23.2 or as reviewed by Owner to remove excess bleed water. Ensure surface is not damaged.

.3 Cure concrete in accordance with CSA A23.1/A23.2. If required, use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete as specified. Provide written declaration of compatibility of compounds used.

.4 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise detailed.

.5 All concrete surfaces, unless specified otherwise, that will be visible on completion of the work shall be rubbed finish.

.6 The Contractor shall take special care during the planning, forming, concrete placing, curing, and stripping phases to ensure defect-free surfaces. Should remedial measures be required, they shall be carried out by personnel expert in this aspect of concrete work.

.7 The surface shall be uniform in colour and texture when viewed from a distance of 15 m.

.8 Rubbed Finish

.1 Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those that are not to be exposed or are not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycombs, spots, broken corners or edges and other defects shall be cut back to sound concrete and thoroughly cleaned. No feather edging is permissible. If reinforcing steel is exposed, concrete shall be cut back for at least 50 mm around the reinforcement.

.2 After having been kept saturated with water for a period of not less than three (3) hours, the cavities shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in the proportions used in the grade of the concrete being finished or an approved product. The mortar

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patches shall be placed and cured as specified by the manufacturer. No mortar shall be placed when the air temperature is forecasted to fall below 5 °C within 24 hours. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges. The resulting surfaces shall be true and uniform.

.3 After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. However, before starting this work the concrete shall be kept thoroughly saturated with water for a minimum period of three (3) hours but sufficient time shall have elapsed before the wetting down to allow the mortar used in the pointing of rod holes and defects to thoroughly set. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone.

.4 When insufficient cement paste can be drawn from the concrete from rubbing, use a small amount of mortar on its face. The mortar shall be composed of extra cement and fine sand mixed in proportions such as to match existing concrete verified by a patch test. Rubbing shall be continued until all form marks, projections and irregularities have been removed, all voids filled, and a uniform surface has been obtained. The paste produced by this rubbing shall be left in place at this item.

.5 After all concrete above the surface being treated has been cast, the final finish shall be obtained by rubbing with a fine carborundum stone and water. This rubbing shall be continuous until the entire surface is of a smooth texture and uniform colour. After the final rubbing is completed and the surface has dried, it shall be rubbed with burlap to remove loose powder and shall be left free from all unsound patches, paste, powder and objectionable marks.

4.3 WATERSTOPS

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in such a 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.

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.6 Use only straight heat sealed butt joints in field.

.7 Use factory field welded corners and intersections unless otherwise approved by Owner.

4.4 JOINT FILLERS

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Owner.

.2 When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation and expansion 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.

4.5 DAMP PROOF MEMBRANE

.1 Install damp proof membrane under concrete slabs-on-grade inside building.

.2 Lap damp proof membrane minimum 150 mm at joints and seal.

.3 Seal punctures in damp proof membrane before placing concrete.

.4 Use patching material at least 150 mm larger than puncture and seal.

4.6 SURFACE TOLERANCE

.1 Concrete slab tolerances in accordance with CSA-A23.1/A23.2, F-number Method, FF =25, FL = 20.

.2 Finish all interior exposed concrete slabs to a tight consistent steel trowel appearance without burnishing the surface.

4.7 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Owner in accordance with CSA A23.1/A23.2, and Section 01400 - Quality Control & Testing Laboratory Services. ~~Ensure testing laboratory certified to CSA A283.~~

.2 The Owner's authorized representative will approve, and the Owner shall pay for, services of Testing Laboratory outside of this contract and as per Section 01400 - Quality Control & Testing Laboratory Services.

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.3 Owner will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete that they represent.

.4 Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.1/A23.2.

.5 Inspection or testing by Owner will not augment or replace Contractor quality control nor relieve them of their contractual responsibility.

4.8 DEFECTIVE WORK

.1 Repairs and classification of unacceptable concrete to be in accordance with CAN/CSA-A23.1.

.2 Remove defective concrete and embedded debris and repair as directed by Owner.

.3 Remove to bare concrete curing compounds detrimental to application of specified finishes.

.4 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 Owner. Cost for such testing to be at the Contractor's expense. Should further tests confirm low values, the Owner has the right to require strengthening of the affected area or removal and replacing of the weak concrete all to the Contractor's expense.

.5 Repair all shrinkage cracks in the completed slab-on-grade to remain exposed employing a suitable epoxy injection technique acceptable to Owner to completely seal all such cracks, all to the Contractor's expense.

4.9 CLEANING

.1 Clean in accordance with 01710.

.2 Divert unused concrete materials from landfill.

.3 Provide appropriate area on job site where concrete trucks can be safely washed.

.4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Departmental of Environment and Climate Change.

.5 Disposal of unused admixtures and additive materials, concrete, concrete washwater, or cleaning materials and residues into sewer systems, into lakes, streams, onto ground or in other location to pose health or environmental hazard is prohibited.

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.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 and National regulations.

PART 5 PAYMENT

5.1 MEASUREMENT FOR PAYMENT

.1 Cast-in-place concrete will be measured in cubic metres calculated from dimensions specified or authorized in writing by the Owner. Concrete placed beyond dimensions specified will not be measured.

.2 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, or piles.

.3 No deductions will be made for volume of concrete less than 0.1 m^3 in volume displaced by individual drainage openings.

.4 Cast-in-place concrete in structures where specified in the MERX Schedule of Quantities and Prices will not be measured but be paid for as a fixed price item for that structure.

.5 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.

.6 Supply and installation of anchor bolts, nuts and washers, and bolt grouting, will not be measured but considered incidental to work.

.7 Supply and installation of waterstops will be considered incidental to the work unless specified otherwise.

.8 Reinforcing steel rebar, fibreglass reinforcing and mats will not be measured and considered incidental to the work, unless otherwise specified.

.9 Concrete for pipe bedding, encasement of pipes, supports, thrust blocks and cut off walls will be measured in cubic metres within measurement limits specified.

5.2 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

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