

1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 03 10 00 – Concrete Forming and Accessories.
- .3 Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA):
 - .1 CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN3-A23.3-04 (R2010), Design of Concrete Structures for Buildings.
 - .3 CSA G30.3-M1983 (R1998), Cold Drawn Steel Wire for Concrete Reinforcement.
 - .4 CSA G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
 - .5 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement.
 - .6 CAN/CSA-G40.21-04 (R2009), Structural Quality Steels.
- .2 Reinforcing Steel Institute of Canada:
 - .1 Reinforcing Steel Manual of Standard Practice, 4th Edition 2004.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop drawings:
 - .1 Indicate on shop drawings - bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if accepted by Engineer with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers.
 - .2 Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.
 - .3 Detail lap lengths and bar development lengths to CAN3-A23.3. Provide Type B tension lap splices unless otherwise indicated.
 - .4 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of New Brunswick, Canada.
- .3 Submit mill certificates/material data if requested by Departmental Representative.

2 Products

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2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, Grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise; plain finish.
- .3 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .4 Mechanical splices: subject to acceptance of Departmental Representative.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada unless indicated otherwise.
- .2 Obtain Departmental Representative's acceptance for locations of reinforcement splices other than those shown on placing drawings.
- .3 Welding of reinforcement is not permitted.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- .5 Fabricate within the following tolerances:
 - .1 Sheared length: +/- 25 mm.
 - .2 Stirrups, ties and spirals: +/- 10 mm.
 - .3 Other bends: +/- 25 mm.
- .6 Locate reinforcing splices not shown on drawings at points of minimum stress.

3 Execution

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3.1 FIELD BENDING

- .1 Do not field bend or field weld 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 PLACEMENT DETAILING

- .1 Conform to CSA-A23.1 and CSA-A23.3 for hooks, bends laps and similar details not specifically shown.
- .2 Detail reinforcing to ensure there are no interferences with anchor rods and other embedments.
- .3 Secure chairs for reinforcing in place located at 915 mm o.c. maximum unless specified or detailed otherwise. Please check.
- .4 Provide horizontal "L" shaped corner bars of same cross section and spacing as horizontal bars or welded wire fabric around wall and grade beam corners unless detailed otherwise.
- .5 Cover electrical conduit, ductwork or piping buried in slabs with 600 mm wide strip of 102 x 102 x MW13.3 x MW13.3 welded wire fabric. If principal slab reinforcement is placed above conduit then place 600 mm strip under conduit. Position of reinforcing steel takes precedence over conduit, ductwork or piping.

3.3 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated and in accordance with CAN/CSA-A23.1.
- .2 Place, support and secure reinforcement against displacement. Do not deviate from required position.
- .3 Ensure cover to reinforcement is maintained to provide required concrete cover to reinforcement during concrete placement.
- .4 Ensure the reinforcing steel foreman and crew are present prior to and during all concrete placement to ensure all reinforcement remains in proper position and to take adequate measures where reinforcing has displaced.
- .5 Prior to concrete placement, ensure all reinforcing is in correct position and tied securely to prevent displacement.

3.4 CLEANING

- .1 Ensure concrete reinforcing is clean and free from oil and deleterious matter.
- .2 Remove all loose scale, loose rust and other deleterious matter from surfaces of reinforcing.
- .3 Store reinforcing on site in a manner to ensure it is kept free of water, dirt, mud or other deleterious material.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 03 10 00 – Concrete Forming and Accessories.
- .3 Section 03 20 00 – Concrete Reinforcing.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C260/C260M-10a, 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-11, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C827/C827M-10, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
 - .5 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
 - .7 ASTM D624-00 (2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .8 ASTM D1751-04 (2008), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
 - .9 ASTM D1751-04a (2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Considerations.
 - .10 ASTM E1745-11, Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- .2 Canadian Standards Association (CSA):
 - .1 CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA-A23.2-09, Methods of Test for Concrete.
 - .3 CAN/CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .4 CAN/CSA A283-06, Qualification Code for Concrete Testing Laboratories.

1.3 STANDARDS

- .1 Concrete materials and methods of concrete construction: to CSA A23.1 unless otherwise specified.

- .2 Keep a copy of CSA A23.1 at the job office, and make available to the Departmental Representative for reference.

1.4 SUBMITTALS

- .1 Submit samples, certificates and mix designs in accordance with Section 01 33 00 – Submittal Procedures.
- .2 All items are to be submitted to Departmental Representative within four (4) weeks prior to start of construction. Submit the following:
 - .1 Proposed source of aggregates.
 - .2 Manufacturer's test data, catalogue data sheet and/or certification by qualified independent inspection and testing laboratory the following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Supplementary cementing materials.
 - .3 Grout and mortar.
 - .4 Admixtures.
 - .5 Aggregates.
 - .6 Water.
 - .7 Adhesive grout.
 - .8 Curing/sealer.
 - .3 Concrete mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
 - .4 Certification report, for fine and coarse aggregate, for alkali-aggregate reactivity tests carried out in accordance with CSA A23.2-14A except:
 - .1 Testing period shall be two (2) years.
 - .2 Minimum cement content shall be 430 kg/m³.
 - .3 Specimen expansion shall not exceed 0.035% during test period.
 - .5 Quality Control Plan, specified in Paragraph 1.5 B Quality Assurance.

1.5 CONTRACTOR QUALITY ASSURANCE

- .1 As part of the General Contractor's Quality Assurance, they shall submit a Concrete Quality Control Plan. The Quality Control Plan shall include a description of the item and a detailed procedure on how each item will be carried out, including but limited to the following items:
 - .1 Hot weather concrete procedures.
 - .2 Cold weather concrete procedures - refer to Specification Section 03 30 10 – Cold Weather Concreting.
 - .3 Methods to maintain construction within tolerances.
 - .4 Formwork removal.
 - .5 Placement method(s), including mass concrete placement.
 - .6 Curing method(s) to be utilized and testing methods to confirm concrete has fully cured.
 - .7 Protection of finished work during curing.
 - .8 Method of confirmation that concrete has been cured according to specifications.
 - .9 Finishes.
 - .10 Joints.

- .11 Provisions to address potential problems such as high winds, monitoring of curing concrete during weekends, breakdown of cold weather heating equipment.
 - .2 Stating only in the Quality Control Plan that the above items will be done in accordance with specifications is not acceptable.
- 1.6 WASTE MANAGEMENT AND DISPOSAL
 - .1 Use trigger operated spray nozzles for water hoses.
 - .2 Designate a cleaning area for tools to limit water use and runoff.
 - .3 Carefully coordinate the specified concrete work with weather conditions.
 - .4 Ensure emptied containers are sealed and stored safely for disposal away from children.
 - .5 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
- 2 Products
 - 2.1 MATERIALS
 - .1 Portland cement: to CAN/CSA-A3000.
 - .2 Supplementary cementing materials: to CAN/CSA-A23.1.
 - .3 The use of fly ash to reduce cement content is not permitted.
 - .4 Water: to CAN/CSA-A23.1.
 - .5 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.
 - .6 Air entraining admixture: to CAN/CSA-A23.1.
 - .7 Chemical admixtures: to CAN/CSA-A23.1, subject to Departmental Representative's acceptance of accelerating or set retarding admixtures during cold and hot weather placing.
 - .8 Concrete retarders: to ASTM C494, water based. Do not allow moisture of any kind to come in contact with the retarder film.
 - .9 Curing compound: to CAN/CSA-A23.1 and to ASTM C309, water-based and compatible with floor finishes.

- .10 Shrinkage Compensating Grout (baseplates): non-shrink grout, premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents. Minimum 50 MPa compressive strength at 28 days. Utilize 'Winter Grade' version of the grout during winter conditions.
 - .1 Standard of Acceptance:
 - .1 SikagROUT 212 HP by Sika.
 - .2 Construction Grout by BASF Construction Chemicals.
 - .3 Planigrout 750 by Mapei.
- .11 Adhesive grout and anchors:
 - .1 Standard of Acceptance:
 - .1 HIT-ICE by Hilti.
- .12 Vapour barrier: To ASTM E 1745, Class B:
 - .1 Standard of Acceptance:
 - .1 Vapor Block 10 by Raven Industries.
 - .2 Perminator by W. R. Meadows.

2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Table 5, Alternative 1 for the following elements and applications.
- .2 Have mix designs prepared by concrete supplier and tested by a CSA Certified Materials Testing Laboratory.

Item	Mudslab	Exterior Concrete
Cement Type	GU	GU
Class	F-1	F-2
Aggregate max., mm	19	19
Slump, mm ⁽²⁾	80 +/- 20 ⁽¹⁾	80 +/- 20 ⁽¹⁾
Max Water/Cement Ratio	0.55	0.55
Air Content, %	0 - 3	4 - 7
f _c min. at 28 days, MPa	15	32
Curing Type	1	1
1. 150 mm maximum with chemical admixture. 2. At point of discharge into work.		

- .3 Chemical admixtures: in accordance with ASTM C494.

- .4 Materials, proportions and source of supply of ready-mix concrete shall be subject to review by the Departmental Representative.

3 Execution

3.1 PREPARATION

- .1 Provide 48 hours notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcement.
- .3 Pumping of concrete is permitted only after Departmental Representative's review of equipment and mix.
- .4 Water is not permitted to be added to concrete after it has left the batch plant.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's acceptance of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous work from staining.

3.2 WORKMANSHIP

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1/A23.2 and as specified.
- .2 Concrete shall be deposited in the forms in a manner that prevents segregation and in accordance with CAN/CSA-A23.1.
- .3 Prior to concrete placement, anchor rod placement to be verified by a licensed surveyor to confirm anchor rod positions. Adjust or repair misaligned anchor rods. Resurvey to confirm positions conform to contract documents. Submit copy of survey to Engineer.
- .4 Maintain accurate records of placed concrete items to indicate date, location of placement, quality, air temperature and test samples taken.
- .5 Prior to placement of concrete, ensure:
 - .1 All formwork complete.
 - .2 Excess water, debris and ice removed.
 - .3 All reinforcement, embedded reinforcing dowels, inserts, anchor rods and other embedments installed in proper position and secured.

3.3 CONCRETE CONSOLIDATION

- .1 Consolidated concrete shall be dense, homogenous and free of cold joints, voids and honeycombing. Concrete shall be bonded to all reinforcing steel, anchors, and embedded parts.

- .2 Concrete shall be consolidated by means of mechanical internal vibrators in accordance with CSA A23.1.
- .3 Concrete shall be placed in approximately 300 mm to 600 mm horizontal lifts. Lifts shall be consolidated before the next lift is deposited.
- .4 The rate of placement shall be such that each successive lift can be vibrated into the previous lift for proper bonding. The rate of concrete placement shall not exceed designer's recommendations.
- .5 Do not use vibrator as a means to move concrete from one location to another.
- .6 Allow vibrator to go into and out of concrete at approximately 90 degree angle. Do not insert or remove at an angle.

3.4 DEFECTIVE CONCRETE

- .1 All defective concrete less than 30 mm deep including, but not limited to, honeycombing, embedded debris, voids and stone pockets shall be patched within 24 hours of form removal.
- .2 Defects shall be removed to sound concrete and to a minimum of 25 mm, leaving edges perpendicular.
- .3 Thoroughly wet surface of area to be patched and the surrounding area.
- .4 Brush surface of defective area with a 1:1 cement-sand grout mixture.
- .5 Patch with 1:1.5 cement-sand mortar with 10% hydrated lime.
- .6 Repair tie holes immediately after formwork removal per above defective concrete. Cut back form ties to a minimum depth of 20 mm from the surface of the concrete.
- .7 Repair areas deeper than 30 mm with structural repair grout in strict accordance with Manufacturer's written instructions. Submit proposed grout and repair method to Engineer for review prior to undertaking repair.

3.5 FINISHING

- .1 Rough form finish not exposed to view: as specified in Clause 7.7.2.5 of CSA A23.1.
- .2 Formed surfaces exposed to view: smooth form finish as specified in Clause 7.7.2.6 of CSA A23.1.
- .3 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

3.6 BASEPLATE GROUTING

- .1 Grout under baseplates in strict accordance with manufacturer's written instructions and with 100% contact with baseplate and concrete.
- .2 Grout shall be placed in a flowable state using forms. Dry pack is not acceptable.
- .3 Ensure air is properly vented out during grout placement to ensure no air voids are formed.
- .4 All surfaces which will be in contact with grout to be clean of debris and foreign matter. All standing water to be removed.
- .5 Grout shall be cured in accordance with manufacturer's written instructions and these specifications, whichever is most stringent.

3.7 ANCHOR RODS

- .1 Place anchor rods prior to placing concrete using templates.
- .2 Place rods plumb and protect alignment.
- .3 Tie top and base of anchor rods to prevent movement or rotation.
- .4 Prior to concrete placement, survey foundation to determine anchor rod positions. Adjust or repair misaligned anchor rods. Resurvey to confirm positions conform to contract documents. Submit copy of survey to Departmental Representative if requested.
- .5 Protect anchor rods from damage after placement of concrete by means acceptable to Departmental Representative.
- .6 Misplaced and damaged anchor rods shall be repaired at no additional cost to the Owner, and to the satisfaction of the Departmental Representative.

3.8 CURING AND PROTECTION

- .1 Cure and protect concrete in accordance with CSA A23.1, as specified herein and to the reviewed and accepted Quality Control Plan.
- .2 Contractor is responsible for verifying that curing has been done in accordance with specifications and accepted Quality Control Plan.
- .3 Curing types, in accordance with Table 20 of CSA A23.1:
 - .1 Type 1 - Basic, for all concrete except as specified otherwise. Basic curing is defined as curing for a minimum of 3 days at a minimum temperature of 10° C or the time necessary to attain 40% of the specified strength, whichever is greater.

- .2 Type 2 - Additional. Additional curing is defined as curing for a minimum of 7 days at a minimum of 10° C or the time necessary to attain 70% of the specified strength, whichever is greater.
- .3 Type 3 - Extended. Extended curing is defined as wet curing for a minimum of 7 days.
- .4 Apply curing compound to concrete surfaces immediately after form removal.
- .5 Curing compounds shall not be used where bond is required by subsequent topping or coating.

3.9 FIELD QUALITY ASSURANCE

- .1 Inspection and testing of concrete and concrete materials.
 - .1 Inspection and testing by independent Testing Agency is undertaken to inform the Owner and Departmental Representative of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.
 - .2 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Owner.
 - .3 Testing lab shall be certified in accordance with CSA A283. Testing shall be in accordance with CSA A23.2.
 - .4 Owner will pay for costs of inspection and testing except where specified otherwise.
 - .5 Provide access to the work for selection of samples, and provide materials required for test specimens.
 - .6 Cast a minimum of one set of three standard cylinders for each day concrete is placed or for each 50 m³ or less of concrete, whichever is greater.
 - .7 Take slump and air tests as required to ensure concrete meets specifications.
 - .8 Testing lab shall also review cold weather concrete placement conditions prior to, during and following cold weather concrete placement. Submit letter reports to Owner, Departmental Representative and Contractor.
 - .9 Additional test cylinders required for confirmation of early form stripping, curing or cold weather concreting requirements: Cure cylinders on job site under same conditions as concrete which they represent. Contractor is responsible for costs associated with additional testing and field cure cylinders, including field storage.
 - .10 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
 - .11 One cylinder shall be tested at 7 days, remaining two at 28 days. When additional cylinders are taken during cold weather concrete conditions, minimum one cylinder shall be tested at 3 days. Additional cylinder taken for confirmation of curing or strength at time of early form stripping shall be tested at 2 days.
 - .12 When defects or non-conforming work is identified, the Departmental Representative may request, at the Contractor's expense, additional review or testing to ascertain the full extent of the defect or non-conforming work.

3.10 DEPARTMENTAL REPRESENTATIVE'S GENERAL REVIEW

- .1 Departmental Representative will identify non-conforming work during general reviews and will submit written reports to Owner and Contractor.
- .2 Pay cost of inspection and testing services incurred by the Owner resulting from non-conforming work identified by Departmental Representative and requiring remedial services to correct the work.
- .3 The Departmental Representative's general review during construction is undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

END OF SECTION