

PART 1 - GENERAL

<u>1.1</u>	<u>Related Sections</u>	.1	Section 03 41 00 Precast Structural Concrete.
<u>1.2</u>	<u>Description</u>	.1	This section specifies the materials for forms, form ties and release agents as well as their fabrication, erection, removal and restoring.
<u>1.3</u>	<u>Measurement Procedures</u>	.1	No measurement will be made under this section. Include costs in items of concrete work for which formwork is required.
<u>1.4</u>	<u>References</u>	.1	Canadian Standards Association (CSA International) .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete. .2 CAN/CSA-O86-09, Engineering Design in Wood. .3 CSA O121-08, Douglas Fir Plywood. .4 CSA O151-09, Canadian Softwood Plywood. .5 CSA O153-M1980(R2008), Poplar Plywood. .6 CSA S269.1-16, Falsework and Formwork.
<u>1.5</u>	<u>Submittals</u>	.1	Submittals in accordance with Section 01 33 00 Submittal Procedures.
		.2	Submit shop drawings for formwork and falsework. .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of New Brunswick. .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, anchorages, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework and formwork drawings. .3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms. .4 Indicate sequence of erection and removal of formwork/falsework as directed by

2.1	<u>Materials</u>	.1 Formwork materials: .1 Formwork materials to be to CAN/A23.1/A23.2. .2 Wood and wood product formwork materials to be to CSA-O121, CSA-O86 and CSA-O153. .2 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. .3 Form release agent: non-toxic, biodegradable. .4 Form stripping agent: colourless mineral oil, non-toxic, and biodegradable. .5 Falsework materials: to CSA-S269.1.
-----	------------------	--

PART 3 - EXECUTION

- | | | | |
|------------|-------------------------------------|----|--|
| <u>3.1</u> | <u>Fabrication and
Erection</u> | .1 | Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings. |
| | | .2 | Fabricate and erect falsework in accordance with CSA S269.1. |
| | | .3 | Fabricate and erect formwork in accordance with CSA-S269.1 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.
.1 Keep form joints to minimum. |
| | | .5 | Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. |
| | | .6 | Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete. |
| <u>3.2</u> | <u>Formwork Removal</u> | .1 | Leave formwork in place for following minimum periods of time after placing concrete.
.1 7 days for concrete anchor block. |
| | | .2 | Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later. |
| | | .3 | Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2. |

END OF SECTION

PART 1 - GENERAL

<u>1.1</u>	<u>Related Sections</u>	.1	Section 03 10 00 Concrete Forming and Accessories.
		.2	Section 03 41 00 Precast Structural Concrete.
<u>1.2</u>	<u>Description</u>	.1	This section specifies concrete reinforcing materials, their fabrication and placing.
<u>1.3</u>	<u>Measurement Procedures</u>	.1	No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required.
<u>1.4</u>	<u>References</u>	.1	American Society for Testing and Materials International (ASTM).
		.1	ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
		.2	Canadian Standards Association (CSA)
		.1	CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction/Methods and Standard Practices for Concrete.
		.2	CSA-A23.3-04 (R2010), Design of Concrete Structures.
		.3	CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
<u>1.5</u>	<u>Shop Drawings</u>	.1	Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00 Submittal Procedures.
		.2	Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, and locations of reinforcement with identifying code marks to permit correct placement without reference to structural drawings. 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

CSA-A23.3, unless otherwise indicated. Provide Class B tension lap splices unless otherwise indicated.

- .4 Each shop drawing submitted to bear the stamp and signature of a qualified Professional Engineer registered in the Province of New Brunswick.

PART 2 - PRODUCTS

- | | | | |
|------------|-------------------------------|----|--|
| <u>2.1</u> | <u>Materials</u> | .1 | Substitute different size bars only if permitted in writing by Departmental Representative. |
| | | .2 | Reinforcing steel: carbon steel, having a yield stress of 400 MPa, deformed bars to CSA-G30.18, unless indicated otherwise. |
| | | .3 | Cold-drawn annealed steel wire ties: to ASTM A82/A82M. |
| | | .4 | Chairs, bolsters, bar supports, spacers: to CSA-A23.1. |
| <u>2.2</u> | <u>Fabrication</u> | .1 | Fabricate reinforcing steel in accordance with CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada. |
| | | .2 | Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings. |
| | | .3 | Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists. |
| <u>2.3</u> | <u>Source Quality Control</u> | .1 | Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis. |

PART 3 - EXECUTION

- | | | | |
|------------|------------------------------|----|---|
| <u>3.1</u> | <u>Field Bending</u> | .1 | Do not field bend or field weld reinforcement. |
| <u>3.2</u> | <u>Placing Reinforcement</u> | .1 | Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1. |
| | | .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.

END OF SECTION

PART 1 - GENERAL

- | | | | |
|------------|-------------------------------|----|---|
| <u>1.1</u> | <u>Description</u> | .1 | The work under this section includes the supply and fabrication of the precast reinforced concrete wall panels, complete with transportation to the site, storage and installation. |
| <u>1.2</u> | <u>Related Sections</u> | .1 | Section 03 20 00 Concrete Reinforcing. |
| <u>1.3</u> | <u>Measurement Procedures</u> | .1 | <u>Concrete Anchor Block</u> : The reinforced concrete anchor Block will be measured for payment by the unit supplied and acceptably installed in the work. |
| | | .2 | <u>Precast Wall Panels</u> : Measure precast wall panels in units supplied, delivered, stored and installed in the work. |
| | | .3 | Reinforcing steel to be incidental to the work and will not be measured separately. |
| | | .4 | No deductions will be made for volume of concrete displaced by reinforcing steel. |
| | | .5 | Supply and installation of concrete additives as recommended by the concrete supplier to be incidental to the work and will not be measured separately. |
| <u>1.4</u> | <u>References</u> | .1 | American Society for Testing and Materials International (ASTM) |
| | | .1 | ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcing. |
| | | .2 | ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete. |
| | | .3 | ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete. |
| | | .2 | Canadian Standards Association (CSA) |
| | | .1 | CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and standard practices for Concrete. |

- .2 CSA-A23.4-09, Precast Concrete - Materials and Construction.
- .3 CSA-A3000-08, Cementitious Materials Compendium.
- .4 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.5 Certificates

- .1 Submit certificates in accordance with Section 01 33 00 Submittal Procedures.
- .2 Provide certification indicating the concrete supplier is certified in accordance with the Atlantic Provinces Ready Mix Concrete Association Program or equivalent.
 - .1 Only concrete supplied from such certified plants shall be acceptable to the Departmental Representative.
 - .2 Plant certification shall be maintained for the duration of the fabrication and erection until the warranty period expires.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1.
- .4 Provide mix design in compliance with CSA-A23.1 to provide concrete of quality, yield and strength as specified under 2.2 Mix Design. Mix design to be prepared by and stamped by an engineer licensed to practice in the Province of New Brunswick.

1.6 Performance
 Requirements

- .1 Tolerance of precast elements to CSA-A23.4, Section 12.
- .2 Length of precast elements not to vary from length indicated by more than plus or minus 10 mm.
- .3 Cross sectional dimensions of precast elements not to vary from design dimensions by more than plus or minus 5 mm.
- .4 Deviations from straight lines not to exceed 6 mm in 3.0 m.

-
- | | | | |
|-----|-----------------------|----|--|
| | | .5 | Precast elements not to vary by more than plus or minus 6 mm from true overall cross sectional shape as measured by difference in diagonal dimensions. |
| 1.7 | <u>Mock-Up</u> | .1 | Contractor to manufacture a single wall panel as representative sample in accordance with CSA-A23.4, Cl. 26.2.1 for inspection and review by Departmental Representative before start of production. |
| | | .2 | Notify Departmental Representative 48 hours in advance of completion of mock-up for inspection. |
| | | .3 | When accepted, mock-up to demonstrate minimum standard of acceptance for this work. |
| | | .4 | Mock-up panel may be incorporated into work if deemed acceptable. |
| 1.8 | <u>Shop Drawings</u> | .1 | Submit shop drawings in accordance with Section 01 33 00 Submittal Procedures, and in accordance with CSA-A23.4. |
| | | .2 | Include the following items: <ul style="list-style-type: none">.1 Details of members, reinforcement and their connections..2 Finish..3 Methods of handling and erection..4 Lifting anchor system with back-up engineer-stamped design calculations. |
| | | .3 | Ensure each drawing submitted bears stamp and signature of qualified professional engineer registered or licensed in province of New Brunswick, Canada. |
| 1.9 | <u>Qualifications</u> | .1 | Precast concrete elements to be fabricated and erected by Contractor who has proven experience in work of this nature and shall be in strict accordance with the requirements of CSA-A23.4. |
| | | .2 | All precast fabrication, curing and protection shall be done within an enclosed, heated building, to the approval of the Departmental Representative. |

- | | | |
|---|----|--|
| <u>1.10 Waste Management and Disposal</u> | .1 | Separate and recycle waste materials. |
| | .2 | Ensure emptied containers are sealed and stored safely for disposal away from children. |
| | .3 | 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. |
| <u>1.11 Warranty</u> | .1 | Contractor hereby warrants that precast elements will not spall or show visible evidence of cracking, except for normal hairline shrinkage cracks, in accordance with subsection GC32.1 of General Conditions "C". |

PART 2 - PRODUCTS

- | | | |
|----------------------|----|---|
| <u>2.1 Materials</u> | .1 | Cement, aggregates, water, admixtures: to CSA-A23.1 and CSA-A23.4. |
| | .2 | Reinforcing steel: as per Section 03 20 00 Concrete reinforcing. |
| | .3 | Portland Cement and Supplementary Cementing Materials (SCM's) to CSA-A3000. |
| | .4 | Aggregates: to CSA-A23.1. Coarse aggregates to be normal density. |
| | .5 | Air Entraining Admixture: to ASTM C260. |
| | .6 | Chemical Admixtures: to ASTM C494/C494M. |
| | .7 | Hardware and miscellaneous materials: to CSA-A23.1. |
| | .8 | Forms: to CSA-A23.4. |
| | .9 | Pipe Sleeve Drains: purpose made plastic of diameter indicated on plans. |

-
- | | | |
|--------------------------------------|----|---|
| <u>2.2</u> <u>Mix Design</u> | .1 | The Contractor shall be responsible for the concrete mix design. |
| | .2 | It shall be the responsibility of the Contractor to ensure that the mixture proportions shall be properly batched, mixed, placed and cured such that the concrete conforms to the specifications. |
| | .3 | Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1, to give following properties: <ul style="list-style-type: none">.1 Cement: use Type GU-F-SF..2 Minimum compressive strength at 28 days: 35 MPa..3 Minimum cement content: 400 kg/m³ of concrete..4 Class of exposure: C-1 and S-3..5 Maximum silica fume not to exceed 10% of the total cementitious content..6 Nominal size of coarse aggregate: 20 mm..7 Maximum water cement ratio: 0.40..8 Air content: 4 to 7%..9 Chloride ion penetrability: less than 1500 coulombs within 91 days. |
| <u>2.3</u> <u>Manufactured Units</u> | .1 | Manufacture units in accordance with CSA-A23.4. |
| | .2 | Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit which will not be exposed. |
| | .3 | Provide hardware suitable for handling elements. |
| | .4 | Support of reinforcing shall be by hanging from top for wall panels. No chairs to be used that will be exposed on formed face of wall panels. |
| <u>2.4</u> <u>Finishes</u> | .1 | Finish surface of units to Finish Grade B to CSA-A23.4, Clause 26.2.4. |
| <u>2.5</u> <u>Curing</u> | .1 | Curing and protection shall be in accordance with CSA-A23.4 and as noted below. |

- .2 Wet cured for a minimum period of 7 days. Concrete shall be kept in a surface damp condition for this period. Ambient temperature to be maintained above 5°C.
- 2.6 Source Quality Control .1 Provide Departmental Representative with certified copies of quality control tests related to this project as specified in CSA-A23.4.
- .2 Provide records from in-house quality control program to Departmental Representative for inspection and review.
- .3 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel supplied, showing physical and chemical analysis.
- .4 Contractor shall keep complete records of supply source of concrete material, and steel reinforcement to Departmental Representative, for review upon request.

PART 3 - EXECUTION

- 3.1 Erection .1 Do precast concrete work in accordance with CSA-A23.3 and CSA-A23.4.
- .2 Install precast elements as specified and as indicated on plans.
- 3.2 Quality Assurance .1 In addition to Contractor's Source Quality Control, inspection and testing of concrete and concrete materials may be carried out by a Testing Laboratory designated by Departmental Representative in accordance with CSA-A23.1 and CSA-A23.4.
- .2 Inspection and testing by Departmental Representative will not augment or replace Contractor's quality control nor relieve him of his contractual responsibility.
- 3.3 Cleaning .1 Remove any impurities of the exposed surfaces on the concrete panels and piles.

- .2 Submit to Departmental Representative for review,
proposed cleaning methods before cleaning soiled
precast concrete surfaces.

END OF SECTION
