

## PART 1 - GENERAL

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| 1.1 References                    | .1 | Canadian Standards Association (CSA)  |
|                                   | .1 | CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.   |
|                                   | .2 | CSA S269.1, Falsework for Construction Purposes.  |
|                                   | .3 | CAN/CSA-S269.3, Concrete Formwork.  |
| 1.2 Shop Drawings                 | .1 | When requested, submit shop drawings for formwork Drawings and falsework.   |
|                                   | .2 | 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. |
|                                   | .3 | Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.   |
| 1.3 Waste Management and Disposal | .1 | Place materials defined as hazardous or toxic waste in designated containers.   |
|                                   | .2 | Ensure emptied containers are sealed and stored safely for disposal away from children.   |
|                                   | .3 | Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.  |

## PART 2 - PRODUCTS

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| 2.1 Materials | .1 | Formwork Materials:   |
|               | .1 | Use formwork materials to CAN/CSA-A23.1.  |
|               | .2 | Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms. |
|               | .3 | Falsework materials: to CSA-S269.1.   |

PART 3 - EXECUTION

- 3.1 Fabrication and Erection
- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
  - .2 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
  - .3 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.
  - .4 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
  - .5 Align form joints and made watertight. Keep form joints to minimum.
  - .6 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
  - .7 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
  - .8 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
  - .9 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.
- 3.2 Removal and Re-Shoring
- .1 Leave formwork in place for following minimum Re-Shoring periods of time after placing concrete.
    - .1 Three days for walls and sides of beams.
    - .2 Three days for columns.

- .3 Twenty days for beam soffits, slabs, decks and other structural members, or seven days when replaced immediately with adequate shoring to standard specified for falsework.
- .4 Three days for footings and abutments.
- .2 Remove formwork when concrete has reached 80% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate re-shoring.
- .3 Provide all necessary re-shoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

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PART 1 - GENERAL

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| 1.1 General       | .1 | Canadian Standards Association (CSA)   |
|                   | .1 | CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.                                  |
| 1.2 Shop Drawings | .1 | When requested submit shop drawings including placing of reinforcement.                                  |
|                   | .2 | Design of detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated.      |
|                   | .3 | Each drawing shall bear the signature and stamp of qualified professional engineer registered in Canada. |

PART 2 - PRODUCTS

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| 2.1 Materials   | .1 | Substitute different size bars only if permitted in writing by Department Representative.   |
|                 | .2 | Reinforcing steel: carbon steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.  |
|                 | .3 | Cold-drawn annealed steel wire ties: to CSA G30.3.  |
|                 | .4 | Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.  |
|                 | .5 | Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1. Chairs shall be plastic or stainless steel.  |
|                 | .6 | Mechanical splices: subject to approval of Department Representative.   |
|                 | .7 | Plain round bars: to CAN/CSA-G40.21.  |
| 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. |
|                 | .2 | Obtain Department Representative's approval for locations of reinforcement splices other than those shown of placing drawings.                                |

- .3 Upon approval of Department Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 Source Quality Control

- .1 Upon request, provide Department Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.

PART 3 - EXECUTION

3.1 Field Bending

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Department 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 as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
- .2 Prior to placing concrete, obtain Department Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.
- .4 Clean reinforcing prior to placing concrete.

3.3 Field Touch-up

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

END

PART 1 - GENERAL

- 1.1 Reference Standards
- .1 Conform to the latest issues of the following standards, amendments and supplements except where otherwise stated in the project documents:
    - .1 Canadian Standards Association (CSA)
      - .1 CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
      - .2 CSA-A23.2, Test methods and standard practices for concrete.
      - .3 CSA-A23.3, Design of Concrete Structures.
      - .4 CSA A3000, Cementitious Materials Compendium.
    - .2 American Society for Testing and Materials (ASTM).
      - .1 ASTM C 156, Test Method for Water Loss (from a Mortar Specimen) Through Liquid Membrane-forming Curing Compounds for Concrete.
      - .2 ASTM C 260, Specification for Air-Entraining Admixtures.
      - .3 ASTM C 309, Standard Specification for Liquid Membrane-Forming Compounds for Concrete.
      - .4 ASTM C 494, Specification for Chemical Admixtures for Concrete.
    - .3 American Concrete Institute
      - .1 ACI 117, Specification for Tolerances for Concrete Construction and Materials.
      - .2 ACI 202R, Guide to Durable Concrete.
      - .3 ACI 305, Hot Weather Concreting.
    - .4 Conflicts between the specifications, codes and standards shall be resolved by the Department Representative in the best interest of the project.
    - .5 Concrete quality will be assessed by the Department Representative in accordance with CSA A23.2-00, Methods of Test for Concrete.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Cementing Materials:
    - .1 Type GU Portland cement to CSA A3000.
    - .2 Supplementary Cementing Materials: to CSA A3000
  - .2 Water:
    - .1 Water used in mixing and curing concrete shall be fresh, clean, potable and free of injurious amounts of contaminants and chemicals. Recycled wash water from concrete plants shall not be used.
  - .3 Aggregates: Only concrete aggregate that have a historical record of usage in a similar environment shall be used in the work.
    - .1 The aggregate shall conform to CSA A23.1 and with this specification.
    - .2 The contractor at his own expense shall provide the necessary certification that the aggregate meets the requirements of this specification. No change in aggregate source shall be made without the prior approval of the Department Representative.
  - .4 Chemical Admixtures:
    - .1 Admixtures for concrete shall conform to ASTM C260 and ASTM C494.
    - .2 All concrete supplied by the contractor shall be air-entrained and contain such other admixtures as required by these specifications.
    - .3 A water-reducing admixture shall be used in all concrete mixtures containing Type GU cement.
    - .4 Chloride based admixtures shall not be used.
    - .5 The contractor shall provide certification that all admixtures proposed for use are compatible with the Portland cement when used in the proposed combinations.

2.2 Concrete Mixtures .1 Mixture Proportions:

.1 All concrete mixture proportions shall be designed in accordance with CSA A23.1.

.2 Normal density concrete to be used in accordance with:

- .1 Cement: Type GU Portland cement.
- .2 Minimum compressive strength at 28 days: 30 MPa.
- .3 Minimum cementing materials content: 385 kg/m<sup>3</sup> of concrete.
- .4 Class of exposure: F1.
- .5 Nominal size of coarse aggregate: 20 mm.
- .6 Slump at time and point of discharge: 80 to ±20 mm.

PART 3 - EXECUTION

3.1 General .1 Perform all cast-in-place concrete work in accordance with A23.1, as specified in these specifications and in accordance with the manufacturer's literature for proprietary products.

.2 The contractor shall maintain daily and accurate records of all concrete placed in the work, indicating date, time of batching, time and location of placement, concrete quantity and proportions, concrete temperature and records of samples taken. These records shall be available to the Department Representative on a daily basis.

3.2 Workmanship .1 The contractor shall submit for approval of the Department Representative, concrete mixture proportions, placement procedures and equipment to be used.

.2 The concrete placement temperatures shall be in accordance with CSA A23.1 for the size and thickness of section under construction.

.3 The minimum cover over the reinforcing steel shall be as shown on the drawings.



- 3.3 Construction Joints
- .1 Construction joints shall comply with CSA A23.1 for the type of joint specified unless otherwise shown on the drawings and in this specification.
  - .2 Joints may be used for the convenience of the contractor with the approval of the Department Representative. Any such joints shall include a water stop.
- 3.4 Finishing
- .1 Concrete shall be finished in accordance with CSA A23.1 and in accordance with this specification.
  - .2 For unformed exposed surfaces, the finish shall be by hand or power float. The surface tolerance shall be as follows:
    - .1 Abrupt irregularities - 2 mm
    - .2 Gradual irregularities - 4 mm
    - .3 Bugholes and pits maximum 12 mm diameter
    - .4 Maximum surface pits 1 per 0.1 m<sup>2</sup>
- 3.5 Curing
- .1 Curing and cold weather concrete placement shall be in accordance with CSA A23.1.
  - .2 Freshly placed concrete shall be protected from drying and extremes of temperature. After the concrete has hardened sufficiently to avoid damage, it shall be suitably and adequately protected from shock and impact, temperature extremes and loss of moisture.
  - .3 The exposed surfaces of freshly placed concrete shall be kept in a continuously moist condition for a period of 7-days by the use of absorbent mats or burlap which shall be wetted down as required to prevent any dry areas on the concrete surface.
  - .4 In areas where appropriate, the Department Representative may allow the use of water based curing compounds.

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| 3.6 Inserts and Embedded Steel | .1 | The contractor shall place embedded parts and assemblies in accordance with CSA A23.1. The embedded parts shall be carefully positioned and placed securely.  |
|                                | .2 | The contractor shall not eliminate or displace reinforcement to accommodate embedded fixtures. Any modifications shall be at the discretion of the Department Representative.                         |
|                                | .3 | All items to be embedded in the concrete shall be clean and free of oil films, rust, dirt or other deleterious substances which affect bond.  |
| 3.7 Patching and Repair        | .1 | Patching and repair of new concrete in defective areas or where embedded fixtures for construction purposes are present shall be repaired in accordance with CSA A23.1 except where otherwise stated. |
|                                | .2 | Concrete surfaces found to be defective upon removal of the forms shall not be repaired until the Department Representative has examined them.  |
|                                | .3 | The Contractor shall commence all permitted repairs within 48 hours of the examination by the Department Representative.  |
|                                | .4 | In general, all repairs shall be conducted using similar concrete to that of the parent concrete. Bonding agents acceptable to the Department Representative shall be used in all repairs.            |
|                                | .5 | Repair patches or replacement concrete shall be cured for the same length of curing period as the base concrete.  |
|                                | .1 | Immediately prior to application of the mortar or concrete, the surface shall be blown with air jets to remove free water.  |
|                                | .2 | The mortar or concrete surface shall then be rubbed thoroughly with clean burlap or other approved methods so as to fill all the voids.   |
|                                | .3 | While the mortar in the voids is still plastic, the surface shall be sack rubbed with a mix of the  |

same proportions and materials except that no water shall be used.

.4 The final rubbing shall be performed in a manner which assures that the voids are filled and left flush with the surface of the surrounding concrete.

- .6 Cracks which develop in the new concrete and which are considered by the Department Representative to lessen the durability of the work shall be repaired by grout injection at no extra cost to the contract. The type of grout to be used shall be determined by the Department Representative based on durability and placing considerations.

3.8 Field Quality Control

- .1 The Contractor in accordance with CSA A23.1 and A23.2, will carry out inspection and testing of concrete and concrete materials. Standard test cylinders of 100 x 200 mm shall be used. The contractor shall provide the necessary facilities for taking and storing the cylinders. The cylinders must be collected and returned to the testing laboratory within 24 hours.
- .2 If defects are revealed, the contractor shall perform additional inspection and/or testing to ascertain the full extent of the non-conforming materials. This additional inspection and testing shall be performed at the contractor's expense.
- .3 Non-destructive testing shall be performed in accordance with CSA A23.2 or as directed by the Department Representative. Only personnel experienced in non-destructive testing and interpretation of the results shall be employed to perform non-destructive testing.

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