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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    The list of work sections in this division is indicative and non-exhaustive. It does not exclude the works described in the other specification sections, shown in the drawings or necessary for the execution of the works in keeping with overall intent of the plans.
- .2    Section 01 32 16.07 – Construction Progress Schedule – Bar (GANTT).
- .3    Section 01 33 00 – Submittal Procedures.
- .4    Section 01 47 21 – Construction/Demolition Waste Management and Disposal.

**1.2            SCOPE OF WORK**

- .1    Provide labour, equipment and material to build and install the formwork as specified on all plans and required for the complete and correct execution of the work.
- .2    Provide and install the blade seals, if applicable.
- .3    Make the construction, control, separation and expansion joints as specified in the plans and specifications.
- .4    Install all of the anchors, plates, supports, bolts and accessories that must be incorporated into the concrete works or required by other disciplines.
- .5    Fabricate and install formwork required for pocket recesses under steel column base plates.
- .6    Remove all of the formworks and waste generated in the course of the work.
- .7    Make all of the openings in the formworks required by other disciplines.
- .8    Caulk all of the construction, control and expansion joints.
- .9    Set in place and verify all of the levels and dimensions of the work covered by this section.
- .10   Provide and install the temporary shoring and braces, when required.
- .11   Fill the tie cones.

**1.3            REFERENCE CODES AND STANDARDS**

- .1    Unless otherwise indicated, the most recent editions of all reference standards must be used.

- .2 Unless otherwise specified, build concrete formwork in compliance with A23.1 and S269.3 standards
- .3 Unless otherwise specified, build temporary works in compliance with S269.1 standard.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - *Submittal Procedures*.
- .2 Submit for information to Departmental Representative shop drawings for formwork and falsework.
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada, and member of the "Ordre des Ingénieurs du Québec".
  - .2 Submit Workplace Hazardous Materials Information System Material Safety Data Sheets.
  - .3 Upon request, provide the Departmental Representative with one copy of a certificate of conformity signed and sealed by an engineer certified with the "Ordre des Ingénieurs du Québec" confirming that the formwork and shoring are compliant with the drawings described in Items 2 and 5 of this section.
  - .4 Shop drawings must indicate, show or include 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. Comply with CSA S269.1, for falsework drawings Comply with CAN/CSA A23.1 and CAN/CSA-S269.3 for formwork drawings.
  - .5 Shop drawings must indicate, show or include formwork design data such as permissible rate of concrete placement, and temperature of concrete in forms.
  - .6 Indicate sequence of erection and removal of formwork/falsework in accordance with the work sequence in section 01 32 16.07 - *Construction Progress Schedule - Bar (Gantt) Chart*.
  - .7 If slip forming and/or flying forms are used, submit details of equipment and procedures for review by Departmental Representative. These form systems may be accepted or not by Departmental Representative upon evaluation of intended mechanical equipment and work procedures to be used.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal :
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 47 21 - *Construction/Demolition Waste Management and Disposal*.
  - .2 Place materials defined as hazardous or toxic in designated containers.
  - .3 Divert wood materials from landfill to a recycling reuse composting facility as approved by Departmental Representative.

- .4 Divert plastic materials from landfill to a recycling reuse composting facility as approved by Departmental Representative.
- .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Formwork materials
  - .1 For concrete without special architectural features (non-exposed surfaces), use plywood, wood and wood derived product formwork materials in compliance with CAN/CSA-O86 and CAN/CSA A23.1.
  - .2 For concrete with special architectural features (exposed surfaces), use new high-density overlay plywood, compliant with the O121 standard.
  - .3 Rigid insulation board : to CAN/ULC-S701.
  - .4 Material for temporary structures : Compliant with the CSA S269.1 standard, Table 1. The materials must have a quality index or come with certificates, testing reports or other confirmations of conformity.
- .2 Form ties :
  - .1 For concrete not meant to have architectural features, use removable or snap-off metal ties, of fixed or adjustable length, free of any devices that could leave holes larger than 25 mm diameter in concrete surface and fitted with polyethylene cones for apparent surfaces. After the removal of the formwork, no part of the tie must be less than 16 mm from the surface.
  - .2 For concrete with architectural features, use snap ties complete with plastic cones and light grey concrete plugs.
- .3 Filling of the tie cones : Quick setting, two-component cement based mortar modified with polymers, cement gray in colour. Compressive strength 20 MPa minimum after 24 hours and 50 MPa after 28 days.
- .4 Form removal oil : Chemical in nature, consisting of components that react with the free lime in the concrete to form water-insoluble soaps and that keep concrete from adhering to the forms, such as Grace's Releaser, ChemRex's Cast-Off or Euclid's Formshield Pure.
- .5 Falsework materials : Compliant with CSA-S269.1.
- .6 Support for construction, control and separation joint caulking: Flexcell, from Sternson or Scelco or Sika equivalent product approved by the Departmental Representative.
- .7 Caulking construction, control and separation joints in unexposed conditions : Duoflex, from Sternson or Sikaflex 2C or equivalent from Scelco approved by the Departmental Representative.

- .8 Acceptable materials or products : When materials or products are specified by their brand names, refer to bidders instructions for procedure on how to submit equivalent/substitution product or material for approval.

## **Part 3 Execution**

### **3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres of walls and columns before proceeding with formwork/falsework and ensure dimensions are as indicated on drawings. The formwork contractor must take into account that tolerance regarding excavation bottoms is 100 mm and that additional formwork is not admissible for this value.
- .2 Obtain Departmental Representative's authorisation before pouring concrete into earth forms or before framing openings in formwork that are not indicated on drawings.
- .3 Before placing concrete in earth forms, trim sides and bottoms of excavated area then remove loose earth and obtain the approval of the Departmental Representative.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Refer to architectural drawings for concrete elements requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 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.
- .9 Align form joints and make them watertight.
- .1 Keep form joints to a minimum.
- .10 Unless otherwise indicated, use 30 mm bevel strips for any visible edges and all edges in contact with a waterproof liner or membrane.
- .11 Form grooves, slots, openings, drips, recesses, expansion and control joints as indicated on drawings.
- .12 Construct forms for architectural concrete, and place ties as indicated.
- .1 Joint pattern may not always allow the use of standard size panels or maximum allowable spacing of ties.
- .13 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

- .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, such as paint for example.
- .14 Provide an adequate camber in the beam and slab forms to correct form slump. This camber must be added to that which is required on the plans, if applicable.
- .15 If the formwork and temporary structures must be used again, comply with the CAN3-A23.1 standard, Article 11.
- .16 Clean formwork in accordance with CSA-A23.1/A23.2 before placing concrete.
- .17 If slip forms and/or flying forms are used, submit the details as specified in section 01 33 00 - *Submittal Procedures*, described in Part 1. The forms may or may not be accepted by the Departmental Representative following the evaluation of the working methods and of the proposed mechanical material.
- .18 Obtain Departmental Representative's approval before making openings which are not shown on drawings in concrete slabs, beams or columns

### 3.2 REMOVAL AND RESHORING

- .1 Once the concrete is poured, in weather conditions near 15 C, the Contractor may remove the forms after the following periods of time, providing that the curing method for free surfaces complies with the specifications and that they are satisfactory to the Departmental Representative :
  - .1 48 h for walls and sides of beams;
  - .2 48 h for columns;
  - .3 28 days for beam soffits, slabs, decks and other structural members, or 7 days when replaced immediately with adequate shoring to standard specified for falsework for curing period;
  - .4 For structural slabs, the removal of formwork, removal of shoring and reshoring (which must remain in place until the 28<sup>th</sup> day) can only start unless the in situ concrete resistance has reached a minimum of 75 % of its specified 28 day resistance. The in situ concrete resistance shall be evaluated by pullout tests (see CSA A23.2-12C standard). Costs for tests shall be at formwork Contractors own expense;
  - .5 12 h for footings and abutments.
- .2 Remove formwork when concrete has reached 75 % of its 28 day specified strength or minimum period noted above, whichever comes first, and replace immediately with adequate reshoring. The curing method for the free surfaces must comply with the specifications and prove to be satisfactory to the Departmental Representative.
- .3 Provide 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.
- .4 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

### 3.3 TOLERANCES

- .1 The following tolerances apply to exposed surfaces where alignment, level or plumb inaccuracies hinder the work of the other trades, reduce resistance under that which is specified or affect the functionality of the structure in any way :

- .1 The following variations are accepted :

Variations in vertical and horizontal lines and surface flatness

- |    |  |                 |
|----|--|-----------------|
| .1 | Walls, edges, slabs, columns and construction joints :   |                 |
| .1 | Over a distance of 3 metres  | 6 mm            |
| .2 | Over a distance of 12 metres or more   | 20 mm           |
| .3 | Maximum offset <i>versus</i> the theoretical position  | 10 mm           |
| .2 | For exposed corners, edges in contact with other materials, construction joints, grooves in formworks and other obvious lines :  |                 |
| .1 | Over a distance of 3 metres  | 3 mm            |
| .2 | Over a distance of 12 metres or more   | 12 mm           |
| .3 | Maximum offset <i>versus</i> the theoretical position  | 6 mm            |
| .3 | Acceptable offsets regarding the position and elevation of the elements to be integrated into concrete other than anchor bolts   | 6 mm            |
| .4 | Acceptable offsets regarding the relative position and elevation of the anchor bolts of a same column or group in compliance with Appendix D of the Code of Standard Practice for Structural Steel published by the Canadian Institute of Steel Construction | 3 mm            |
| .5 | Acceptable offset regarding the dimensions and location of openings  | 6 mm            |
| .6 | Acceptable offsets regarding the dimensions of column cross-section and beams and the thickness of walls and slabs   | + 12 mm / -6 mm |
| .7 | Acceptable offset in setting of anchor bolt reference grid lines   | 6 mm            |

### 3.4 FORMWORK INSPECTION PRIOR TO CONCRETING

- .1 Immediately prior to the pouring of concrete, inspect the formworks to make sure they are positioned correctly, adequately rigid and leak tight, perfectly clean, and that the surfaces have been adequately prepared and are free of snow, ice or other foreign substances.
- .2 Make temporary holes or openings at the bottom of all deep elements, such as columns and walls, to facilitate cleaning and inspection. For elements where space is restricted, the openings must be located such that water can be used to flush out debris and then sealed at the same level as the bottom of the wall.

### **3.5 FORMWORK PREPARATION PRIOR TO CONCRETING**

- .1 Use form oil on all of the prepared form surfaces. Use form oil that will not stain or modify the colour of the exposed concrete surfaces. Use only the necessary amount and remove any form oil from reinforcing steel bars. If a coating is applied to the concrete surface, make sure it is compatible with the form oil. If necessary, use another product for form removal.
- .2 Wet all untreated formwork surfaces to avoid shrinkage and wet the surfaces again immediately prior to concreting.

### **3.6 LINES AND LEVELS**

- .1 Mark all level and reference points.
- .2 During concreting, verify the lines, levels and alignment of the formworks.

### **3.7 CONSTRUCTION, CONTROL, SEPARATION AND EXPANSION JOINTS**

- .1 Construction joints
  - .1 Irregular construction joints are prohibited.
  - .2 Construction joints will be made at the locations indicated on the plans and where required by the Departmental Representative, conditional to the Contractor's working method. With regard to the latter, the joints will be located in such a way as to reduce the strength of the work as little as possible.
  - .3 The position and construction detail of the joints not indicated on the plans are subject to the approval of the Departmental Representative.
  - .4 The steel reinforcements must be continued through the joint. The joint's shear strength will be ensured where required using either key joint formed in the concrete, special reinforcements or any other process deemed satisfactory by the Departmental Representative.
  - .5 Horizontal construction joints in the walls are prohibited except where specified on the plans.
  - .6 For foundation walls (except if backfilled on both sides), walls and slabs exposed to the weather and in all cases required on the plans, make construction joints using a blade seal on the entire length of the joint and caulk.
  - .7 Clean the surface of the construction joints to remove the laitance on the joint's surface as a result of over-vibrating.
  - .8 Make the joints in the slabs on ground and in structural slabs as specified in the plans.
  - .9 Make column construction joints at bottom elevation of beams.
  - .10 Floor joints must be approved beforehand by the Departmental Representative through a detailed plan of the joints produced by the Contractor.
- .2 Control joints
  - .1 Make the control joints on the slabs on ground as indicated on the plans.

- .2 Clean the control joint surface to remove the laitance left on surface as a result of over-vibrating
- .3 Unless otherwise noted on drawings, perform control joints as follow :
  - .1 For walls :
    - Space control joints no more than 6m maximum.
    - Position control joints no further than 3m maximum from a corner.
    - Position a control joints a all sudden change in member section.
    - Use triangular wood strips on both sides of wall; the penetration depth of the wood strips must be equal to the nominal covering of the reinforcement.
    - Caulk the control joints.
    - Interrupt 50 % of the horizontal reinforcing steel.
  - .2 Do not perform control joints in shear walls, deep beams or other members listed on plans.
- .3 Separation joints
  - .1 Make the separation joints as indicated on the plans.
  - .2 For foundation walls, walls and slabs exposed to the weather, place a blade seal in all of the separation joints, as well as a support for caulking.
  - .3 Caulk the separation joints with a sealant, as specified in Part 2.
  - .4 Except if indicated on the plans, place a 12 mm isolation board over the entire height of the slabs on ground in contact with a foundation wall or column. Caulk the last 12 mm of the joint height with a sealant, as specified in Part 2.
- .4 Expansion joints
  - .1 Make the expansion joints as specified on the plans.

### **3.8 WATERTIGHT BLADE SEAL PLACEMENT**

- .1 Contractor must take all necessary care in maintaining blade seals into position during concrete work; among other things, he must install a 15M rebar at the blade seal top. This bar is attached to blade seal and held in place by wires attached to wall or mat vertical rebar.
- .2 Weld blade seal joints to insure they are watertight. Same applies for blade seal joints in walls and slabs.

### **3.9 ELEMENTS TO BE EMBEDDED IN CONCRETE AND CSST CERTIFICATE**

- .1 Make openings and place the sleeves, fasteners, anchor bolts, stirrups and other elements to be incorporated into concrete floors and walls as specified by other trades. Sleeves, openings, etc., more than 100 mm x 100 mm and that are not indicated on the structural drawings must be approved by the Departmental Representative.



- .2 If anchor bolts must be set when pouring concrete columns, contractor must use necessary methods (double templates etc.) to insure bolts are straight and within tolerances listed in section 3.2.
- .3 No sleeves, pipes or other opening-type element shall pass through a concrete wall or column unless formally indicated in the structural drawing details or authorized by the Departmental Representative.
- .4 Removing or moving reinforcement bars in order to install hardware is prohibited. If elements to be integrated into concrete cannot be placed at the specified location, have any modifications approved by the Departmental Representative.
- .5 Make sure all of the indications on the construction drawings regarding the location and size of sleeves, openings, etc., match those indicated on the drawings of other trade specialties.
- .6 Welding metal pieces to the steel reinforcement is prohibited, unless authorized by the Departmental Representative.
- .7 The Contractor must provide the “Commission de santé et sécurité du travail du Québec” (CSST) with all of the certificates required by the latter as per the “Code de sécurité pour les travaux de construction” (construction work safety code) of the “Loi sur la santé et la sécurité du travail” (law on health and safety in the workplace), including those requiring the signature of an engineer certified by the “Ordre des Ingénieurs du Québec” and related to the installation of column anchor rods shown on erection plan (ref. : Articles 3.24.11 and 3.24.12 of the “**Modifications réglementaires au Code de sécurité pour les travaux de construction et Règlement sur la santé et la sécurité du travail**”).

### 3.10 REINFORCING STEEL ON STAND BY

- .1 At some locations, stand by reinforcement steel rods are shown on drawings. The Contractor must take these details into account when preparing his bid. If required, he will have to perforate, notch or saw the formwork in order to respect the details shown.

### 3.11 CAMBERS

- .1 Make cambers in structural slabs according to typical details on structural drawings. An increased curve or camber may be needed to compensate for formwork deflexion when concreting. These additional corrections must be determined by Contractor and added to camber specified on drawings.
- .2 Prior to pouring concrete, Contractor must perform a complete survey of top of formwork (5 survey points per bay). Contractor will provide Departmental Representative with the survey and await his approval before proceeding to pour the slabs.
- .3 At each survey point, (see typical detail) Contractor will install a level mark (wood stake) before pouring concrete in order to insure constant thickness of slab.

- .4 Concrete placement shall be made using straight edge wooden screed. Use of vibrating steel screed 12 feet or longer is prohibited.
- .5 Five (5) days after pouring slab, Contractor shall provide a complete survey of top of slab elevations (5 survey points per bay).
- .6 Upon Departmental Representative's request, provide a complete survey of top of slab elevation after shoring has been removed.

**END OF SECTION**