

**PUBLIC WORKS AND GOVERNMENT
SERVICES CANADA**

**Roof and Chimney Repairs
Former Officers' Barracks
Quebec Citadel NHSC**

STRUCTURAL SPECIFICATIONS

PROJECT No. R.057742.001

FOR TENDER

DO NOT USE THIS DOCUMENT FOR CONSTRUCTION PURPOSE.

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Part 1 - GENERAL

1.1 Related requirements

- .1 Section 03 20 00 – Concrete Reinforcing
- .2 Section 03 30 00 – Cast-in-place Concrete

1.2 References

- .1 Refer to the latest applicable editions of the following standards:
 - .1 Canadian Standards Association (CSA)/CSA International
 - .2 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .3 CAN/CSA-S269.3, Concrete Formwork, National Standard of Canada.

1.3 Delivery, storage and handling

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

Part 2 - PRODUCTS

2.1 Materials

- .1 Formwork materials: use wood and wood product formwork materials to CSA O121, CAN/CSA-O86 and CSA O153. Duraform is prohibited. Use high density overlay in Douglas Fir to CSA O121. Plywood shall be new (first use).
- .2 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Holes must be filled with concrete product.
- .3 Form release agent: non-toxic, biodegradable, low VOC product.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 à 24 mm² /s at 40 °C, flashpoint minimum 150 °C in open cup.
- .5 Falsework materials: to CSA-S269.1.

Part 3 - EXECUTION

3.1 Fabrication and erection

- .1 Verify dimensions before proceeding with formwork/falsework and they agree with drawings.
- .2 Fabricate and erect falsework in accordance with CSA S269.1.
- .3 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.
- .4 Align form joints and make watertight. Keep form joints to minimum.
- .5 Incorporate anchors and other inserts required in specified Work.
- .6 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.
- .7 Tolerances:
 - .1 Comply with the following tolerances in the construction of formwork:
 - .2 General dimensional tolerances (D):

Length in metre	Acceptable deviation in millimetre
0<D<2,4	± 5
2,4<D<4,8	± 8
4,8<D<9,6	± 12

3.2 Removal and reshoring

- .1 After placing concrete, leave formwork in place for minimum three (3) days. This period of time does not relieve the Contractor of his responsibility to take into account the complexity and type of work as well as climatic conditions, and to ascertain prior to stripping that the concrete has attained sufficient strength to support its own weight and other loads applied.

END OF SECTION

Part 1 - GENERAL

1.1 Related requirements

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

1.2 References

- .1 Refer to latest applicable editions of following standards:
 - .1 American Concrete Institute (ACI)
 - .1 SP-66, ACI Detailing Manual 2004.
 - .2 ASTM International
 - .1 ASTM A 82/A 82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A 143/A 143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .3 ASTM A 185/A 185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .4 ASTM A 775/A 775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .3 CSA International
 - .1 CSA-A23.1-F09/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3, Design of Concrete Structures.
 - .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .4 Reinforcing Steel Institute of Canada (RSIC/IAAC)
 - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.3 Delivery, storage and handling

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 - PRODUCTS

2.1 Materials

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400R, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Weldable reinforcing bars: high adherence and weldable low alloy steel bars in accordance with CSA-G30.18, grade 400W.
- .4 Steel wire ties: cold-drawn annealed steel wire ties to ASTM A 82/A 82M .
- .5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .6 Galvanizing of reinforcement: minimum coating 610 g/m² to CAN/CSA-G164.

2.2 Fabrication

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and SP-66 standards and the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada (RSIC).
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

Part 3 - EXECUTION

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 slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.2 Placing reinforcement

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

3.3 Cover to reinforcement

- .1 Concrete exposed to weather conditions: 50 mm.

3.4 Tolerance in the placement of reinforcement

- .1 Cover thickness: minus 5 mm, plus 8 mm.

- .2 Position of bars according to concrete element thickness:
 - .1 Thickness 200 mm or less: plus or minus (\pm) 8 mm.
 - .2 Thickness greater than 200 mm but smaller than 600 mm: plus or minus (\pm) 12 mm.
- .3 Longitudinal position of bar extremities: plus or minus (\pm) 50 mm.
- .4 Longitudinal position of hooks and of bar extremities at discontinuities in the framework: plus or minus (\pm) 20 mm.
- .5 Distance between hangers, casings, collars, pins and hoops: plus or minus (\pm) 20 mm.

3.5 Splicing

- .1 Lap splices:
 - .1 The location of spliced bars not indicated on the drawings to be approved by the Departmental Representative. Such splices shall always be performed away from locations where tensile load is high in the bars. Unless otherwise indicated on the drawings, minimum splice lengths shall be as follows:

Bars	f'c = 20 MPa	f'c = 25 MPa	f'c = 30 MPa	f'c = 35 MPa
10 M	550	490	450	420
15 M	820	740	670	620
20 M	1090	980	890	830
25 M	1710	1530	1390	1290
30 M	2050	1830	1670	1550
35 M	2390	2130	1950	1800

3.6 Cleaning

- .1 Progress cleaning: leave work area clean at end of each day.
- .2 Final cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste management: separate waste materials for recycling.

END OF SECTION

Part 1 - GENERAL

1.1 Related requirements

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing

1.2 References

- .1 Abbreviations and Acronyms
 - .1 Portland Cement: hydraulic cement or blended hydraulic cement (where 'b' denotes blended).
 - .1 Type GU, GUb and GUL: General use cement.
 - .2 Fly ash
 - .1 Type F: with calcium oxide (CaO) content less than 15%.
 - .3 Type S: granulated blast furnace slag.
- .2 References
 - .1 Refer to the latest applicable editions of the following standards:
 - .1 Canadian Standards Association (CSA)/CSA International
 - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 Quality control of concrete

- .1 The Departmental Representative will assign quality control of concrete to a laboratory specializing in this type of work and pay for all inspections and testing.
- .2 The Laboratory is the Departmental Representative's agent for all matters pertaining to concrete proportioning and placing. In this capacity, the laboratory is authorized to issue directives which the Contractor and concrete supplier are required to conform.
- .3 Submit the following to the Laboratory's approval:
 - .1 Samples of coarse and fine aggregates
 - .2 Concrete mix proportioning
 - .3 The type and make of admixtures
 - .4 The analyses of the alkali aggregate reactivity.
- .4 Provide laboratory minimum 24h notice prior to placing of concrete specifying date and time of every pour.

1.4 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 in writing by Departmental 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 Packaging waste management: recover packaging waste for reuse/recycling.

Part 2 - PRODUCTS

2.1 Materials

- .1 Portland cement: general use to CAN/CSA-A3001, Type GU.
- .2 Water: to CSA A23.1.
- .3 Aggregates: to CSA A23.1/A23.2.
- .4 Shrinkage-compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
 - .1 Compressive strength: 50 MPa at 28 days.
- .5 Curing product: white, to CSA A23.1/A23.2 and ASTM C 309.

2.2 Mixes

Description	Type-Class of exposure	Compressive strength at 28 days (MPa)	Max. Water/Cement Ratio ⁽¹⁾⁽²⁾	Coarse aggregates (mm)	Air content ⁽³⁾ (%)	Slump ⁽⁴⁾⁽⁵⁾ (mm) ±20
Coping of chemines	C-2	32	0,45	20	5-8	80

- (1) Ternary cement, type GUb-S/SF or GUb-F/SF. The total mass of supplementary cementing materials (fly ash, silica fume and slag) shall not exceed 30% of the total weight of the binder.
- (2) Where silica fume is used, the water/cement ratio becomes the water/(cement + silica fume) ratio.
- (3) Air content is always the same, whether a superplasticizer is added or not.
- (4) Tolerances in specified slump values slump apply only for control.
- (5) When pumping is used to place concrete, slump without the addition of superplasticizer may be increased by 20 mm. However, the water/cement ratio must be maintained.

2.3 Ready-mix supplier

- .1 The ready-mix supplier shall be responsible for the mix of this concrete and shall control at own cost the quality and uniformity of his products.
- .2 Selection of the concrete supplier is subject to acceptance by the Departmental Representative.

Part 3 - EXECUTION

3.1 Preparation

- .1 Obtain Departmental Representative's approval in writing before placing concrete. Provide 24h notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with section 03 20 00 (Concrete Reinforcing).
- .3 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4 Protect existing structures Work from staining.
- .5 Clean and remove stains prior to application for concrete finishes.

3.2 Concrete making and delivery

- .1 Prepare and mix concrete at ready-mix plant and deliver to the work site in mixers that comply with the requirements of CSA-A23.1.
- .2 Take appropriate steps to ensure that concrete poured is carried out within ambient air temperature limits stated in Table 16 of CSA-A23.1.
- .3 Organise and schedule concrete deliveries to ensure that each concreting operation is conducted without interruption
- .4 Where superplasticizer is required to improve concreting, proceed to addition of superplasticizer on site after all other ingredients are thoroughly mixed. Add superplasticizer in such way that the properties of concrete are maintained during unloading, placement and consolidation. Comply with the requirements and methods recommended by the manufacturer. Proportion the superplasticizer to obtain concrete slump between 100 mm and 150 mm.
- .5 Do not add water to concrete before unloading the mixer without prior authorisation by Departmental Representative. Water quantities added to concrete shall be indicated on the delivery slip.

3.3 Placing

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Where placement operations involve dropping the concrete more than 1.5 m in formwork, place vertically using a suitable tubular conduit..

3.4 Cure and protection

- .1 When the concrete has set sufficiently, the exposed surfaces shall be kept wet continually for at least seven (7) consecutive days after placing. The water used for curing shall be clean and free of any material likely to stain or discolor the concrete.
- .2 During exceptional weather conditions such as when temperature is hot, winds high and relative humidity low, take special measures throughout concrete hardening period. Wall and column formwork shall then be kept thoroughly damp.
- .3 Freshly placed concrete shall be protected against direct sunlight, dry winds, frost, excessive heat and running water using adequate tarps or other membrane or sheeting to cover or fully enclose all freshly finished surfaces during entire concrete hardening period.

3.5 Cold weather concreting

- .1 Where ambient temperature is 5 °C or lower, or when it is likely that temperature will drop below this limit during placement or hardening, the requirements of this subsection concerning cold weather concreting shall apply.
- .2 Where concrete must be placed in cold weather conditions, all that is necessary to execute the work must be readily available. The tools and materials at hand shall maintain the required temperatures during concrete placement and hardening. Heating systems shall not be detrimental to concrete quality or adversely affect in any way the finishing materials. Heating devices that release carbon monoxide shall not be permitted.
- .3 Concrete shall not be laid on or against formwork, on grade or on any surface displaying a temperature lower than 5 °C.
- .4 The temperature of fresh concrete at time of placement shall read between 15 °C and 30 °C. Where the ambient temperature is relatively low, concrete temperature should come close to the 30 °C upper limit.
- .5 Implement efficient measures to maintain all concrete surfaces at 20 °C minimum during three (3) days or at 10 °C minimum during five (5) days after placement. Where dry heat is used, moisten the air in the enclosure and maintain both concrete and formwork continuously moist.
- .6 Concrete shall be kept at a temperature above freezing for a 7-day period; avoid alternating freeze-thaw cycles for a minimum of fourteen (14) days after concrete placement.
- .7 Protection methods:
 - .1 The above protection specifications may be complemented using adequate insulation and covering concrete surfaces with raised tarps (sheeting in contact with the concrete is absolutely counter-productive) or by fully enclosing the concrete and providing an opening for the introduction of heat in the enclosure as needed.

Note: Adequate protection depends on outside temperature, wind velocity and massivity of concrete.
 - .2 Where the outside temperature is likely to drop below -12 °C during placement or during the above mentioned protection period, fully enclose the concrete structure and provide supplementary heating source.
 - .3 Where the ambient temperature is likely to drop below -4 °C but not lower than -12 °C during placement or during the above mentioned protection period, cover all concrete surfaces using adequate raised tarps or insulating blankets in addition to supplementary heating source.
 - .4 Where the ambient temperature is likely to drop to -4 °C during placement or during the above mentioned protection period, cover all concrete surfaces using adequate raised tarps or insulating blankets and supplementary heating should be available.
 - .5 At the end of the specified protection period, withdraw protection and heating gradually such that air temperature around concrete does not drop by more than 10 °C per day until ambient temperature is reached.
 - .6 Do not use salt or other so-called chemical freezing-point reducers unless written authorisation is obtained from the Departmental Representative.

3.6 Cleaning

- .1 Proceed to cleaning at work completion.
- .2 Waste management: separate waste for recycling.
 - .1 Divert unused concrete and concrete materials from landfill to local facility approved by Owner's Representative.
 - .2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .3 Remove and dispose of waste in accordance with applicable local, Provincial and Federal regulations.

END OF SECTION

Part 1 - GENERAL

1.1 Alternates

- .1 Obtain Departmental Representative's approval before changing manufacturer's brands, sources of supply, wood species, or wood grade.

1.2 References

- .1 ASTM International
 - .1 ASTM A 325M-09, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimal Tensile Strength Metric.
- .2 CSA International
 - .1 CSA O86 Consolidation-09, Engineering Design in Wood.
 - .2 CSA O121-08, Douglas Fir Plywood.
- .3 National Lumber Grading Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber 2007.

1.3 Action and informational submittals

- .1 Product Data: Submit required manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Source Quality Control Submittals
 - .1 Submit invoices, purchase orders, and suppliers' certificates when requested by Departmental Representative.
 - .2 Advise Departmental Representative before ordering or purchasing materials.
 - .3 Departmental Representative to examine and approve materials prior to purchase by contractor.
 - .4 Provide free access to materials for examination by Departmental Representative before beginning work on site.
- .3 Submit to Departmental Representative drawings of all shoring systems, bracing or other as required, bearing the signature of a professional engineer in good standing with OIQ (Ordre des ingénieurs du Québec).

1.4 Delivery, storage and handling

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Storage area designated by Departmental Representative.
 - .2 Store materials off ground, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Store and protect wood from nicks, scratches, and blemishes.
 - .4 Replace defective or damaged materials with new.

1.5 Ambient conditions

- .1 Adhesive repair:
 - .1 Maintain temperature of elements to be repaired at between 21 °C and 24 °C throughout its thickness and for 48 hours after repairing.
 - .2 Provide temporary enclosure and heating or cooling equipment necessary to maintain temperatures specified.
 - .3 Undertake work under conditions of relative humidity at same level as operational requirements of end product.

Part 2 - PRODUCTS

2.1 Materials

- .1 Timber framing:
 - .1 Use «SS» quality Spruce red pine for the replacement of framing elements.
 - .2 CAN/CSA-Z809 or FSC or SFI certified.
 - .3 Actual size: wood pieces boxed heart sawn according to dimensions of pieces to replace, saw finished sawing, non planished.
 - .4 Moisture content: kiln dry to 15%.
 - .5 Wedges: to be made of high-density wood.
- .2 Dowels and pins:
 - .1 Dowels and pins : high-density wood
 - .2 Size: as existing or according to specifications.
- .3 Adhesives:
 - .1 Crack injection resin : two component low viscosity epoxy resin.
 - .1 VOC : 9,13 g/L.
 - .2 Tension resistance at 14 days (ASTM D638) : 58 MPa.
 - .2 Sealing resin: High modulus and high resistance two component structural epoxy gel.
 - .1 VOC : 1,71 g/L.
 - .2 Tension resistance at 14 days (ASTM D638) : 24 MPa.
 - .3 Protective coating: multi-purpose, two-component, solvent-free, structural epoxy adhesive and protecting coating.

Part 3 - EXECUTION

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable.
 - .1 Visually inspect substrate in presence of Departmental Representative.

- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .2 Stop work and report immediately to Departmental Representative conditions relevant to this contract not described in drawings: evidence of deficiencies, fungal or insect attack which may affect the scope of work and durability of the finished product.

3.2 Preparation

- .1 Protection of in-place conditions: Protect existing works and materials adjacent to repair area from damage during the Work.
- .2 Surface Preparation:
 - .1 Install adequate scaffolding, ladders and platforms for completion of work.
 - .2 Install adequate shoring and bracing. Ensure support in vicinity of repair. Review with Departmental Representative before start of Work.
 - .3 Verify the effectiveness of the shoring system and make adjustments as needed.

3.3 Construction

- .1 Cut back damaged or decayed wood as indicated.
- .2 Remove decayed and infested wood from building site daily.
- .3 Joints:
 - .1 Lay out and cut joints as indicated.
 - .2 Trial fit joints before fastening in place. Adjust as necessary to ensure close accurate fit with adjacent surfaces.
 - .3 Pegs: Fabricate pegs for joints by splitting with axe.
 - .4 Holes: Largest outer diameter: slightly larger than bored located hole.

3.4 Cleaning

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.5 Protection

- .1 Cover completed work not enclosed or sheltered with waterproof covering. Anchor securely in place.

END OF SECTION