

---

**03 10 00-Concrete Forming and Accessories**

**GENERAL NOTE**

Comply with Instructions to Bidders, the General Conditions as amended and with Division 1 requirements.

**1.0 GENERAL**

**1.1 WORK INCLUDED BUT NOT LIMITED TO:**

- .1 All formwork for cast-in-place concrete including false work.
- .2 Re-shoring of concrete slabs and beams.
- .3 Shoring existing construction to support construction loads.
- .4 Pull-out Testing.
- .5 All embedments, water stops, anchor accessories etc.
- .6 Refer to General Notes on the Structural drawings.

**1.2 RELATED SECTIONS:**

- .1 Section 03 20 00: Concrete Reinforcing
- .2 Section 03 30 00: Cast-in-Place Concrete

**1.3 FORMWORK DESIGN AND CODE REQUIREMENTS**

- .1 Design all formwork including shores, bracing, false work, etc. for all loads and lateral pressures as recommended in the Ontario Building Code and the National Building Code of Canada, latest edition, CAN/CSA A23.1-94 and CAN/CSA-S269.2-M92, ACI Standard 347. False work to CSA Standard S269.1-1975 for supported work. The design and erection of formwork and related supporting works shall comply with the Construction Safety legislation and regulations. This Contractor must assume full responsibility for the design and adequacy of all formwork and false work.

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 Submittals.
- .2 Submit shop drawings for formwork, falsework and reshoring. Illustrate method, materials, cambers etc. Illustrate sequence of erection and removal of falsework, formwork and reshoring.
- .3 Provide shop drawing for all forming accessories, forms, liners, ties, tie plugs, etc.

- .4 Provide shop drawings sealed and signed by a Professional engineer in the Province of Ontario.

## **1.5 TOLERANCES**

- .1 Conform to CSA A23.1, Clause 6.

## **1.6 FORMING FOR ARCHITECTURAL CONCRETE**

- .1 Architectural concrete is exposed to view concrete. The concrete can be exposed on the exterior and/or interior of the building. Refer to architectural drawings for locations of walls, columns, ceilings (underside of floor slab) and other formed surfaces.
- .2 The quality of the forming materials and accessories will contribute to the final finish of the concrete. The consultant has the right to reject forming materials that are not applicable to the intended finish concrete expectations.
- .3 The final appearance of the concrete will determine acceptance or rejection.

## **1.7 SAMPLES AND MOCK-UPS**

- .1 Submit sample of formwork, circular forms, form liner, form tie, tie hole plug, etc.
- .2 Construct a mock-up field sample of wall and column for review of the finish architectural concrete surface. The accepted sample will be the minimum standard of quality of work. Repeat the sample until the consultants have accepted the samples.

## **2.0 PRODUCTS**

### **2.1 MATERIALS**

- .1 Falsework materials to meet CSA S269.1.
- .2 Formwork materials to meet CAN/CSA S269.3 as follows:
  - .1 For concrete not exposed to view, plywood and wood formwork materials to CSA O121 and CAN/CSA O141.
  - .2 For Architectural concrete (exposed to view) high density overlay plywood to CSA O121.
  - .3 Circular forms for architectural concrete (exposed to view) having no spiral pattern, Redline Poli-Permaform with poli-liner by Perma Tubes Ltd. or approved equal.
- .3 Form ties as follows:

- .1 For concrete not exposed to view, removable or snap ties, fixed or adjustable length, free of devices leaving a hole larger than 25mm (1") in concrete surface.
- .2 For Architectural concrete (exposed to view) galvanized ties complete with temporary plastic cones and permanent grey concrete plugs recessed 6mm (0.25").
- .3 Form ties to be metal designed as ties and spreaders having a minimum strength of 13 kN (3,000 pounds).
- .4 Snap ties to snap at minimum of 25mm (1") from the concrete surface.
- .5 Cone ties to internal disconnecting snapping 38mm (1 ½") from concrete surface without damage to the concrete.
- .4 Form liner to be high density plywood to CSA O121 or equal to maintain exposed concrete finish.
- .5 Form releasing agents designed for application and resist staining of concrete.
- .6 Grooves, reglets and chamfers using select pine shall be straight and accurately dressed to the sizes indicated on the drawings.

## **2.2 ACCESSORIES**

- .1 PVC Waterstops:
  - .1 CDP PVC Waterstop
  - .2 W.R. Meadows of Canada Sealtight PVC Waterstop.
- .2 Bentonite Waterstops:
  - .1 Waterstop RX 101 by CETCO
  - .2 Waterstop EC by W.R. Meadows

## **3.0 EXECUTION**

### **3.1 FABRICATION AND ERECTION**

- .1 All work to conform to CSA A23.1.
- .2 Fabricate and erect falsework in accordance with CSA-S269.1.
- .3 Fabricate and erect falsework in accordance with CAN/CSA-S269.3 to provide finished concrete to shapes, dimensions etc. as per the drawings.
- .4 Fabricate formwork tight and flush to prevent leakage and panel outlines.

- .5 Form sides of footings unless noted otherwise on structural drawings.
- .6 Refer to drawings and schedules for required cambers in set concrete members.
- .7 Obtain Consultant's review of required form openings not indicated on the structural drawings.
- .8 Build in sleeves, anchors etc. required to accommodate the Work of other trades.
- .9 Use internal form ties:
  - .1 Do not permit loads from forms to be transmitted to existing structural elements.
  - .2 Apply a form coating and releasing agent to contact surfaces.
- .10 Construction joints:
  - .1 Provide construction joints where shown on drawings or as indicated in the general notes. Locate all other joints in consultation with the Consultant.
- .11 PVC Waterstops:
  - .1 Install waterstops in expansion joints, construction joints, control joints etc. of exterior walls, basement walls, retaining walls and other locations as indicated on the drawings.
  - .2 Heat splice all sections of waterstops for continuity over the length of the run. Use prefabricated splice sections at intersecting runs.
- .12 Bentonite Waterstops:
  - .1 Install bentonite waterstops in all construction joints of exterior walls, pit walls, basement walls etc.
  - .2 Install bentonite waterstops 75 mm (3") from outside face of concrete.
  - .3 Butt strips together and fasten at 600 mm (24") maximum.
- .13 Architectural Concrete:
  - .1 Conform to CSA-A23.1. Minimize formwork joints. Locate joints and ties in a repetitive symmetrical grid commencing at the center point of the wall or element.
  - .2 No ties to be located within 300 mm (12") of an edge or joint.
  - .3 Locate the lowest horizontal joint for exposed columns 2400 mm (8'-0") above finish floor.
  - .4 Refer to drawings for all corner bevels, reglets, grooves, etc.

- .5 Do not reuse forms that have surface damage, holes, etc that will compromise the quality of the concrete finish. Clean forms and fill holes and ensure the tie pattern is correct.

### **3.2 FORM STRIPPING AND RESHORING**

- .1 Conform to CSA A23.1.
- .2 Refer to the structural general notes for all stripping and reshoring requirements.
- .3 Obtain a field review and issue a report of all falsework and reshoring by a professional engineer registered in the province of Ontario prior to each pour.

### **3.3 MISCELLANEOUS FORMWORK**

- .1 Construct all concrete sumps, pits, trenches, housekeeping pads, curbs, etc.
- .2 Co-ordinate the work with all trades so as to accommodate the requirements of other sections of the specifications and drawings.

### **3.4 CLEANING**

- .1 Upon completion of the work, remove all containers, surplus materials, and installation equipment, excess material, and debris. Project area must be left in a clean and orderly condition.

**END OF SECTION**



---

**03 20 00-Concrete Reinforcing**

**GENERAL NOTE**

Comply with Instructions to Bidders, the General Conditions as amended and with Division 1 requirements.

**1.0 GENERAL**

**1.1 WORK INCLUDED:**

- .1 All reinforcing for cast-in-place concrete.
- .2 Supply of reinforcing bars for masonry.

**1.2 RELATED SECTIONS:**

- .1 Section 03 10 00: Concrete Forming and Accessories
- .2 Section 03 30 00: Cast-in-Place Concrete
- .3 Section 04 80 00: Masonry Assemblies

**1.3 QUALITY CONTROL OF MATERIAL**

- .1 Provide a certified copy of the material mill test report, source of supply, plant certification for epoxy coating and patching procedures for factory applied epoxy coating.

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 Submittals.
- .2 Submit shop drawings, plans, elevations, sections and bar lists to facilitate review and placing.
- .3 Indicate bar bending details, lists, quantities, sizes, spacing, location and splices with identifying code marks to permit placement and inspection without referencing the structural drawings.
- .4 Provide all accessories as required by the standard.
- .5 Design and detail lap lengths and bar development lengths to CSA-A23.3.
- .6 A copy of the reviewed shop drawings shall be on the construction site and made available to consultants, inspectors, installers, etc.

**2.0 PRODUCTS**

**2.1 MATERIALS**

- .1 Reinforcing steel: billet steel, grade 400R, deformed bars to CSA-G30.18 unless otherwise indicated.
- .2 Cold-drawn annealed steel wire ties to meet ASTM A82.
- .3 Welded Wire Fabric to meet ASTM A185, flat sheets only.
- .4 Epoxy coated reinforcement to be fusion bonded epoxy coating conforming to ASTM D3963/D3963M. All bars to be supplied by plants certified by the Concrete Reinforcing Steel Institute for epoxy-coated steel.
- .5 Bar supports and side form spacers to meet CSA-A23.1 Use plastic bar supports and form side supports.

### 3.0 EXECUTION

#### 3.1 FABRICATION

- .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 Ship bundles of bar reinforcing clearly identified in accordance with the shop drawing bar list.

#### 3.2 INSTALLING REINFORCING

- .1 Install reinforcing to CSA A23.1.
- .2 Handle epoxy coated bars in accordance with CSA S413.
- .3 Place reinforcing to maintain the concrete coverage as indicated on the structural drawings and/or as required by the fire rating.
- .4 Before placing reinforcing remove all scale, dirt, oil or other contaminate that would reduce bond.
- .5 Use bar supports and spacers.

#### 3.3 PATCHING FACTORY APPLIED EPOXY COATING

- .1 At damaged epoxy coating locations patch in accordance with coating manufacturer written instructions and material.

#### 3.4 INSPECTIONS

- .1 Provide the consultant and Independent Inspection and Testing Agency 24 hours notice of intent to pour concrete to permit review of installed reinforcing.
- .2 The cost of the inspection will be paid from the Cash Allowance.



### **3.5 MASONRY REINFORCING**

- .1 Supply all reinforcing required for the construction of masonry walls, lintels, beams, columns, etc. Refer to Architectural and Structural drawings for scope of Work.

### **3.6 MISCELLANEOUS REINFORCING**

- .1 Supply and install reinforcing at all concrete sumps, pits, trenches, housekeeping pads, curbs, exterior light standards, etc.
- .2 Co-ordinate the work with all trades so as to accommodate the requirements of other sections of the specifications and drawings.

### **3.7 CLEANING**

- .1 Upon completion of the work, remove all containers, surplus materials, and installation equipment, excess material, and debris. Project area must be left in a clean and orderly condition.

**END OF SECTION**



---

**03 30 00-Cast-In-Place Concrete**

**GENERAL NOTE**

Comply with Instructions to Bidders, the General Conditions as amended and with Division 1 requirements.

**1.0 GENERAL**

**1.1 WORK INCLUDED BUT NOT LIMITED TO:**

- .1 All concrete related the erection of the Change Facility, Covered Roof Area and miscellaneous low Walls and Benches as detailed on the Architectural, Structural and Mechanical and Electrical drawings.
  - .1 All plain and reinforced concrete footings, walls, column footings, piers, columns, floor slabs, thickened floor slabs, roof toppings, housekeeping pads.
  - .2 Finishing of all concrete surfaces inclusive of polished concrete (POL. CONC) as per the Room Finish Schedule.
  - .3 Installation of anchor bolts and steel bearing plates complete with grout.
  - .4 Expansion strips, pre-molded expansion joints, saw cut control joints, slotted inserts, cast-in-place plates, sleeves, bonding agents, non-shrink grout, etc.
  - .5 Below slab, on grade Vapour Barrier.
  - .6 All thickened and depressed floor slabs, concrete formed platforms.
  - .7 All concrete work called for on architectural, structural, mechanical and electrical drawings unless noted by others.
  - .8 Finishing of all concrete surfaces.
  - .9 All concrete sidewalks, pads and platforms, etc. shown on Site Plan under Covered Canopy and to within 5'-0" surrounding building.
  - .10 Concrete testing.

**1.2 RELATED SECTIONS:**

- .1 Section 03 10 00: Concrete Forming and Accessories
- .2 Section 03 20 00: Concrete Reinforcing
- .3 Section 04 80 00: Masonry Assemblies - Grout fill in masonry walls
- .4 Section 07 26 16: Underslab Vapour Retarder

### **1.3 SUBMITTALS**

- .1 Prior to the commencement of any work, submit the following:
  - .1 The concrete supplier to provide a copy of Certificate of Ready Mixed Concrete Production Facilities as issued by the Ready Mixed Concrete Association of Ontario.
  - .2 Submit all concrete mix designs, including pump mixes and indicate where the concrete mix is to be used.
  - .3 Submit all admixtures intended to be used in the concrete mix design.
  - .4 Each concrete mix design shall include the following:
    - .1 Aggregate type and size
    - .2 Concrete density range, wet and dry
    - .3 CSA exposure class
    - .4 Cement type
    - .5 Maximum water/cement ratio
    - .6 plastic air content range
    - .7 air-void system test data
    - .8 slump range
    - .9 percentage and type of supplemental cementing materials
    - .10 admixtures (all admixtures must be from the same supplier)
    - .11 assumed method of placement of the concrete.
  - .5 Submit a drawing, indicating all formwork joint layouts for the underside of the Covered Area and for any exposed to view walls within the interior.
  - .6 Submit sawcut locations for floors.

### **1.4 COLD WEATHER REQUIREMENTS**

- .1 When air temperature is at or below 5 degrees Celsius or there is a probability of it falling to that limit during the placing or curing period, cold weather requirements shall be applicable and shall be governed by CAN/CSA A23.1-94 and ACI Standard 306, Recommended Practice for Cold Weather Concreting.
- .2 Provide heating equipment and enclosures to maintain humidified air within the enclosures to keep the concrete above freezing temperature for seven days. Heating equipment inducing carbon monoxide gas in the building is not acceptable. Also, concrete shall be protected from alternately freezing and thawing for a period of 14 days after placement.
- .3 When placed, concrete shall have a temperature of not less than 5 degrees C. and not more than 27 degrees C. Accelerators or so-called anti-freeze compounds shall not be permitted unless approved in writing by the Architect. 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.

- .4 Forms must be clean of ice and snow. Use compressed air or other means to remove foreign matter.

## **1.5 HOT WEATHER REQUIREMENTS**

- .1 Hot weather protection shall meet the requirements of CAN/CSA A23.1-94.
- .2 When the air temperature exceeds 27 degrees C. hot weather requirements shall be applicable. The time of initial mixing to complete discharge shall not exceed one hour and fifteen minutes. Temperature of concrete as placed shall not exceed 27 degrees C.
- .3 Concrete forming surfaces and reinforcing steel shall be sprinkled with cool water just prior to placing concrete but no standing water or puddles will be allowed.
- .4 Slabs shall be kept damp continuously for 24 hours followed by normal curing procedures.
- .5 Slabs may be cured by the application of a clear pigmented curing compound applied immediately after finishing of slab but before evaporation of surface moisture. The use of water reducing agents must be approved by the Architect when hot weather conditions prevail.

## **1.6 MIXING AND DELIVERY**

- .1 Concrete shall be mixed in a mechanical batch mixer or a type approved by the Architect and meeting the requirements of CAN/CSA A23.1-94.
- .2 Mixing time shall conform to CAN/CSA A23.1-94. Mixers shall be rotated at the rate recommended by the manufacturer of the equipment.
- .3 Concrete from the mechanical batch mixer shall be transported to the project site in agitating or non-agitating equipment conforming to CAN/CSA A23.1-94.
- .4 Ready mixed or transit mixed concrete shall be batched, mixed and transported in accordance with CAN/CSA A23.1-94.
- .5 Each load of ready mixed or transit mixed concrete delivered to the project site shall be accompanied by duplicate delivery slips providing all information pertaining to each batch of concrete and/or as the Owner's Representative may require.

## **1.7 STRENGTH AND CONSISTENCY**

- .1 Concrete materials shall be proportioned to provide a workable mix that can be handled, placed and worked into angles and corners of forms and around reinforcing steel and inserts. The mix proportion shall not be such that the concrete will easily segregate or cause excessive water to collect on the surface.

- .2 The strength of concrete shall be considered to be its strength at 28 days.

### **1.8 INSERTS FOR OTHER WORK**

- .1 Install inserts, hangers, metal ties, plates, anchors, bolts, dowels, slots, nailing strips, dove tail anchors, blocking or other fastening devices required for the attachment of other work. Properly locate in cooperation with other trades and secure in position before concrete is poured.
- .2 Provide embeds, boxes and the like for mechanical and electrical fixtures and devices.

### **1.9 INSPECTION AND TESTING**

- .1 The Consultant will appoint and costs will be paid from cash allowance in contract for an independent testing agency to test average concrete of each days pouring. The independent testing agency shall perform the following:
  - .1 Supply cylinder moulds sample the concrete, make and cure test cylinders and perform compressive strength tests in accordance with current CSA-A23.2-94 Standards.
  - .2 Make slump tests and air content tests as required in accordance with current CSA-A23.2-94.
  - .3 A concrete test shall consist of four (4) cylinders properly labeled showing mix, location and date of pouring. Cylinders shall be cured under laboratory conditions. Contractor shall make provisions for initial curing of all cylinders a minimum of 24 hours.
    - .1 Provide facilities for storing specimens at the required temperature and in a location free from vibration or injury.
    - .2 Test one (1) cylinder at seven (7) days and two (2) cylinders at 28 days. Should the 7 or 28 day test fail to meet the design strength, test the fourth (4th) cylinder at 90 days to verify results.
- .2 Send two (2) certified copies of all test results direct to the Consultants with additional copies to the Contractor as directed.

### **1.10 POLISHED CONCRETE QUALITY ASSURANCE**

- .1 Installer/manufacturer Qualifications:
  - .1 Installer with a minimum of 5 years' experience in performing work of this section who has specialized in installation of work similar to that required for this project.
  - .2 Installer trained and holding a current certificate as a FGS PermaShine installer OR EQUAL.

- .3 Current Certification from the CPAA stating that the technicians are trained craftsmen.
- .4 Concrete finishing components and materials shall be from single manufacturer
- .5 Manufacturer capable of providing field service representation during construction and approving application method.
- .6 Manufacturer shall have a minimum 5 years of experience in manufacturing components similar to or exceeding requirements of project.
- .2 Mock-ups:
  - .1 Mock-Up Size: 100 sf (9.3 m2) sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
  - .2 Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
  - .3 Allow 24 hours for inspection of mock-up before proceeding with work.
  - .4 When accepted, mock-up will demonstrate minimum standard of quality required for this work.
  - .5 Approved mock-up can remain as part of the finished work.
- .3 Polished Concrete System:
  - .1 Level 2 - Salt/Pepper Finish: (No colour) Expose the fine aggregate such as sand and small aggregate with the concrete. The depth of grind will depend greatly on the placement and finishing procedures. Generally, this level of cut can be achieved within 1/16" of the surface.
  - .2 Sheen Level B: Sheen (high gloss) as determined by a gloss reading of 60 – 70 with silicate liquid densifier.
- .4 Pre-installation Meetings: Conduct a pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Review the following:
  - .1 Environmental requirements.
  - .2 Scheduling and phasing of work.
  - .3 Coordinating with other work and personnel. Remind all trades that they are working on a surface that is to become a finished surface.
  - .4 Protection of adjacent surfaces.
  - .5 Surface preparation.

- .6 Repair of defects and defective work prior to installation.
- .7 Cleaning.
- .8 Installation of polished floor finishes.
- .9 Application of liquid hardener, densifier.
- .10 Protection of finished surfaces after installation.
- .11 Placing of materials on the concrete surface that may cause staining, etching or scratching.
- .5 Project Conditions as follows:
  - .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
  - .2 Protect Concrete Slab:
    - .1 Protect from petroleum stains during construction.
    - .2 Diaper hydraulic power equipment.
    - .3 Restrict vehicular parking.
    - .4 Restrict use of pipe cutting machinery.
    - .5 Restrict placement of reinforcing steel on slab.
    - .6 Restrict use of acids or acidic detergents on slab.
  - .3 Waste Management and Disposal:
    - .1 Separate waste materials for Reuse and Recycling in accordance with Section 01 74 11.
    - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .4 Project Ambient Conditions as follows:
    - .1 Installation to comply with manufacturer's written recommendations.
  - .5 Sequencing as follows:
    - .1 Sequencing with 'Other Work' to comply with manufacturer's written recommendations for sequencing construction operations.



.6 Warranty as follows:

- .1 Manufacturer's Three (3) Year Warranty to be submitted executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights the Owner has within the Contract Documents.

## **2.0 PRODUCTS**

### **2.1 EXPANSION JOINT STRIPS**

- .1 Expansion joint strips shall be ½" (12.7mm) thick fiber expansion joint filler to ASTM D994.

### **2.2 NON-SHRINK GROUT**

- .1 Non-shrink grout to be premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents of pouring consistency having a compressive strength of 40Mpa at 28 days.
- .2 Acceptable suppliers:
  - .1 Masterflow 713, BASF
  - .2 V-3 Grout, W.R. Meadows of Canada
  - .3 SikagROUT 212 by Sika Canada

### **2.3 BONDING AGENT**

- .1 Concrete bonding agent shall be a high solids, acrylic polymer latex bonding agent and admixture that conforms to the ASTM C1059 Type I standard.
- .2 Approved product: Intralok Bonding agent by W.R. Meadows of Canada.

### **2.4 ADMIXTURES**

- .1 Admixtures shall not be used unless prior written approval is obtained from the Consultant. All admixtures shall conform to the appropriate A.S.T.M. and CSA Standards. Air entraining admixtures and chemical admixtures shall conform to the requirements of the latest issue of CAN3-A266.1-M78.
- .2 For slabs on grade, mid-range water-reducing admixture, conforming to the requirements of the latest issue of CAN/266.6-M85 and ASTM-C494, Type A. Acceptable Product: Master Builders Technologies Limited, Polyheed at a mixing rate of 10 fl. oz. /cwt. cement.
- .3 No other admixture shall be used, without the permission of the consultant.

### **2.5 CURING COMPOUNDS**

- .1 Curing compounds shall conform to the requirements of the latest issue of A.S.T.M. Standard C-309, Type 1, Class B, Vocomp - 20 by W.R. Meadows of Canada Ltd. or approved equal.

- .2 For exterior concrete slab work curing compound shall be W.R. Meadows Sealtite white pigmented curing compound Conchem Promulsion 200, CPD White Cure (Water Emulsion) or Architect's approved equal. Concrete curing treatment must be applied in strict accordance to manufacturer's labeled instructions.

## **2.6 CURING AND SEALING FOR CONCRETE FLOORS**

- .1 Curing and sealing for all interior concrete floors shall conform to A.S.T.M. C309, Type 1, Class B, Vocomp-20 by W. R. Meadows of Canada Ltd., Conchem Promulsion 100, or CPD Acrylic Floor Sealer (Water Emulsion). Apply in strict accordance with manufacturer's labeled instructions.

## **2.7 CONCRETE MIX DESIGNS**

- .1 Use ready-mix concrete. Proportion concrete in accordance with CSA A23.1, for exposures specified. Use a water-reducing agent in all concrete. Obtain approval of the Consultant for the use of admixtures other than water-reducing and air entraining agents.

Supplementary cementing materials: Conform to the directions of the slag and fly ash manufacturers for the proportioning and mixing concrete. Except as otherwise required, limit supplementary cementing materials to no more than 25% of total cementitious content and limit the fly ash component to no more than 10% of total cementitious content. The limit on supplementary cementing materials may be increased for Class N exposure concrete provided that the effects of the resulting concrete properties, including finishing, rate of early age strength gain, curing and protection, are considered by the Contractor and a letter describing these effects and any special construction procedures is submitted for the review with the mix design. Do not use supplementary cementing materials in architectural concrete.

Supplementary cementing materials for Class N exposure concrete: Conform to the directions of the slag and fly ash manufacturers for the proportioning and mixing concrete. Provide supplementary cementing materials equal to 50% of total cementitious content and limit water-to-cementing materials ratio to 0.45 maximum. Use no more than 15% fly ash of total cementitious material. Do not use supplementary cementing materials in architectural concrete. For columns less than 300mm in least dimension and for walls less than 200mm thick, reduce nominal size of coarse aggregate to 10mm.

- .2 Interior slabs (including slabs on steel deck), beams, walls and columns: Provide normal density concrete to give following properties unless otherwise noted:
  - .1 Class of exposure: N
  - .2 Cement: Type GU
  - .3 Minimum compressive strength at 28 days: see Structural Drawings
  - .4 Nominal size of coarse aggregate: 20mm
  - .5 Slump at time and point of discharge: 50mm to 110mm

For interior slabs on steel deck with resilient floor finishes, reduce water/cement material ratio to 0.45 and provide minimum 25 MPa concrete. Protect finished and cured slabs from water.

- .3 Footings, piers, grade beams and foundation walls: Provide normal density, frost resistant concrete to give following properties:
  - .1 Class of exposure: F-2
  - .2 Cement: Type GU
  - .3 Minimum compressive strength at 28 days: see Structural Drawings
  - .4 Maximum water/cementing material ratio: 0.55
  - .5 Nominal maximum size of coarse aggregate: 20mm.
  - .6 Slump at time and point of discharge: 50mm to 110mm
  - .7 Air content: 4 to 7%
- .4 Lean concrete and mud slabs: Provide normal density concrete to give following properties:
  - .1 Class of exposure: N
  - .2 Cement: Type GU
  - .3 Minimum compressive strength at 28 days: 10 MPa
  - .4 Nominal maximum size of coarse aggregate: 20mm
  - .5 Slump at time and point of discharge: 50mm to 110mm
- .5 Exterior, exposed walls and columns exposed to freezing and thawing, but not exposed to chlorides: Provide normal density, frost resistant concrete to give following properties:
  - .1 Class of exposure: F-2
  - .2 Cement: Type GU
  - .3 Minimum compressive strength at 28 days: see Structural Drawings
  - .4 Maximum water/cementing material ratio: 0.55
  - .5 Nominal maximum size of coarse aggregate: 20mm
  - .6 Slump at time and point of discharge: 50mm to 110mm
  - .7 Air content: 4 to 7%
- .6 Structurally reinforced concrete exposed to chlorides, including grade beams and exterior reinforced slabs: Provide normal density concrete to give following properties:
  - .1 Class of exposure: C-1
  - .2 Cement: Type GU
  - .3 Minimum compressive strength at 28 days: 35 MPa
  - .4 Maximum water/cementing material ratio: 0.40
  - .5 Nominal maximum size of coarse aggregate: 20mm
  - .6 Slump at time and point of discharge: 50mm to 110mm
  - .7 Air content: 5 to 8%
- .7 Interior slabs-on-grade: Provide normal density concrete to give following properties:
  - .1 Class of exposure: N

- .2 Cement: Type GU
  - .3 Minimum compressive strength at 28 days: see Structural Drawings
  - .4 Maximum water/cementing material ratio: 0.55
  - .5 Normal maximum size of coarse aggregate: 20mm. Increase to 40mm where slab-on-grade thickness exceeds 130mm
  - .6 Slump prior to addition of fibres: 50mm to 110mm
  - .7 Plastic fibre additive: apply at rate of 0.9 kg/m<sup>3</sup>. Add sufficient water reducing agent to restore slump loss.
  - .8 Slump at time and point of discharge, after addition of fibres and plasticizer: 50mm to 110mm
- .8 Interior and roof concrete toppings, curbs and bases: Provide normal density concrete to give following properties:
- .1 Class of exposure: N
  - .2 Cement: Type GU
  - .3 Minimum compressive strength at 28 days: 25 MPa
  - .4 Nominal size of coarse aggregate for:
    - Toppings between 25 and 35 mm thick: 10mm
    - Toppings between 35 and 50 mm thick: 14mm
    - Thicker toppings: 20mm
  - .5 Slump at time and point of discharge: 20mm to 60mm

Where topping is less than 25mm thick, no coarse aggregate is allowed and a bonding agent shall be provided within the mix and to bond the topping to the substrate.

- .9 Exterior unreinforced slabs, driveways, sidewalks, curbs and gutters, parking slabs on grade: Provide normal density, chloride resistant concrete to give following properties:
- .1 Class of exposure: C-2
  - .2 Cement: Type GU
  - .3 Minimum compressive strength at 28 days: 32 MPa
  - .4 Maximum water/cementing material ratio: 0.45
  - .5 Nominal maximum size of coarse aggregate: 20mm
  - .6 Slump at time and point of discharge: 50mm to 110mm
  - .7 Air content: 5 to 8%

## **2.8 GROUT**

- .1 Grout for base plates, bearing plates and other structural members requiring grouting shall be a non-shrink Meadows V-3 Construction Grout, Sika Grout 212, Embico Expansion Grout, Master Builders "Construction Grout" and shall be used in all cases where grouting is shown on drawings or otherwise scheduled. The material shall be used in the amounts specified by the manufacturer and explicitly in compliance with all directions for surface preparation, batching, mixing, placing and curing.

## **2.9 SAW CUT FILLER**

- .1 Saw cut filler for all interior saw cut control joints shall be Sealtight Rezi-Weld Flex, Saw cut Filler or Consultant's approved equal applied in strict accordance with manufacturer's labeled instructions. Colour to be determined by architect.

## **2.10 ACCESSORIES**

- .1 Waterstops and other accessories - refer to Concrete Forming and Accessories section.

## **2.11 POLISHED CONCRETE**

- .1 Products/Systems:
  - .1 Hardener, Sealer, Densifier: Proprietary, water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
    - .1 Acceptable Material: L & M Construction Chemicals, Inc., FGS Hardener Plus. Basis of design.
    - .2 Acceptable Material: L&M Construction Chemicals, Inc., Lion Hard may be substituted when conditions exist where disposing of rinse water is in conflict with local building codes.
  - .2 Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
    - .1 Acceptable Material: L & M Construction Chemicals, Inc., Joint Tite 750.
  - .3 Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.
    - .1 Acceptable Material: L & M Construction Chemicals, Inc., Petrotex.
  - .4 Cleaning Solution: Proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).
    - .1 Acceptable Material: L & M Construction Chemicals, Inc., FGS Concrete Conditioner.
  - .5 Stain Guard Sealer: Ready to use, is a low odor, VOC compliant, topical sealer consisting of low molecular emulsified cross-linking, coupling polymers that effectively protect concrete and other natural stone floor surfaces from the damaging effects of staining, defacing and deterioration due to contaminant penetration.

- .1 Acceptable Material: L& M Construction Chemicals, Inc.  
Permaguard SPS.

### **3.0 EXECUTION**

#### **3.1 ERECTION OF FORMS**

- .1 Construction formwork, shoring and bracing to produce finished concrete conforming to the shape, dimensions, locations and levels shown on the drawings and within the tolerances required by CAN/CSA A23.1-94.
- .2 Form chases, slots, openings, drips, recesses and control joints as detailed.
- .3 Formwork shall be so arranged and assembled as to permit easy dismantling and stripping so that the concrete will not be damaged during its removal. Make form joints tight in order to prevent leakage of mortar. Clean all edges and contact surfaces before erection.
- .4 Verify lines, levels and column centre's before proceeding with formwork and ensure dimensions agree with drawings.
- .5 Formed chamfers and reglets at exterior retaining walls, benches and water feature shall be straight, level and precise. Waving and deviations in the finish product of these details will constitute a rejection of the work. Removal and reconstruction of the wall (walls) in its entirety will be at the expense of the contractor.

#### **3.2 STRIPPING OF FORMS**

- .1 Remove forms only in accordance with requirements of CAN/CSA A23.1-94 the Ontario Building Code and the National Building Code and not sooner than concrete will safely bear its own and intended superimposed loads. Forms shall not be removed without notifying Engineer intent to remove forms. The Contractor shall be fully responsible for safe removal of the forms.
- .2 Re-use of formwork and false work subject to requirements of CAN/CSA A23.1-94 and CAN/CSA-S269.3-M92.

#### **3.3 EMBEDDED PARTS AND OPENINGS**

- .1 Provide formed openings where required for pipes, conduit, sleeves and other work to be embedded in and passing through concrete members.
- .2 Accurately locate and set in place items which are to be cast directly into the concrete.
- .3 Coordinate the work of other sections and cooperate with the trade involved in the forming and setting of openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.

#### **3.4 PLACEMENT OF REINFORCEMENT**

- .1 Reinforcement of the size and shapes shown on the drawings shall be accurately placed in accordance with the approved placement drawings, the structural drawings and the requirements of CAN/CSA A23.1-94.
- .2 Reinforcement including wire mesh shall be adequately supported by metal chairs, spacers or hangers and secured against displacement within the tolerances permitted and in accordance with the latest A.C.I. Standard 315.
- .3 Mechanical splices subject to the approval of the Consultant.
- .4 Obtain Consultant's approval of reinforcing steel and placing before pouring concrete.

### **3.5 INSERTS**

- .1 Set sleeves, ties, anchor bolts, pipe hangers, plates and other inserts, openings and sleeves in concrete floors as required by other trades.
- .2 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Consultant before placing of concrete.
- .3 Place anchor bolts to layout and under supervision of trade supplying anchors prior to placing concrete.

### **3.6 PLACEMENT OF CONCRETE**

- .1 Place concrete in accordance with CAN/CSA A23.1-14. Ensure reinforcement and inserts are not disturbed during concrete placement.
- .2 Notify the Consultant and the independent testing agency at least 24 hours before any concreting operation is to proceed.
- .3 Before beginning a run of concrete, hardened concrete and foreign materials shall be removed from the inner surface of the conveying equipment.
- .4 Before depositing concrete, debris shall be removed from the space to be occupied by the concrete, reinforcing steel and forms accurately placed and secured in position. Clean reinforcing before placing concrete.
- .5 When pouring concrete against previously poured work, the surface shall be thoroughly cleaned and roughened removing all latency and scum and coated with a paste of neat cement and water not more than 15 minutes in advance of depositing the new concrete.
- .6 Concrete shall be conveyed to the place of final deposit by methods that will prevent segregation or loss of material keeping concrete sufficiently plastic to ensure proper bonding of successive layers or panels. Free fall of concrete shall not exceed 3'-0" (900 mm).

- .7 During placement, concrete shall be consolidated thoroughly and uniformly by means of tamping, hand tools, vibrators or finishing machines to secure dense, homogeneous structure, close bond with reinforcement and smooth formed surfaces. Extreme care shall be taken to ensure that internal type vibrators do not disturb the reinforcing steel or the forms.
- .8 Maintain accurate records of concrete pours to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 Footings to be poured within the same day as exposure or a 2" lean concrete mud mat shall be provided.

### **3.7 TROWELLING**

- .1 Concrete floor slabs requiring a concrete finish shall be screeded to the proper shape and elevation, machine floated and finished by skilled mechanics to produce a smooth, dense surface, free from ridges, voids, or machine marks. Floor flatness to FF=40. Floor Levelness to FL=30.
- .2 Pitch slabs as noted on drawings or to floor drains.
- .3 Sprinkling of dry cement or dry cement and sand mixture over concrete surfaces is not acceptable.
- .4 Float surface with wood or metal floats or with power finishing machine and bring surface to true grade.
- .5 Steel trowel to smooth and even surface concrete slabs to be left exposed or to receive resilient tile or sheet flooring.

### **3.8 CURING AND PROTECTION**

- .1 Freshly placed concrete shall be protected from the effects of direct sunshine, drying winds, cold, excessive heat and running water by the use of clear resin based curing compound or adequate tarpaulins or other suitable material until the end of the curing period.
- .2 All exposed non-formed surfaces shall be kept continuously moist for a minimum of seven consecutive days after placement of the concrete. Water shall be clean and free of any material that will cause staining or discoloration.
- .3 Apply curing and sealing compound to all interior concrete floors in strict accordance with manufacturer's labeled instructions where it will not jeopardize the bonding of future floor finishes. Co-ordinate with flooring divisions for compatibility.

### **3.9 CONSTRUCTION JOINTS**

- .1 The location and detail of all construction joints not detailed on drawings shall be approved by the Architect. Where fresh concrete is to be placed against concrete which has set or partially set concrete shall be roughened, cleaned of all latency and thoroughly soaked with water prior to the placement of fresh concrete.



- .2 In general, the construction joints in floor systems shall be located as indicated on drawings. Proper key and dowels or extensions of reinforcing shall be provided at all constructions joints.

Note: Saw cut crack-control joints to CAN/CSA A23.1-14 as indicated on drawings. Fill all saw-cut joints in exposed concrete floors (which do not receive flooring) with saw-cut filler.

- .3 Saw-cuts at areas of exposed polished concrete are to be masked each side of the joint prior to applying approved saw-cut filler

### 3.10 DEFECTIVE CONCRETE

- .1 Concrete not meeting the requirements of the specifications and the drawings will be considered defective concrete and shall be modified or replaced at the Contractor's expense and to the satisfaction of the Engineer.
- .2 Excessive honeycombing or other defects in critical areas of stress shall be repaired or replaced at the Contractor's expense to the satisfaction of the Architect.
- .3 Concrete of insufficient strength or improper consistency shall be as required by the Architect subject to one or more of the following, all at the Contractor's expense and at no extra cost to the Owner.
  - .1 Changes in mix proportion for the remainder of the work.
  - .2 Cores drilled and tested from the areas in question as directed by the Engineer and in accordance with C.S.A. Standard CAN/CSA A23.1-14 test method A23.2-14C. The test results shall be indicative of the strength of the in-place concrete.
  - .3 Load testing of the structural elements in accordance with CAN3A-123.3-M84.
- .4 Concrete failing to meet the strength requirements of this specification shall be strengthened or replaced at the Contractor's expense to the satisfaction of the Architect.

### 3.11 FOOTINGS, WALLS, COLUMN PADS AND PIERS

- .1 Install all concrete footings, pads, canopy columns, piers and foundations as indicated on drawings of all sizes, forms and thickness indicated and reinforced as noted on drawings and schedules. Finish tops of footings, walls, columns and piers true and level at heights indicated providing all necessary keyways.
  - .1 Where pipes or sleeves pass through or under footings, consult the Engineer for direction.
  - .2 The excavation for the footings shall be clean and free of water and kept so until the concrete has set.

- .3 All footings shall be placed upon firm approved soil the same day as exposure or a previously poured 2" lean concrete mud mat or a combination of both.
- .4 Step footings in accordance with Building Code requirements and required by construction.
- .5 Plumbness of walls and columns shall be within 1:400 measured at any one surface but total variation shall not be more than  $\frac{3}{4}$ " (20 mm) for the total height of the structure.
- .6 Thickness variations for cross section for walls, columns and slabs other than slabs on grade shall not exceed the following:
  - .1 12" (300 mm) and less  $\pm .31$ " (8 mm).
  - .2 Greater than 12" (300 mm) but less than 3'-3" (1 m)  $\pm \frac{3}{8}$ " (12 mm).
  - .3 3'-3" (1 m) and greater  $\pm \frac{3}{4}$ " (20 mm).

### 3.12 REINFORCED SLABS

- .1 Make all slabs of thickness with reinforcing as noted on drawings.
- .2 Set all reinforcing steel as shown or directed. Pitch slabs as noted on drawings.
- .3 Build in all anchors, sleeves, inserts, floor drains and other items furnished by this Contractor or others.
- .4 Floor slabs on grade shall be poured over a continuous vapour barrier and insulation board as shown on drawings. Care must be taken not to puncture vapour barrier. Damaged portions of vapour barrier must be replaced before concrete is poured.
  - .1 Thickened and depressed floor slabs as indicated on drawings.
  - .2 Pitch slab to floor drains.

### 3.13 VAPOUR RETARDER & UNDERFLOOR INSULATION

- .1 Immediately prior to pouring all concrete floor slabs on grade, inside of building, Vapour Barrier shall be laid over granular fill, lapping 6" at joints. All seams and joints to be taped. The tape adhesion areas to be free of dust, dirt and moisture to allow maximum adhesion of pressure sensitive tape. Vapour barrier to be adhered to vertical intersections, walls where applicable.
- .2 Vapour retarder shall be continuous with all punctures and tears repaired before concrete is poured.

- .3 Install under floor insulation where detailed on the drawings. Refer to Site Plans for exterior slab locations having rigid insulation installed below the slab.

### **3.14 CURING AND SEALING INTERIOR FLOORS**

- .1 Apply curing and sealing compound to all interior exposed concrete floors in strict accordance with manufacturer's labeled instructions.
- .2 A second and final application of sealer to be applied at all locations as per the room finish schedule just prior to owner occupancy

### **3.15 PREMOULDED EXPANSION STRIPS**

- .1 Provide pre-molded expansion strips as specified under concrete materials in the following locations:
  - .1 between edges of all concrete floor slabs and all vertical surfaces.
  - .2 between edges of sidewalks and vertical surfaces.
  - .3 between edges of concrete platforms and concrete or masonry vertical surfaces.
  - .4 in sidewalks as noted on drawings.
- .2 Expansion strips shall be ½" (12.7mm) thick and shall extend from bottom of slab to within ½" of top of slabs and platforms then insert raw oakum or polytape bond breaker and fill joint with polysulphide sealant as manufactured by Sternson "Load Flex" or approved equal where exposed. Alternatively provide saw cut exterior slabs, except joint between curb and walks and walks and building shall have expansion joints installed.

### **3.16 ANCHOR BOLTS & LEVELLING PLATES**

- .1 This Contractor shall accurately set all anchor bolts and leveling plates furnished by other contractors.

### **3.17 SIDEWALKS & PLATFORMS**

- .1 Provide 4" thick sidewalks and platforms as shown on drawings reinforced with 152 x 152 MW11.1 x MW11.1 (6" x 6" #9/9) welded wire fabric for all sidewalks and platforms. Sidewalks and platforms shall be struck off and left with broom finish. Unless otherwise indicated, provide dummy joints as indicated on drawings. Walks and paving shall be pitched uniformly away from the building or crowned as directed.

### **3.18 MISCELLANEOUS CONCRETE**

- .1 This Contractor to install the following miscellaneous reinforced concrete work:

- .1 Grout under base plates and wall bearing steel members as indicated on drawings and required.
- .2 Thickened and depressed floor slabs or addition rebar as detailed on the drawings.
- .3 House-keeping pads as required for Mechanical/Electrical equipment.

### **3.19 CONCRETE FINISH SCHEDULE**

- .1 The following finishes shall be applied to concrete surfaces.
  - .1 Exterior walks and platforms. Float and broom finish.
  - .2 Interior exposed concrete floors. Float and steel power trowel finish.
  - .3 Rub exposed sharp edges from concrete to product 1/8" radius edge.

### **3.20 POLISHED CONCRETE**

- .1 Examination
  - .1 Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.
  - .2 Do not begin installation until substrates have been properly prepared.
  - .3 Consult floor finishing product manufacturer for additional concrete placement specifications required for application of floor finishing products.
  - .4 Verify concrete is cured to 28 days duration and 3500 psi (24 MPa) strength.
  - .5 Verify concrete surfaces have received a hard steel-trowel finish (3 passes) during placement.
  - .6 Verify overall floor flatness is a minimum of Ff 40.
- .2 Preparation
  - .1 Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.
  - .2 Examine surface to determine soundness of concrete for polishing.
- .3 Installation

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions.
- .2 Floor Surface Polishing and Treatment:
  - .1 Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.
  - .2 Apply floor finish prior to installation of fixtures and accessories.
  - .3 Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit. Installer to determine the optimum starting grit in order to achieve the specified aggregate exposure.
  - .4 Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Following the initial passes of metal bond diamonds, the installer shall drop back a minimum of one grit level when transitioning to resin bond diamonds. The separation in grit designation shall be a minimum of 50 for the transitioning step. The installer shall refine each abrasive grit to its fullest potential before moving on to the next level. Floor shall be thoroughly scrubbed between each grit pass to remove all loose material. Level of sheen shall match that of approved mock-up.
  - .5 Expose aggregate in concrete surface only as determined by approved mock-up.
  - .6 All concrete surfaces shall be as uniform in appearance as possible.
- .4 Hardener and Densifier Application:
  - .1 First coat of FGS Hardener Plus at 250 ft<sup>2</sup>/gal (6.25 m<sup>2</sup>/L), following the 400 grit level. (Lion Hard at 400-600 sq ft / gallon).
  - .2 Second coat of FGS Hardener Plus at 350 ft<sup>2</sup>/gal (8.75 m<sup>2</sup>/L), prior to the final polishing pass (Lion Hard at 600-800 sq ft / gallon).
  - .3 Follow manufacturer's recommendations for drying time between successive coats.
  - .4 Remove defects and re-polish defective areas.
  - .5 Finish edges of floor finish adjoining other materials in a clean and sharp manner.
- .5 Adjustments

- .1 Re-polish those areas not meeting specified gloss levels per mock-up.
- .2 Fill joints flush to surface prior to the start of polishing operations.
- .6 Final Cleaning
  - .1 Upon completion, remove surplus and excess materials, rubbish, tools and equipment.
- .7 Protection
  - .1 Protect installed product from damage during construction in accordance with manufacturer's recommendations.

### 3.21 CLEANING

- .1 Contractor shall be responsible for good housekeeping during the work of this Section.
- .2 Remove all debris and inflammable rubbish from the site daily.
- .3 Do not bury any waste concrete on the project site.

**END OF SECTION**