

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 74 21 - Construction/Demolition Management and Disposal.
 - .2 Section 03 20 00 - Concrete Reinforcing.
 - .3 Section 03 30 00 - Cast-in-Place Concrete.
- 1.2 References
- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA-O86-09, Engineering Design in Wood (Limit States Design).
 - .3 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .4 CAN/CSA-S269.3-M92(R2013), Concrete Formwork.
 - .5 CSA 0121-08(R2013), Douglas Fir Plywood.
 - .2 Council of Forest Industries of British Columbia (COFI)
- 1.3 Shop Drawings
- .1 Submit shop drawings for formwork and falsework in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangements of joints, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
 - .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
 - .4 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.
-

- .5 Each shop drawing submission shall bear stamp and signature of qualified professional Engineer registered or licensed in the Province of Newfoundland and Labrador.

1.4 Responsibility

- .1 Design for method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

- .2 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete.

1.5 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .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 sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

1.6 Delivery, Storage and Handling

- .1 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.
- .2 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign matter. handle and erect the fabricated formwork so as to prevent damage.

PART 2 - PRODUCTS

2.1 Materials

- .1 Formwork materials:
 - .1 Use high density overlaid plywood to CSA 0121, CAN3-086.1, CAN3-086.1SI, CSA 0153. Alternatively, use heavy-gauge steel forms.
-

- .2 The form facing material shall be free from surface defects and meet deflection requirements in accordance with CAN/CSA S169.3.
- .2 Falsework materials: to CSA S269.1.
- .3 Form ties:
 - .1 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface. Holes are to be filled with non-shrink grout.
 - .2 Adjustable in lengths to permit tightening and alignment of forms.
 - .3 Form tie colour shall be grey.
- .4 Form release agent: compatible with repair materials, non-toxic, biodegradable, low VOC, 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.
- .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 and 24 mm²/sat 40°C, flashpoint minimum 150°C, open cup.

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. Review all drawings and check dimensions prior to construction for proper fit and report any discrepancies before proceeding with the work.
 - .2 Assemble formwork so that concrete is not damaged during its removal.
 - .3 Fabricate and erect falsework in accordance with CSA S269.1 and COFI exterior plywood for concrete formwork.
 - .4 Do not place shores and mud sills on frozen ground.
 - .5 Provide site drainage to prevent washout of soil supporting mud sills and shores.
 - .6 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 CSA-A23.1/A23.2.
- .7 Align form joints and make watertight. Keep form joints to minimum.
 - .8 Make the form mortar tight by sealing with building tape or sealants along all joints.
 - .9 Where concrete is to remain exposed, use 25 mm chamfer strips on external corners and 25 mm fillets at interior corners, joints, unless specified otherwise.
 - .10 Form chases, slots, openings, drips, recesses and expansion joints as indicated.
 - .11 Prior to placing concrete, the elevations of forms shall be checked to verify drainage slopes.
 - .12 Provide 48 hours notice to Departmental Representative for inspection prior to concrete placement.
 - .13 Clean formwork to remove foreign matter. Remove cuttings, shavings and debris from within forms. Flush completely with water to remove remaining foreign matters. Ensure that water and debris drain to exterior through clean-out ports.
 - .14 During cold weather, remove ice and snow from within forms, do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure.
 - .15 Repair concrete will be placed within the working time of bonding coats.
 - .16 Patch all form tie holes and finish surface to remove all evidence of tie holes and/or patching.
 - .17 Construction Joints:
 - .1 Form construction joints where required and as approved.
 - .2 Build waterstops into forms, supported against displacement by pouring of concrete. Locate waterstops at construction joints in
-

abutment and pier walls and as indicated on Drawings.

.3 Use preformed waterstop corners and intersections where they are available to suit conditions.

.4 Join waterstops to preformed corners and intersections, and between lengths with butted and welded connections in accordance with manufacturer's recommendations.

.18 Build inserts, anchor bolts, miscellaneous frames, flashing reglets, weather bars, holes, sleeves, and items otherwise specified as supplied and located under the Work of other sections into formwork. Imbed no wood in concrete for purposes of anchorage.

.19 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.20 Clean formwork in accordance with CSA A23.1/A23.2 before placing concrete.

3.2 Removal and Reshoring

.1 Notify Departmental Representative prior to form removal.

.2 Form removal times are dependent on proper curing in accordance with CAN/CSA-A23.1, CSA S269.1 and CAN/CSA-S269.3. Provide written evidence of concrete strength to the Departmental Representative 24 hours prior to form removal to show that suitable strength has been achieved. Contractor shall pay for the concrete cylinder strength tests to demonstrate concrete strength prior to form removal.

.3 Remove formwork progressively and in accordance with the reference code requirements, and so that no shock loads or imbalanced loads are imposed on the structure.

.4 Leave formwork in place for following minimum periods of time after placing concrete.
.1 3 days or at achievement of 80% of 28-day design strength for walls and vertical surfaces.
.2 28 days for deck soffits or 7 days when replaced immediately with adequate shoring and concrete has achieved at least 70% of its 28 day

design strength.

.3 Remove all forms. Do not leave any forms in place after completion of project.

.5 Remove forms not directly supporting the weight of concrete as soon as stripping operations will not damage concrete.

.6 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

.7 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.

.8 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

3.3 Form Finishes

.1 Form finishes: to CSA A23.1-09 and ACI 301 as follows:

.1 Exposed soffit "Smooth Form Finish".

.2 Sides of footings, walls and formed surfaces buried below earth: Rough form finish.

.3 Sides of walls and formed surfaces exposed to view: Rubbed finish as per ACI 301.