
PART 1 – GENERAL

1.1 RELATED WORK

- .1 Division 1 – General Requirements
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .3 Section 03 20 00 – Concrete Reinforcing
- .4 Section 03 30 00 - Cast-in-Place Concrete
- .5 Section 03 35 00 – Concrete Finishing

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA O121-17, Douglas Fir Plywood.
 - .3 CSA S269.1-16, Falsework and Formwork
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM E1643-18a, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
 - .2 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- .3 Canadian General Standards Board
 - .1 CGSB 19-GP-16M, Sealing Compound, One Component, Polyurethane Base, Chemical Curing

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Division 1.
- .2 Clearly indicate method and schedule of construction, materials, and locations of temporary embedded parts. Shop drawings shall clearly indicate shoring left in place under floors as construction proceeds..
- .3 Each shop drawing submitted shall bear the stamp of a qualified Professional Engineer registered or licensed to practice in the Province of New Brunswick.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- .1 Construction Waste Management in accordance with Section 01 74 21.

1.5 QUALITY ASSURANCE

- .1 The Contractor shall be responsible for the structural design of formwork and its construction, to ensure its stability, and to support safely and resist loads imposed by weight of forms and wet concrete, equipment and workers.
- .2 Design of formwork to be performed by a structural Engineer registered or licensed to practice lawfully in the Province of New Brunswick and who is experienced in design of formwork.
- .3 The Contractor shall be responsible for the safety of the structure, both before and after removal of the forms, until the concrete has reached the specified 28 day compressive strength.
- .4 The Subcontractor responsible for formwork shall have a minimum of three years documented experience in designing and constructing formwork similar to that required for this project. The Subcontractor responsible for formwork shall submit documentation describing previously completed projects similar in scope, including project location.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Construction shall conform to requirements of Governmental Authorities and Applicable Laws including, without limitation the New Brunswick Occupational Health and Safety Act and Regulations.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Formwork lumber:
 - .1 Plywood and wood formwork materials shall be in accordance with CSA A23.1.
 - .2 Form boards shall be matched pine or spruce, dressed on three sides and in uniform widths.
 - .3 Plywood form panels: Douglas fir, minimum thickness 19 mm, to meet specified requirements of CSA O121, finished one side, fabricated specially for use as concrete form panels, with sealed edges.
- .2 Form release agent: use VOC compliant, biodegradable agent that prevents set of film of concrete in contact with form. To be non-staining, non-grain raising; suitable for type of formwork on which used; having no adverse affect on paint, adhesives, or other treatments which are specified for application to concrete; and containing no non-drying ingredients such as mineral oil.
- .3 Underslab vapour retarder and accessories:
 - .1 Provide a vapour retarder, which meets all criteria for Class A, per ASTM E-1745.
 - .2 100 mm wide seam tape approved by vapour retarder manufacturer.

PART 3 - EXECUTION

3.1 DEMOLITION

- .1 Demolish and remove slabs on grade as required to perform new work.
- .2 Demolish to clean, straight lines.
- .3 Roughen edges of slabs and apply bonding agent and dowels as shown on drawings.
- .4 Extend existing reinforcing steel and welded wire mesh 300 mm into new work.

3.2 ERECTION

- .1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with construction drawings prepared as part of this project.
- .2 Construct and remove formwork to produce finished concrete conforming to shape, dimensions, locations and levels shown on the structural drawings within the tolerances required by CSA A23.1.
- .3 On completion of formwork and reinforcing steel for each contemplated concrete placement, notify Departmental Representative so that they may review the work in advance of placing of concrete. Do not place concrete in forms until review has been completed.
- .4 Construct concrete formwork and provide sufficient bracing to safely resist concrete pressures and other construction loadings without excessive bulging, distortion or displacement.
- .5 Construction of formwork shall permit easy dismantling and stripping in order to avoid damage to concrete during formwork removal.
- .6 Obtain Departmental Representative approval before framing openings in concrete unless shown on structural drawings prepared as part of this project.
- .7 Hand-trim bottom and remove loose earth or lean concrete before placing concrete. All footings shall be founded a bearing surface with an allowable bearing capacity of 150 kPa and approved by the Departmental Representative's geotechnical consultant. Earth forms on sides will not be permitted, i.e. formwork shall extend full depth of all footings.
- .8 Install wood stringers for suspension of reinforcement in place where chairs are not utilized.
- .9 Coat formwork with form release agent before reinforcement, anchors or other accessories are placed. Do not coat plywood forms pre-coated with a chemical release agent.
- .10 Set all required embedded items. Anchor securely to formwork before placing concrete.
- .11 Leave formwork in place for a minimum of two days after placing concrete:

- .12 Take care in removing plywood forms. Use wood wedges and gradual force to pry the formwork loose from the concrete. Do not beat, jar or shake the formwork or pry with metal bars. Leave plywood forms in place as long as possible to permit maximum shrinkage away from concrete and to protect concrete surfaces.
- .13 Re-use of formwork:
 - .1 Re-use of formwork subject to requirements of CSA A23.1 and CAN/CSA S269.1.
 - .2 Re-use forms that can be repaired to original condition only. Remove nails, clean and repair surfaces and reapply specified form coating.
 - .3 Re-use forms for exposed concrete surfaces only if their surfaces are not marred in any manner, they are cleaned and retreated and their tie holes may be utilized to maintain pattern of layout.

3.3 UNDER-SLAB VAPOUR RETARDER

- .1 Ensure that subsoil is approved by Departmental Representative.
- .2 Level and tamp aggregate, sand or tamped earth base.
- .3 Install vapour retarder in accordance with manufacturer's instructions and ASTM E 1643.
- .4 Lap Vapor Retarder over footings.
- .5 Overlap joints 150 mm and seal with 100 mm wide pressure sensitive tape.
- .6 Repair damaged areas by cutting patches of vapor retarder, overlapping damage area 150 mm and taping all four sides with 100 mm wide pressure sensitive tape.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

- .1 Division 1 – General Requirements
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 03 10 00 – Concrete Forming and Accessories
- .4 Section 03 30 00 - Cast-in-Place Concrete

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A1064/A1064M-18a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- .2 Canadian Standards Association (CSA International)
 - .1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
 - .2 CSA A23.3-19, Design of Concrete Structures
 - .3 CSA G30.18-09 (R2019), Carbon Steel Bars for Concrete Reinforcement
 - .4 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 Reinforcing Steel Manual of Standard Practice, 2018

1.3 SUBMITTALS

- .1 Provide Departmental Representative with certified copy of mill test report of steel supplied, showing physical and chemical analysis prior to commencing reinforcing work.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- .1 Construction Waste Management in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.5 TEST REPORTS

- .1 Provide Departmental Representative with certified copy of mill test report of steel supplied, showing physical and chemical analysis prior to commencing reinforcing work.

1.6 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Division 1.

- .2 Clearly indicate bar sizes, spacings, location and quantities of reinforcement, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; to CSA A23.3, to Reinforcing Steel Manual of Standard Practice.
- .3 Detail placement of reinforcing where special conditions occur.
- .4 Use minimum lap lengths indicated on the structural drawings prepared as part of this project.
- .5 Each shop drawing shall bear the stamp and signature of a qualified professional Engineer registered or licensed to practice in the Province of New Brunswick.
- .6 All shop drawings and material lists are to contain a blank area measuring 70 mm high by 100 mm long located near the bottom right hand corner of the drawing or page. This area is to be reserved for the Engineer's review stamp.

1.7 SUBSTITUTES

- .1 Substitutions of different size bars are permitted only upon written approval of Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Reinforcing bars: billet steel, Grade 400W deformed bars in accordance with CAN/CSA-G30.18 unless indicated otherwise.
- .2 Weldable reinforcing steel to CAN/CSA-G30.18, Grade 400W.
- .3 Welded steel wire fabric: to ASTM A185. Provide in flat sheets only.
- .4 Chairs, bolsters, bar supports, spacers: adequate for strength and support of reinforcing construction conditions
- .5 Tie Wires: Cold-drawn annealed steel wire ties in accordance with ASTM A1064/A1064M.
- .6 Dowel Bar Splicers: Threaded splicing system, Grade 400W reinforcing steel.

2.2 FABRICATION

- .1 Fabricate reinforcing to CSA A23.1.
- .2 Fabrication tolerances for reinforcing steel in accordance with Reinforcing Steel Manual of Standard Practice.
- .3 Obtain Departmental Representative's approval for locations of reinforcement splices.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.

PART 3 - EXECUTION

3.1 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.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel in accordance with CSA A23.1 and as indicated on reviewed shop drawings.
- .2 Place and space reinforcing as indicated and support to maintain position.
- .3 Do not relocate bars without approval from Departmental Representative.
- .4 Remove and replace reinforcement which is visibly damaged or cracked.
- .5 Clean reinforcing before placing concrete.
- .6 Obtain Departmental Representative's approval of reinforcing steel and placing before placing concrete.
- .7 Obtain Departmental Representative's approval before welding reinforcing bars. Weld in accordance with CSA W186.
- .8 Place footing reinforcing steel only after bearing surface has been inspected and approved by the Departmental Representative.
- .9 Reinforce slabs on grade as detailed on the drawings.
- .10 Adjust reinforcement immediately before concrete is placed to ensure that bars are in correct position and are securely tied to maintain position.
- .11 Ensure that reinforcing steel foreman is present at all times concrete is placed to ensure that reinforcing remains in place as tied, and to take necessary remedial action.

3.3 ON-SITE STORAGE AND HANDLING

- .1 Reinforcing steel shall be handled and stored in such a manner to 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.

- .3 Any reinforcing steel which is dirty, muddy and/or rusty shall be cleaned with wire brushes and/or shot blasted to the satisfaction of the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

- .1 Division 1 – General Requirements
- .2 Section 01 74 21 - Construction/Demolition Waste Management: and Disposal
- .3 Section 03 10 00 – Concrete Forming and Accessories
- .4 Section 03 20 00 – Concrete Reinforcing
- .5 Section 03 35 00 – Concrete Finishing

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
 - .2 CAN/CSA A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
 - .3 CSA W59-18, Welded Steel Construction
 - .4 CSA G40.20-13/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel /Structural Quality Steel
 - .5 CSA S16-19, Design of Steel Structures
- .2 American Society for Testing and Materials (ASTM International)
 - .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

1.3 SUBMITTALS

- .1 Submit mixture proportions in accordance with CSA A23.1 and Clause 2.2 of this specification for review by Departmental Representative at least 72 hours prior to commencing cast-in-place concrete work. No concrete shall be placed prior to written review of the concrete mixes.
- .2 Provide certification that plant, equipment, and all materials to be used in concrete comply with the requirements of CSA A23.1.
- .3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA A23.1.
- .4 At least four weeks prior to commencing cast-in-place concrete work, inform Departmental Representative of proposed source of aggregates and SCMs, and provide access for sampling.

- .5 Provide certification that mixture proportions include preventative measures to mitigate potential expansions due to alkali aggregate reactivity in accordance with CSA A23.2.
- .6 Provide proof that the ready mixed concrete producer has a current membership with Atlantic Concrete Association as well as a current Certificate of Conformance for Concrete Production Facilities, issued by ACA.
- .7 Submit a plan for curing to the Departmental Representative for review and approval together with other tender documents. The curing plan shall be prepared in strict accordance with the requirements of CSA A23.1 including without limitation:
 - .1 Method of protecting the concrete from evaporation of surface moisture from the fresh concrete
 - .2 Type of curing material to be used
 - .3 How the surface will be kept moist and the quality control requirements for keeping the surface moist
 - .4 Time of initiation and duration of curing
 - .5 Provisions to address potential problems such as high winds, and hot and cold weather
 - .6 Limitations of access, if any, to the surfaces being cured.

1.4 SUSTAINABLE DESIGN SUBMITTALS

- .1 Construction Waste Management in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.5 AS-BUILT DRAWINGS

- .1 Maintain “As Built” conditions on record drawings for all concrete work as specified in Division 1.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Cement: Type GU in accordance with CSA A3001
- .2 Blended cement: Type GUbF in accordance with CSA A3001
- .3 Supplementary cementing materials: in accordance with CSA A3001
- .4 Water: in accordance with CSA A23.1
- .5 Fine aggregate: FA1 as per Table 10 of CSA A23.1.
- .6 Coarse aggregate: 20 to 5 mm maximum nominal size as per CSA A23.1
- .7 Air entraining admixture: in accordance with ASTM C260
- .8 Chemical admixtures: in accordance with ASTM C494/C494M

- .9 Chemical adhesive anchor system: Hilti HIT HY200, Powers AC100+ Gold, Epcon Acrylic 7 or approved equal
- .10 Welding materials: in accordance with CSA W59
- .11 Welding electrodes: E49XX

2.2 CONCRETE MIXTURES

- .1 The mixture designs shall use supplementary cementing materials (SCMs), such as fly ash, silica fume, and blast furnace slag, to reduce the cement content of the concrete unless noted otherwise.
- .2 The use of supplementary cementing materials is not permitted in slabs on grade.
- .3 Proportion normal density concrete in accordance with Alternative 1 (Performance) of CSA A23.1 for the following elements and applications:

Interior footings and slabs on grade:

- .1 Class N exposure
- .2 Compressive strength at 28 days: 25 MPa
- .3 Total air content: less than 3 percent
- .4 Slump at point of discharge into the work: 80 mm

Mud slabs and lean concrete:

- .1 Class N exposure
- .2 Compressive strength at 28 days: 15 MPa
- .3 Total air content: less than 3%
- .4 Slump at point of discharge into the work: 80 mm

2.3 ADMIXTURES

- .1 Use of admixtures subject to review by Departmental Representative.
- .2 Use only compatible admixtures.
- .3 Use of free calcium chloride and chloride bearing admixtures is not permitted.
- .4 If required, add a water reducing admixture to concrete in accordance with manufacturer's specifications. Incorporate admixture as a liquid by automatic mechanical dispenser. Reduce mix water, thereby, but do not change cement content from that required in plain mix design. Take admixtures into account when designing mix, and ensure that they are compatible with each other and with concrete accessories.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- .1 All cast-in-place concrete work shall be in accordance with CSA A23.1 and CSA A23.2 except where specified otherwise.

- .2 Hard copies of CSA A23.1 and CSA A23.2 shall be on site at all times.
- .3 Obtain Departmental Representative's approval before placing concrete. Provide 24 hours of notice to Departmental Representative prior to placing of concrete.
- .4 All concrete shall be consolidated using high frequency vibrators.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement and consolidation.
- .6 Preparations prior to placing of concrete shall include:
 - .1 Formwork completed and secured.
 - .2 Reinforcement secured in place.
 - .3 All embedded items accurately located and held in position.
- .7 Maintain accurate records of all concrete placed to indicate date, location of placement, quantity placed, concrete temperature and test specimens cast. Keep these records at site until project is complete.
- .8 Prior to placing, submit to the Departmental Representative for review the proposed method of curing and protection of concrete during placing and curing in adverse weather conditions.

3.2 INSERTS

- .1 Embedded structural holds downs, studs and anchor rods for attaching wood construction to foundations shall be supplied by Subcontractor responsible for rough carpentry under Section 06 10 00 – Rough Carpentry to the site and installed by the Subcontractor responsible for cast-in-place concrete, unless noted otherwise on the construction drawings prepared as part of this project.
- .2 All embedded metal shall be carefully set to conform to the dimensions shown on the drawings and shall be rigidly held in place during placing of the concrete.
- .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Departmental Representative before placing of concrete. See architectural, mechanical and electrical drawings for additional inserts to be installed in this section.
- .4 No core drilling of concrete is allowed unless approved by the Departmental Representative.

3.3 FINISHING

- .1 Unless specified elsewhere, interior slabs on grade shall receive sufficient passes with a trowel to obtain a dense hard smooth surface free of trowel marks.

3.4 CURING

- .1 Curing of all elements cast under this section shall begin immediately following placing and finishing following the requirements of CSA A23.1.
- .2 Obtain the approval of the Departmental Representative for proposed means of monitoring concrete curing conditions. Contractor shall be responsible for confirming completion of curing.
- .3 Concrete for exposure Classes C-2 shall receive an additional curing period as defined by Table 20 of CSA A23.1.

3.5 DEFECTIVE CONCRETE

- .1 All honeycombed concrete shall be removed to sound concrete and the areas patched in a manner acceptable to the Departmental Representative.
- .2 All imperfections greater than 30 mm deep shall be removed to sound concrete and the areas patched in a manner acceptable to the Departmental Representative.
- .3 Embedded debris shall be removed to sound concrete and the areas patched in a manner acceptable to the Departmental Representative.

3.6 PATCHING

- .1 Patch imperfections within 24 hours of stripping of forms. Patch imperfections less than 30 mm deep as follows:
 - .1 Chip down edges perpendicular to surface to Departmental Representative's approval.
 - .2 Wet area and brush on 1:1 cement-sand grout.
 - .3 Patch with 1:2 cement-sand mortar with 10% hydrated lime.
- .2 Patch existing concrete surfaces where damaged by cutting or drilling.

3.7 INSPECTION AND TESTING

- .1 Inspection, sampling, testing and reporting of concrete and concrete materials will be carried out by a testing laboratory approved by the Departmental Representative as specified in Division 1. All test methods shall be in accordance with CSA A23.2.
- .2 Testing laboratory will cast three test specimens for every placement. Cylindrical specimens shall be tested in compression at 7 and 28 days (2 specimens) unless directed otherwise by the Departmental Representative.
- .3 Testing laboratory will make at least one slump test and one air content test for each set of test specimens cast.
- .4 Alkali-aggregate reaction tests are to be performed or certification reports supplied verifying the quality of the aggregates to be used.

- .5 Copies of all test reports to be submitted to the General Contractor, Ready Mixed Concrete Producer, and the Departmental Representative.
- .6 Cost of all testing to be borne by the Contractor as specified in Division 1.
- .7 CSA A23.1 shall form the basis for acceptance, strengthening or replacement of concrete not meeting specified quality.
- .8 Cooperate with and assist the testing company by providing access to all parts of the work as required.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

- .1 Division 1 – General Requirements
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .3 Section 03 20 00 – Concrete Reinforcing
- .4 Section 03 30 00 - Cast-in-Place Concrete

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA A23.1-19A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM C109/C109M-16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
 - .2 ASTM C309-19, Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

1.3 SUSTAINABLE DESIGN SUBMITTALS

- .1 Construction Waste Management in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Concrete materials and reinforcement: in accordance with Section 03 20 00 – Concrete Reinforcing and Section 03 30 00 – Cast-in-Place Concrete.
- .2 Concrete curing compound to be high solids, water based, VOC compliant curing and sealing compound to ASTM C309. Concrete curing compound shall be compatible with flooring adhesives.
 - 1. Unless specified elsewhere herein, apply curing compound to manufacturer's written instructions.
- .3 Additives, admixtures, hardeners, curing compounds and sealers are to be compatible.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- .1 All work shall be in accordance with CSA A23.1 except where specified otherwise.
- .2 Concrete slabs to receive ceramic tile to be screeded off to true lines and levels shown and left ready to receive finish. Depress slabs to accommodate finish.
- .3 Ensure formwork and embedded metal parts are not disturbed or displaced during the finishing operation.

3.2 PLAIN FLOOR FINISHES

- .1 Consolidate concrete by vibrating to force coarse aggregate into concrete mix and then screed.
- .2 Float surface with wood or metal floats or with power finishing machine and bring surface to true grade.
- .3 Steel trowel to smooth and even surface in accordance with CSA A23.1, Table 22, Class A.
- .4 After Item 3.2.3 of this Section, follow with second steel trowelling to produce smooth burnished surface to within 8 mm tolerance when measured in any direction using a 3 m straight edge.
- .5 Sprinkling of dry cement or dry cement and sand mixture over concrete surfaces is not acceptable.
- .6 All concrete slabs shall be cured by applying curing compound in strict accordance with manufacturer's instructions at the rate of 7 square meters per litre.
- .7 After curing and when concrete is dry, seal all slab floor joints at junction with vertical surfaces with joint sealant.
- .8 Grind slab edges where curling occurs.

END OF SECTION