

**1 General**

**1.1 SECTION INCLUDES**

- .1 Formwork, complete with required bracing and anchorages.
- .2 Concrete reinforcing, complete with required supports, spacers and tie wire.
- .3 Cast-in-place concrete.

**1.2 REFERENCE STANDARDS**

- .1 CSA 03001- Cementitious Materials Compendium
- .2 CAN CSA A23.1 - "Concrete Materials and Methods of Concrete Construction".
- .3 CSA CAN3 A23.3 - "Code for Design of Concrete Structures in Buildings".
- .4 CSA G30.12 - "Billet Steel Bars for Concrete Reinforcement".
- .5 ACI 315 - "American Concrete Institute - Manual of Standard Practice"
- .6 CSA-O121- M1978 (R1998), Douglas Fir Plywood
- .7 CAN/CSA O141-91, Softwood Lumber

**1.3 QUALITY ASSURANCE**

- .1 Perform cast-in-place concrete work in accordance with requirements of CAN CSA A23.1.

**1.4 INSPECTION AND TESTING**

- .1 Concrete testing shall be carried out by an independent testing agency, acceptable to the Consultant, appointed and paid for by the Contractor.
- .2 The testing agency shall be responsible for sampling, initial curing and transporting of test cylinders to the Laboratory.
- .3 Notify the Consultant and Testing Agency at least 24 hours prior to each concrete pour.
- .4 Provide free access to all portions of work and cooperate with appointed firm.
- .5 Concrete testing shall consist of three (3) test cylinders taken for every 50 cubic meters or less of each class of concrete placed each day. One (1) cylinder to be tested at 7 days, the remaining two (2) cylinders to be tested at 28 days.
- .6 For concrete walks, curbs and gutters, three (3) concrete test cylinders shall be taken for every 75 cubic metres or less of concrete placed each day.
- .7 One (1) additional test cylinder shall be taken during cold weather concreting, and be cured on

- jobsite under same conditions of concrete it represents.
- .8 One (l) slump test and one (1) air content test shall be taken for each set of test cylinders taken.
  - .9 Testing of concrete shall be performed in accordance with CAN/CSA-A23.2.
  - .10 Test results shall be issued to the Architect, Structural Engineer, Contractor, Owner and Ready-mixed Concrete Supplier. Test reports are to be numbered consecutively beginning with number one, and identify the location of the concrete placement in the project.
  - .11 Required retesting will be paid for by the Contractor.
  - .12 The Consultant may order additional testing any time even though the required tests indicate the strength requirements have been met. In this instance, the Owner will pay for those tests that meet the specified requirements and the Contractor shall pay for those that do not.
  - .13 Non-destructive methods for testing concrete shall be according to CAN/CSA-A23.2.

## **1.5 SHOP DRAWINGS**

- .1 Submit shop drawings of reinforcing steel.
- .2 Clearly indicate bar sizes, spacings, locations and quantities of reinforcing steel bending and cutting schedules, and supporting and spacing devices.
- .3 All drawings and schedules shall be prepared and checked under the direct supervision of a qualified professional engineer who is experienced in this work. Conform to ACI 315.
- .4 Consultant's review of shop drawings will be for size and arrangement only. Such review will not relieve Contractor of responsibility for general and detail dimensions and fit or any errors or omissions.

## **1.6 SUBMITTALS**

- .1 Submit proposed mix design for each class of concrete to consultant for review two weeks prior to commencement of work.
- .2 Submit certification that proposed mix proportions will produce concrete of the specified quality.
- .3 Submit name and company qualifications of concrete testing firm two weeks prior to commencement of work.

## **2 Products**

### **2.1 FORMWORK MATERIALS**

- .1 Plywood: Douglas Fir, species: conforming to requirements of CSA-O121, solid one side, exterior grade; sound undamaged sheets with clean true edge.

- .2 Lumber: conform to CSA Standard 0141 for softwood lumber with grade stamp clearly visible.
- .3 Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: sized as required; of sufficient strength and character to maintain formwork in place while pouring concrete.
- .4 Form Ties: removable snap-off metal type of adjustable length; minimum working strength of 21 MPa when assembled; free of defects that will leave holes larger than 25 mm in concrete surface.
- .5 Form Release Agent: proprietary material which will not stain concrete or impair natural bonding or colour characteristics of coating intended for use on concrete.

## **2.2 REINFORCING**

- .1 Reinforcing Steel; deformed billet steel bars conforming to requirements of CSA G30.12; plain finish. 300 MPa for stirrups and ties. 400 MPa for all other bars.
- .2 Tie Wire: minimum 1.5 mm annealed type, or patented system approved by Consultant.
- .3 Chairs, Bolsters, Bar Supports, Spacers: adequately sized and shaped for strength and support of reinforcing during construction conditions.

## **2.3 CONCRETE MATERIALS**

- .1 Cement: Portland type, conforming to requirements of CSA 03001- Cementitious Materials Compendium
- .2 Supplementary Cementing Materials: to CSA 03001- Cementitious Materials Compendium. Flyash Type C or F permitted to a maximum of 15% by weight of total cementitious material.
- .3 Fine and Coarse Aggregates: standard concrete type, conforming to requirements of CSA A23.1.
- .4 Water: clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material.
- .5 Air Entrainment Admixtures: conforming to requirements of CSA 23.1.
- .6 Chemical Admixture: conforming to requirements of CSA 23.1 water-reducing, strength increasing type WN-normal setting.

## **2.4 ACCESSORIES**

- .1 Void Form: system made decomposable cardboard slab and beam forms or GeoVoid compressible void filler manufactured by PlastiSpan.
- .2 GeoVoid compressible void filler system to be designed and installed to fail at a maximum net uplift pressure of 1.2 kPa when combined with concrete self weight alone. Void space shown on drawings is sized for cardboard void form. For GeoVoid, increase depth of void to

provide space for crushed material. Contractor to provide shop drawings sealed by a professional engineer registered in the province of Saskatchewan. Shop drawings to provide detailed information regarding slab uplift pressures.

## **2.5 CONCRETE MIX**

- .1 Mechanical mix concrete in accordance with requirements of CSA A23.1.
- .2 Provide concrete with properties as indicated on the drawings.

## **2.6 REINFORCING FABRICATION**

- .1 Fabricate concrete reinforcing in accordance with Drawings and CSA CAN3-A23.3. Spacing and arrangement of supports in accordance with ACI-315.
- .2 Locate reinforcing splices, not indicated on Drawings, at points of minimum stress. Location of splices is to be approved by Consultant.
- .3 Unless indicated otherwise on other drawings, provide reinforcing not shown on structural drawings as follows:  
Sections up to 100 mm thick: 10M @ 400 o.c. each way mid depth  
Sections up to 150 mm thick: 10M @ 300 o.c. each way mid depth  
Sections up to 200 mm thick: two layers of 10M @ 400 o.c. each way  
Provide matching dowels along full perimeter, 600mm long to be embedded in concrete 125mm with anchor adhesive.

## **3 Execution**

### **3.1 PATCH AND REPLACEMENT OF SLAB ON GRADE**

- .1 Sawcut and remove concrete slab on grade as required by drawings for underslab services.
- .2 Backfill to underside of existing slab with well compacted granular material in maximum 150mm lifts.
- .3 Place 6mil poly vapour barrier over compacted granular.
- .4 Drill and install dowels to existing slab using anchor adhesive.
- .5 Place reinforcing and ensure bars to properly secured.
- .6 Place and finish concrete to match existing elevations and thickness.

### **3.2 FORMWORK ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork. Ensure that dimensions agree with Drawings.

- .2 Construct formwork, shoring and bracing to meet design and code requirements, accurately so that resultant finished concrete conforms to shapes, lines and dimensions indicated on Drawings.
- .3 Arrange and assemble formwork so as to permit easy dismantling and stripping, so that concrete is not damaged during its removal.
- .4 Align joints and make watertight, to prevent leakage of mortar and disfigured appearance of concrete. Keep form joints to minimum.
- .5 Provide bracing to ensure stability of formwork as a whole. Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.
- .6 Construct formwork to maintain the following maximum tolerances:
  - .1 Deviation from horizontal and vertical lines: 6 mm in 3000 mm.
  - .2 Deviation in cross sectional dimensions of columns or beams, or in thickness of slabs and walls: 6 mm.
- .7 Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices and embedded parts.

### **3.3 REINFORCING PLACEMENT**

- .1 Place reinforcing as indicated on Drawings, adequately supported and secured against displacement. Do not deviate from true alignment.
- .2 Before placing, ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings which would reduce the bond to concrete.

### **3.4 PLACING CONCRETE**

- .1 Place concrete in accordance with lines and levels indicated on Drawings and in accordance with requirements of CAN/CSA-A23.1.
- .2 Ensure all core duct sleeves are placed, held securely and will not cause undue hardship in placing concrete. Rectify same before proceeding with work.
- .3 Ensure reinforcements and core duct are not disturbed during concrete placement.
- .4 Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's recommendations.

### **3.5 FORM REMOVAL**

- .1 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, and design loads which are liable to be imposed upon it.
- .2 Remove formwork progressively and in accordance with code requirements and so that no shock loads or unbalanced loads are imposed on structure.

- .3 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.
- .4 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.

### **3.6 COLD WEATHER REQUIREMENTS**

- .1 When the air temperature is at or below 5°C or when there is a probability of it falling to that limit during the placing or curing period, cold weather requirements shall be applicable.
- .2 Protection shall be provided for newly placed concrete by means of suitable enclosures, coverings, and / or adequate insulation as indicated in CAN/CSA-A23.1-94, Clause 21.2.3.
- .3 Concrete shall not be placed on or against reinforcement, formwork, ground or any surface that is at a temperature less than 5°C.
- .4 The temperature of the concrete at all surfaces shall be maintained at not less than 10°C for three days or the time necessary to attain a specified strength of 15 mPa. Means shall be provided to humidify the air within enclosures and to keep the concrete and formwork continuously moist if dry heat is used.
- .5 At the end of the specified protection period, the temperature of the concrete shall be reduced gradually to the temperature differential shown in CAN/CSA-A23.1-94, Table 16.
- .6 Accelerator or so-called anti-freeze compounds shall not be permitted unless otherwise approved in writing by the Consultant.
- .7 All protective coverings shall be kept clear of the concrete and form surfaces to permit free circulation of air and shall be maintained intact for at least 24 hours after artificial heat is discontinued.

### **3.7 DEFECTIVE CONCRETE**

- .1 Allow consultant to inspect concrete surfaces immediately upon removal of forms. Patch imperfection as directed.
- .2 Modify or replace concrete not conforming to lines, detail and elevations indicated on Drawings, to the satisfaction of the Consultant.
- .3 Repair or replace concrete not properly placed resulting in excessive honeycombing and other defects in critical areas of stress, to the satisfaction of Consultant. Excessive honeycombing is when eraser part of a pencil fits in the hole.
- .4 Concrete of insufficient strength or improper consistency shall be, as required by the Consultant, subject to one or more of the following:

- .1 Changes in mix proportions for the remainder of the work.
- .2 Cores drilled and tested from the areas in question as directed by the Consultant and in accordance with CAN/CSA-A23.2. The test results shall be indicative of the in-place concrete.
- .3 Load testing of the structural elements in accordance with CAN3-A23.2.
- .4 The changes in the mix proportions and the testing shall be at the Contractor's expense.
- .5 Concrete failing to meet the strength requirements of this Specification shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Consultant.

### **3.8 VOID FORM**

- .1 Install void form on a minimum of 50 mm compacted sand screed.
- .2 Install cardboard void form in strict accordance with manufacturers recommendations.
- .3 Protect the ground from freezing during the curing period.
- .4 When constructing in cold weather ensure cardboard void decomposes immediately after the curing period.

### **3.9 FINISHING**

- .1 Exterior concrete walks/pads: light broom. Match reviewed sample.
- .2 Interior slabs: final finished to a hard, smooth dense trowelled surface free from blemishes. Final finish to CAN/CSA-A23.1, Clause 7.5, to produce floor surface of pleasing appearance, easily cleaned and maintained with high wear-resistance characteristics.

### **3.10 FLOOR TOLERANCES**

- .1 Maintain surface flatness with maximum variation of 5mm in 3 metres, and absolute maximum of 6mm. Surface flatness to be measured by the straightedge method according to CAN/CSA-A23.1, Clause 7.5.1.2.
- .2 Maintain surface slope between reference points more than 3m apart to 1:600 with absolute maximum of 30mm over the total length of the structure. Refer to CAN/CSA-A23.1, Figure

### **3.11 FLOOR CURING**

- .1 All floors shall be kept continuously moist for a minimum of seven consecutive days after placement of the concrete. The water for curing shall be clean and free from any materials that will cause staining or discoloration of the concrete. A liquid, membrane forming, curing compound may be used under circumstances where the application of moisture is impracticable and where such compounds will not jeopardize the appearance of the concrete nor the bonding of future floor finishes.

**END OF SECTION 03 30 00**