

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-Place Concrete.
- .3 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
 - .2 CSA O86-14, Engineering Design in Wood.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O151-17, Canadian Softwood Plywood.
 - .5 CSA O153-13, Poplar Plywood.
 - .6 CSA S269.1-16, Falsework and Formwork.
- .2 Council of Forest Industries of British Columbia (COFI). COFI Exterior Plywood for Concrete Formwork.

1.3 SHOP DRAWINGS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
- .3 Submit drawings stamped and signed by a qualified Professional Engineer registered or licensed in the Province of New Brunswick.
- .4 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 30 - Health and Safety Requirements.
- .5 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework and formwork drawings.
- .6 Indicate sequence of erection and removal of formwork/falsework.
- .7 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .8 A copy of the formwork drawings shall be kept at the Contractor's work area while temporary supporting structures are under construction or use.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 01 35 29 - Health and Safety Requirements.

- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.
 - .2 Place materials defined as hazardous or toxic in designated containers.
 - .3 Divert wood materials from landfill to a recycling facility.
 - .4 Divert plastic materials from landfill to a recycling facility.
 - .5 Divert unused form release material from landfill to an official hazardous material collections site.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For unexposed surfaces, use plywood and wood formwork materials to CSA O121, CSA O151, CSA O153 and CSA O86.
 - .2 For exposed to view flat surfaces use medium density overlay plywood 19 mm thick.
- .2 Form ties: Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
- .3 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, preventing concrete from sticking to forms.
- .4 Sealant: to Section 07 92 00 - Joint Sealants.

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 framing openings not indicated on drawings.
- .3 Use of earth forms for footings and walls is not permitted.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Fabricate and erect formwork in accordance with CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2 and as indicated below.
- .7 Formwork and all supporting or bracing members shall be designed such that they will not deflect noticeably under the weight or pressure of the concrete and other loadings incidental to construction. The maximum deflection of facing materials in concrete surfaces exposed to view shall be 1/360 of the span between supporting members.

- .8 When necessary to maintain specified tolerances, the formwork shall be cambered to compensate for anticipated deflections.
- .9 Formwork for exposed concrete must be constructed with watertight joints. To prevent leakage of paste at corners and joints in the forms and against existing concrete, use gaskets or other approved means which will not mar the finished appearance of the concrete. Arrange form ties and plywood panels in a regular pattern. Submit shop drawings showing pattern of forms and form ties.
- .10 A form release agent shall be applied to all forms where the finished concrete surface is to be exposed. The release agent shall be non-staining.
- .11 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .12 Form reveals, chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .13 Build in anchors, sleeves and other inserts required to accommodate work specified in other sections.
 - .1 Ensure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .14 Clean formwork in accordance with CSA A23.1/A23.2 before placing concrete.
- .15 Inspect forms after each use. Damaged surfaces must be replaced or repaired so that no evidence of the damage is apparent in the finished concrete.

3.2 FORMWORK REMOVAL

- .1 Leave formwork in place for following minimum periods of time after placing concrete:
 - .1 1 day for footings.
 - .2 7 days for walls.
- .2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later.
- .3 Wall forms shall not be removed until concrete has achieved 15 MPa minimum strength and form removal will not damage concrete.
- .4 Re-use formwork subject to requirements of CSA A23.1.

3.3 ALLOWABLE TOLERANCES

- .1 Variations from the plumb: In the lines and surfaces of walls: - 6 mm per 3 metres, but not more than 20 mm.
- .2 Variation from the level of the grades indicated on the drawings: - 6 mm in 3 metres, but not exceed 10 mm.
- .3 Variations in the sizes and locations of sleeves, floor openings and wall openings: Plus or minus 6 mm.
- .4 Variation in the thickness of slabs and walls: Minus - 6 mm; Plus - 12 mm.

- .5 Footings: Variations in dimensions in plan: Minus - 12 mm. Plus - 50 mm. Misplacement or eccentricity: Plus or minus - 30 mm.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 30 00 - Cast-in-place Concrete.

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66(04), ACI Detailing Manual - 2004.
- .2 American National Standards Institute/American Concrete Institute (ANSI/ACI)
 - .1 ANSI/ACI 315-99, Details and Detailing of Concrete Reinforcement.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A1064/A1064-17, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .4 Canadian Standards Association (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
 - .2 CSA A23.3-14, Design of Concrete Structures.
 - .3 CSA G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
- .5 Reinforcing Steel Institute of Canada
 - .1 Reinforcing Steel Manual of Standard Practice, RSIC, Fourth Edition, 2004.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and by the Reinforcing Steel Institute of Canada.
- .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

- .4 Detail lap lengths and bar development lengths to CSA A23.3, unless otherwise indicated.
 - .1 Provide Class "B" tension lap splices unless otherwise indicated.
- .5 Quality Assurance: in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - 2.3 SOURCE QUALITY CONTROL.
 - .1 Mill Test Report: Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.
 - .2 Upon request, submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.
- .6 Each shop drawing submitted to bear the stamp and signature of a qualified Professional Engineer registered in the Province of New Brunswick.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 01 35 29 - Health and Safety Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.
 - .2 Place materials defined as hazardous or toxic in designated containers.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Reinforcing steel: carbon steel, grade 400W, deformed bars to CSA G30.18, unless indicated otherwise.
- .2 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
- .3 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2. Non-metallic where within 40 mm of exposed concrete surfaces.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2, ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, unless indicated otherwise.
- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on drawings.
- .3 Welding of reinforcement will not be permitted.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to commencing reinforcing work.
- .2 Upon request, inform Departmental Representative of proposed source of materials to be supplied.

Part 3 EXECUTION

3.1 ON-SITE STORAGE AND HANDLING

- .1 Reinforcing steel shall be handled and stored in such a manner to keep it free of dirt, mud and water.
- .2 Reinforcing steel shall be off-loaded from the truck directly onto purpose made storage racks and covered with tarp.
- .3 Clean reinforcing steel of excess rust and previously deposited concrete prior to placing concrete.

3.2 FIELD BENDING

- .1 Do not field bend reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.3 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1/A23.2.
- .2 Install, support and space reinforcement in alignment to position and clearances indicated and secure to supports.
- .3 Unless otherwise indicated, provide the following cover for reinforcing:
 - .1 75 mm - Where concrete is cast against earth.
 - .2 50 mm - 20M bars or larger.
 - .3 50 mm - Slabs-on-grade.
 - .4 40 mm - 15M bars or smaller.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Prior to placing concrete, obtain Departmental Representative's approval, in writing, of reinforcing material and placement. Use of approved chairs to support reinforcement in slabs is mandatory.

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- .6 Remove and replace reinforcement which is visibly damaged or cracked.
 - .7 Do not cut reinforcement, either before or after concrete is placed, to permit incorporation of other work.
 - .8 Do not relocate reinforcement without approval.
 - .9 Clean reinforcement before placing concrete.
 - .10 All wall dowels shall be set in footing forms prior to placing concrete and held in place by approved means so that each dowel is maintained in its correct position. Dowels shall not be inserted in freshly placed concrete.
 - .11 The Departmental Representative shall be notified when the reinforcing steel is in place and in sufficient time to permit an inspection of same prior to concrete placement. Minimum 24-hour notification required.

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.
- .3 Section 07 92 00 – Joint Sealants.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM D545-14, Standard Test Methods for preformed Expansion Joint Fillers for Concrete Construction (Non Extruding and Resilient Types).
 - .6 ASTM D1752-04a(2013), Standard Specification for preformed Sponge Rubbed Cork Expansion and Joint Fillers for Concrete Paving and Structural Construction.
 - .7 ASTM D3575-14, Standard Test Methods for Flexible Cellular Materials made from Olefin Polymers.
 - .8 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A283-06(R2016), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-13, Cementitious Materials for Use in Concrete.

1.3 DESIGN REQUIREMENTS

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

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit proposed quality control procedures for Departmental Representative's review.
- .3 Minimum two (2) weeks prior to starting concrete work, submit proposed quality control procedures for Departmental Representative's approval for following items:
 - .1 Cold and hot weather concreting.
 - .2 Temporary bracing.
 - .3 Chairs and spacers for support of reinforcing.
 - .4 Curing of concrete.
 - .5 Finishes.
 - .6 Formwork removal.

1.5 CONSTRUCTION QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out in accordance with CSA A23.1.
- .2 Testing laboratory will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .3 Non-destructive methods for testing concrete shall be in accordance with CSA A23.2.
- .4 Inspection or testing by Departmental Representative, or Testing Agency designated by Departmental Representative, will not augment or replace the Contractor's quality control nor relieve him of his contractual responsibilities.

1.6 SAMPLES

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

1.7 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Convene pre-installation meeting one week prior to beginning of concrete work.
- .3 Ensure key personnel, site supervisor, Departmental Representative, speciality contractor - finishing, forming concrete producer, and representative from testing laboratories attend.
 - .1 Verify project requirements.
- .4 Provide certification that plant, equipment and materials to be used in concrete comply

with requirements of CSA A23.1.

- .5 Provide mix designs in compliance with CSA A23.1 to provide concrete quality, yield and strength as specified under 2.2 MIXES. Mix designs to be prepared by and stamped by a qualified Professional Engineer registered or licensed in the Province of New Brunswick.
 - .1 Mix designs to be project specific.
- .6 Provide certification that the concrete supplier is certified by the Atlantic Provinces Ready Mixed Concrete Association program or equivalent. This certification is to remain in good standing for the duration of the project and until the warranty period expires.

1.8 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 with Engineer 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.
- .3 Waste Management and Disposal:
 - .1 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .2 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Departmental Representative.
 - .3 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.
 - .4 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Cement: to CAN/CSA A3001, Type GU, or Type GUb.
- .2 Supplementary cementing materials: to CAN/CSA A3001.
- .3 Water: to CSA A23.1.
- .4 Aggregates:

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- .1 To CAN/CSA A23.1/A23.2. Coarse aggregates to be normal density.
 - .2 Maximum aggregate size in footings shall be 38 mm. In walls, the maximum aggregate size shall not exceed 19 mm.

 - .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260/C260M. Air entrainment shall be used in all concrete except the floors and footings.
 - .2 Chemical admixture: to ASTM C494 and ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

 - .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 Acceptable products:
 - .1 M-Bed standard by Sika Canada Inc.
 - .2 Masterflow 713 Grout by Master Builders Technologies Ltd.
 - .3 NS Grout by Euclid Canada Inc.
 - .4 Alternate materials: Approved by addendum in accordance with Instructions to Tenderers.

 - .7 Acrylic adhesive for dowel and anchor rod anchorage: to ASTM C881, Type IV, Grade 3, Class A, B and C.
 - .1 Acceptable products:
 - .1 Epcon Acrylic 7 by ITW Ramset/Red Head.
 - .2 HIT HY200 Adhesive System by HILTI.
 - .3 Acrylic-Tie-Anchoring System by Simpson Strong-tie.
 - .4 Alternate materials: Approved by addendum in accordance with Instructions to Tenderers.

 - .8 Curing compound:
 - .1 To CSA A23.1/A23.2 white and ASTM C309,
 - .2 To be white pigmented. Subject to compatibility with specified finishes, removal may be required.
 - .3 Acceptable products:
 - .1 Kurez Vox by Euclid Chemical Company.
 - .2 Sealtight 1220 White Pigmented Curing Compound by W.R. Meadows.
 - .3 Florseal by Sika Canada Inc.
 - .4 Alternate materials: Approved by addendum in accordance with Instructions to Tenderers.
 - .5 Use curing compounds compatible with applied finish on concrete surfaces. Provide written certification that compounds used are compatible.

 - .9 Premoulded joint fillers (Isolation Joints):
 - .1 Isolation Joint Filler: Closed cell foam expansion joint material. To be chemical resistant, ultraviolet stable, non-absorbent, low density.
 - .2 To be supplied with removable strip to provide a uniform sealing reservoir in the joint.
 - .3 Recovery to be 97% minimum to ASTM D545. Compressive strength to be 10 psi minimum to 25 psi maximum to ASTM D1752, Section 5.1 – 5.4. Water absorption to be less than 0.25% by volume to ASTM D3575.

2.2 MIXES

- .1 The Contractor shall be responsible for the concrete mix design.
- .2 It shall be the responsibility of the Contractor to ensure that the mixture proportions shall be properly batched, mixed, placed and cured such that the concrete conforms to the specifications.
- .3 Proportion normal density concrete in accordance with A23.1, Alternative 1, to give the following quality for concrete as indicated:
 - .1 For concrete in foundation walls:
 - .1 Type GU cement.
 - .2 Minimum compressive strength at 28 days: 30 MPa.
 - .3 Class of exposure: F-2.
 - .4 Maximum water/cement ratio: 0.45.
 - .5 Nominal maximum size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 80 mm \pm 30 mm.
 - .7 Air content: 4 to 7%.
 - .2 For concrete in footings, interior slab-on-grade, pads and bases:
 - .1 Type GU cement.
 - .2 Minimum compressive strength at 28 days: 30 MPa.
 - .3 Class of exposure: N.
 - .4 Maximum water/cement ratio: 0.45.
 - .5 Nominal maximum size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 80 mm \pm 30 mm.
 - .3 For concrete in exterior slabs:
 - .1 Type GU cement.
 - .2 Minimum compressive strength at 28 days: 35 MPa.
 - .3 Class of exposure: C-1.
 - .4 Maximum water/cement ratio: 0.40.
 - .5 Nominal maximum size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 80 mm \pm 30 mm.
 - .7 Air content: 5 to 8%.
 - .4 For concrete used in mud-slabs:
 - .1 Type GU cement.
 - .2 Compressive strength at 28 days: 15 MPa.
 - .3 Slump: 75 mm.
 - .4 Nominal size of coarse aggregate: 20 mm.

Part 3 EXECUTION

3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete.
 - .1 Provide 24 hours' 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 by Departmental Representative.
- .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 Clean and remove stains prior to application for concrete finishes.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 Do not place load upon new concrete until authorized by Departmental Representative.
- .10 Reinforcing steel, embedded parts, and inserts to be secured in position prior to placing concrete.

3.2 CONSTRUCTION

- .1 Do cast in place concrete work in accordance with CSA A23.1/A23.2.
- .2 Hot-weather and cold-weather concreting shall be carried out, protected, and cured in accordance with CSA A23.1.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Saw-cut control joints:
 - .1 Use purpose-made "early entry" concrete saws. To be Soff-cut, or approved alternate.
 - .2 Capability: Employ sufficient number of saws and workers to complete cutting sawed joints before shrinkage produces cracking.
 - .3 Start cutting sawed joints as soon as concrete has hardened sufficiently to prevent ravelling or dislodging of aggregates.
 - .4 For "early entry" saws, this will typically be from 1 hour in hot weather to 4 hours in cold weather after completing finishing of slab in that joint location.

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- .5 Saw-cut pattern to be as shown on reviewed shop drawings.
 - .6 Re-cut joints where required to provide recess dimensions indicated for joint sealant installation.
 - .7 Apply joint sealer in saw-cut joints in accordance with sealant manufacturer's written instructions.
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- .5 Cure all concrete slab-on-grade and topping surfaces by moist cure for a minimum of 7 days after placing.
 - .6 Sleeves and inserts:
 - .1 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .2 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If 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 required by non-destructive method of testing concrete.
 - .7 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
 - .8 Embedded components:
 - .1 Where approved by Departmental Representative, set embedded components as indicated or specified elsewhere.
 - .2 Do not eliminate or displace reinforcement to accommodate hardware. If embedded components cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.
 - .3 Check locations and sizes of embedded components shown on the drawings.
 - .9 Finishing and curing:
 - .1 Finish concrete in accordance with CSA A23.1/A23.2.
 - .2 Slab and floor finishes: as per CSA A23.1.
 - .1 Concrete intended as finished surface: except as specified herein, finish to produce a smooth, steel troweled surface free from ridges, trowel marks or undulations to a tolerance defined in Table 22.
 - .2 Float surface with wood or metal floats and power finishing machine and bring surface to true grade.
 - .3 Steel trowel to smooth and even surface.
 - .4 Slope floors to drains as directed by Departmental Representative.
 - .3 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.
 - .4 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: Provide written declaration that compounds used are compatible.
 - .5 Floor slabs-on-grade and precast floor topping to be moist cured for initial 7 consecutive days.

- .10 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 construction 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.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA A23.1/A23.2 and as otherwise indicated on the drawings.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Concrete strength tests.
 - .2 Slump tests.
- .2 Inspection and testing of concrete and concrete materials will be carried out in accordance with CSA A23.1/A23.2 by testing laboratory designated by Departmental Representative.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
 - .2 Submit test results to Departmental Representative as soon as test is complete.
 - .3 Ensure test results are distributed for discussion at pre-pour meeting between testing laboratory and Departmental Representative.
 - .4 Costs of tests will not be measured separately for payment but shall be included in the overall cost of the project.
 - .5 Departmental Representative 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: in accordance with CSA A23.1/A23.2.
 - .7 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
 - .8 Should the strength of concrete already poured, as shown by job cured test cylinders, fall below the required strength at 28 days, or at 7 days test fail to reach a minimum of 70% of 28 days strength, the Departmental Representative shall have the right to require changes in mixing proportions for the remainder of the work so as to attain these strengths. He shall also have the right to require additional curing of these portions of the work represented by test specimens not meeting the herein quoted strength criteria.
 - .9 Should such additional curing not produce the required strength, the Departmental Representative shall have the right to require strengthening or

replacement of the portions of work in question at no additional cost to the Owner.

- .10 The Departmental Representative reserves the right to reduce the amount of payment for all concrete which failed to meet the requirements of the drawings and this specification, where the defect is such as to permit leaving the concrete in question in place.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .2 Canadian Standards Association (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include application instructions for concrete floor treatments.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Use chemical hardeners that are non-toxic, biodegradable and have zero or low VOC's.
- .5 Dispose of surplus chemical and finishing materials in accordance with federal, provincial and municipal regulations.
- .6 Dispose of waste from stripping of floors in a manner that will not have unfavourable effects on the environment.

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting:
 - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 square metres of floor being treated.
- .2 Electrical power:
 - .1 Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
 - .1 Make the work area watertight and protected against rain and detrimental weather conditions.
- .4 Temperature:

- .1 Maintain ambient temperature of not less than 10 °C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture:
 - .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
- .6 Safety:
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
 - .1 Ventilate area of work as directed by Engineer by use of approved portable supply and exhaust fans.
 - .2 Provide continuous ventilation during and after coating application.

Part 2 PRODUCTS

2.1 EPOXY FINISH

- .1 Concrete floors to be finished to CSA A23.1 and will have two (2) coats of epoxy floor coating.
- .2 Acceptable product: STONKOTE GS4 as manufactured by STONEHARD Limited, or approved equal. Floor finish colour to be determined by Engineer.
- .3 Pipe sleeves to be sealed with STONEFLEW CJ4 by STONEHARD Limited, or approved equal.

2.2 MIXES

- .1 Mixing, ratios and application in accordance with manufacturer's instructions.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that slab, substrate or site conditions surfaces are ready to receive work and elevations are as indicated on shop drawings instructed by manufacturer.

3.2 PREPARATION OF SLAB

- .1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .2 Use strong solvent mechanical stripping to remove chlorinated rubber or existing surface coatings.
- .3 Use protective clothing, eye protection and respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

3.3 APPLICATION

- .1 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.
- .2 Apply floor treatment in accordance with manufacturer's written instructions.
- .3 Clean overspray. Clean sealant from adjacent surfaces.

3.4 PROTECTION

- .1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete
- .2 Section 07 92 00 – Joint Sealant

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
- .2 Canadian Standards Association (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 A23.3-14, Design of Concrete Structures.
 - .3 CSA A23.4-16, Precast Concrete - Materials and Construction.
 - .4 CAN/CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA A3001-13, Cementitious Materials for Use in Concrete.
 - .5 CSA G279-M1982, Steel for Prestressed Concrete Tendons.
 - .6 CSA G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .7 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
 - .8 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

1.3 QUALIFICATIONS

- .1 Both fabrication and erection of precast concrete elements to be by manufacturing plant certified in appropriate categories according to CSA A23.4.
- .2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting tender and to specifically verify as part of tender that plant is currently certified in appropriate categories: Structural, Prestressed, Architectural and Hollow-Core.
- .3 Only precast elements fabricated in such certified plants to be acceptable to Departmental Representative and plant certification to be maintained for duration of fabrication, erection until warranty expires.

1.4 DESIGN REQUIREMENTS

- .1 Design precast elements to CSA A23.3 and CSA A23.4 to carry handling stresses.
- .2 Design loads in accordance with NBCC for use and occupancy, wind, temperature and earthquake.
- .3 Consider vibration characteristics due to occupancy and wind in accordance with NBCC.
- .4 Design connections/attachments of precast elements to load/forces specified.
- .5 Provide detailed calculations and design drawings for typical precast elements and connections as described in PART 1 - 1.7 SUBMITTALS.

1.5 PERFORMANCE REQUIREMENTS

- .1 Tolerance of precast elements to CSA A23.4.

1.6 SOURCE QUALITY CONTROL

- .1 Upon request, provide Engineer with certified copies of quality control tests related to this project as specified in CSA A23.4 and CSA G279.
- .2 Inspection of prestressed concrete tendons is required in accordance with CSA G279.

1.7 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings in accordance with CSA A23.3 and CSA A23.4 and include following items:
 - .1 Design calculations for items designed by manufacturer.
 - .2 Details of prestressed and non-prestressed members, reinforcement and their connections.
 - .3 Camber.
 - .4 Finishing schedules.
 - .5 Methods of handling and erection.
 - .6 Openings, sleeves, inserts and related reinforcement.
- .3 Submit copies of detailed calculations and design drawings for typical precast elements and connections for review by Departmental Representative 4 weeks prior to manufacture.
- .4 Shop Drawings: submit drawings stamped and signed by qualified professional engineer registered or licensed in the Province of New Brunswick.
- .5 Submit samples in accordance with Section 01 33 00 - Submittal Procedures and provide sample and sample number of each finish to be used on project to Departmental Representative.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 01 35 29 Health and Safety Requirements.
- .2 Deliver, handle and store precast/prestressed units according to manufacturer's instructions.
- .3 Protect unit corners from contacting earth to prevent from staining.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 22 – Construction Demolition Waste Management.

Part 2 Products

2.1 MATERIALS

- .1 Cement, aggregates, water, admixtures: to CSA A23.1 and CSA A23.4.
- .2 Prestressing steel: Uncoated 7 wire cable conforming to CSA G279.
- .3 Reinforcing steel: to CSA G30.18.
- .4 Anchorages and couplings: to CSA A23.1.
- .5 Embedded steel: to CSA G40.21, Type 300W.
- .6 Welding materials: to CSA W48.
- .7 Bearing pads: 3 mm thick purpose-made plastic bearing strips as per precast manufacturer's recommendations.
- .8 Air entrainment admixtures: to CSA A266.1.
- .9 Chemical admixtures: to CSA A266.2.

2.2 CONCRETE MIXES

- .1 Use concrete mix designed to produce 41 MPa (6000 psi) compressive strength at 28 days with a maximum water/cement ratio to CSA A23.1, for Class D exposure.
- .2 Air entrainment of concrete mix: to CSA A266.4.
- .3 Admixtures: to CSA A266.4, CSA A266.5.
- .4 Do not use calcium chloride or products containing calcium chloride.

2.3 GROUT MIXES

- .1 Cement grout: one-part Type 10 Portland cement, 2-1/2 parts sand, sufficient water for placement and hydration.
- .2 Shrinkage compensating grout: to Section 03 30 00 - Cast-in-Place Concrete. For use in joints between panels, infilling of ends of hollow cores at openings and penetrations.

2.4 MANUFACTURE

- .1 Manufacture units in accordance with CSA A23.4.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit which will not be exposed.
- .3 Provide hardware suitable for handling elements.

Part 3 Execution

3.1 GENERAL

- .1 Do precast concrete work in accordance with CSA A23.4 and CSA A23.3.

3.2 ERECTION

- .1 Erect precast elements within allowable tolerances as indicated or specified.
- .2 Erection tolerances to be non-cumulative in accordance with CSA A23.4.
- .3 Install 3mm thick bearing strips, when bearing on concrete or masonry supports.
- .4 Set units in a tight, level position on true level bearing surface. Minimum bearing 90 mm on masonry and 75 mm on structural steel.
- .5 Fasten precast/prestressed units in place as indicated on reviewed shop drawings.
- .6 Level differential elevation of horizontal joints with grout to slope not more than 1:12.
- .7 Clean field welds with a wire brush and touch up with primer.
- .8 Field cut holes and openings up to 150mm diameter for mechanical trades. Locate in area of hollow cores between reinforcing lines. Openings larger than 150mm to be located on shop drawings at time of approval and to be formed in the plant or cut in field. Do not cut reinforcing without prior approval of the precast hollow core slab manufacturer and the Departmental Representative. Co-ordinate all required openings for mechanical and electrical services with related trades.
- .9 Close off holes at ends of hollow core slabs and where other openings into cores have been introduced. Grout closed using shrinkage compensating grout. Use purpose-made plastic dams to close off hollow cores for grouting.

- .10 All grouting operations to be performed in protected environment. Provide protection and curing as specified for concrete work in Section 03 30 00.

3.3 BONDED FLOOR TOPPING

- .1 Concrete topping for floors shall conform to the requirements of CSA A23.1. Materials, mix design, construction, curing, finishing, and tolerances shall be as specified in Section 03 30 00 - Cast-in-Place Concrete. The top surfaces of all hollow core precast planks shall be raked (roughened) for bonding of the topping, (CSP 4). Minimum topping thickness shall be as indicated on drawings.

3.4 CEILINGS

- .1 Caulk exposed ceiling longitudinal joints, using pick-proof caulking as specified under Section 07 92 00 - Joint Sealants.
- .2 Unless otherwise indicated, the underside of precast shall be finished as per CSA A23.4, STANDARD GRADE.
- .3 All formed surfaces of hollow-core planks and solid units used in exposed ceiling areas shall have a smooth surface of uniform appearance when painted. Finish to be as per CSA A23.4, FINISH GRADE B.

3.5 CLEAN-UP

- .1 Upon completion of the work of this section, all surplus material and debris shall be removed from the site.

END OF SECTION