

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 - Excavating, trenching and backfilling
- .2 Section 03 20 00 - Concrete reinforcing
- .3 Section 03 30 00 - Cast-in-place concrete

1.2 REFERENCES

- .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 CSA O86-09 CONSOLIDATION, Engineering Design in Wood.
 - .3 CSA O121-08 (R2013), Douglas Fir Plywood.
 - .4 CSA O151-09, Canadian Softwood Plywood.
 - .5 CSA O153-13, Poplar Plywood.
 - .6 CSA O325-07 (R2012), Construction Sheathing.
 - .7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
 - .8 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA S269.3-M92 (R2013), Concrete Formwork.
- .2 Do concrete formwork to CSA A23.1 and CAN/CSA-S269.3, except where specified otherwise.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .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 Ontario, Canada.
- .3 Indicate 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. Company with CAN/CSA-S269.3 for formwork drawings.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

Part 2 Products

2.1 MATERIALS

- .1 Formwork lumber:
 - .1 Plywood and wood formwork materials to CAN/CSA-O86-09.
 - .2 Plywood form panels. Douglas fir, minimum thickness 19 mm, to meet specified requirements of CSA O121, finished one side,

fabricated specially for use as concrete form panels, with sealed edges. Plywood material to be new, clean, sound, and free from defects detrimental to the quality of the finished concrete surface.

- .2 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing set of film of concrete in contact with form.
- .3 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes no larger than 25 mm dia. in concrete surface.
- .4 Structural steel protective coating:
 - .1 Heavy duty asphalt Mastick. Standard of Quality Bakor 110-14.
- .5 Premoulded joint fillers:
 - .1 Bituminous impregnated fiberboard: to ASTM D1751.
 - .2 Polyethylene or urethane: extruded closed cell foam 16 mm and 8 mm diameter.
 - .3 Joint Sealant: polyurethane base, self-leveling, Class A to CGSB 19-GP-16M. Standard of quality: Vulkem 45 by Tremco Incorporated.

Part 3 Execution

3.1 ERECTION

- .1 Verify lines, levels and column centers before proceeding with formwork and ensure dimensions agree with drawings.
- .2 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.
- .3 Construct concrete formwork and provide sufficient ties and bracing to safely resist concrete pressures and other construction loadings without excessive bulging, distortion or displacement.
- .4 Construction of formwork shall permit easy dismantling and stripping in order to avoid damage to concrete during formwork removal.
- .5 Obtain Departmental Representation's permission before framing openings in concrete unless shown on drawings.

- .6 Hand-trim bottom and remove loose material before placing concrete. All footings shall be founded upon a minimum 300 mm thick compacted structural fill over insitu soil with an allowable bearing capacity of 150 kPa as per Division 31. Lean concrete shall be used as required. Earth forms on sides will not be permitted, i.e. all forms shall extend for the full depth of the footings.
- .7 Align form joints and make watertight. Keep form joints to minimum.
- .8 Locate vertical wall control and construction joints as indicated on the drawings. Use 25 mm V-joint on exposed faces unless noted otherwise.
- .9 Use 19 mm chamfer strips on external corners of columns and walls unless noted otherwise. Coordinate with Architectural drawings.
- .10 Construction joints:
 - .1 In general, horizontal construction joints in walls are not permitted unless specifically approved by the Departmental Representative. Vertical construction joints in accordance with details on drawings.
 - .2 Provide construction joints in concrete where work is left off at day's end. Run reinforcement continuous through joint. .3 Provide proper key and V-joint on exposed faces.
 - .4 Immediately before next pour, clean construction joint and brush with grout of neat cement.
- .11 Form chases, slots, openings, drips, recesses, expansion and control joints as detailed.
 - .12 Coat formwork with form release agent before reinforcement, anchors or other accessories are placed. Do not coat plywood forms precoated with a chemical release agent.
- .13 Set all required bolts, anchor rods, inserts and other embedded items. Anchor securely to formwork before placing concrete.
- .14 Leave formwork in place for following minimum periods of time after placing concrete:
 - .1 Three days for walls.
 - .2 Two days for footings and trenches.
 - .3 Three days for columns and piers.
- .15 Take care in removing plywood forms. Use wood wedges and gradual force to pry the formwork loose from the concrete. Do not beat, jar or shake the formwork or pry with metal bars. Leave plywood forms in place as long as possible and until other adjacent formwork is stripped to permit maximum shrinkage away from concrete and to

protect concrete surfaces. Take particular care to prevent damage to external corners and top edges of walls.

- .16 Re-use formwork and falsework subject to requirements of CSA A23.1/A23.2.

3.2 STRUCTURAL STEEL PROTECTIVE COATING

- .1 Apply 3 mm thick layer of protective coating to the base of all structural steel columns which extend below top of concrete slabs on grade.
- .2 Apply 3 mm protective coating to base plates, anchor rods and columns from underside of base plates to 25 mm below top of concrete.

3.3 JOINT FILLERS

- .1 Locate and form isolation joint as indicated. Install joint filler to manufacturer's instructions.
- .2 Unless otherwise indicated, use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces. Extend joint filler from bottom of slab to within 24 mm of finished slab surface.
- .3 Install 16 mm foam filler to separate joint filler and sealer.
- .4 Fill remaining 8 mm with joint sealer to manufacturer's instructions.
- .5 Locate saw cut control joints in slabs as indicated and detailed.
- .6 Install 8 mm foam filler 8 mm below finished slab surface and fill saw cut with joint sealer to manufacturer's instructions.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00 - Concrete forming and accessories
- .2 Section 03 30 00 - Cast-in-place concrete
- .3 Section 03 35 00 - Concrete finishing

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A1064/A1064M-14 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - .2 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Bars
 - .3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .2 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 CSA A23.3-04 (R2010), Design of Concrete Structures.
 - .3 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC Manual of Standard Practice, 2004.
- .4 Do reinforcing work in accordance with CSA A23.1/A23.2 and welding of reinforcing with CSA W186 except where indicated otherwise.

1.3 SUBMITTALS

- .1 Provide Departmental Representative with certified copy of mill test report of steel supplied, showing physical and chemical analysis prior to commencing reinforcing work.
- .2 For material supplied by this section, the Contractor shall provide information indicating types and quantities of recycled materials and provide information indicating types and quantities of materials that are from locally manufactured sources. Submit this information attached to relevant shop drawings.
- .3 Reinforcing Steel Contractor shall participate and comply with the requirements of the Contractor's construction waste management plan to maximize diversion of recyclable and waste materials from landfill.

1.4 SHOP DRAWINGS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Clearly indicate bar sizes, spacings, location and quantities of reinforcement, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; to CAN/CSA A23.3, to Reinforcing Steel Manual of Standard Practice by Reinforcing Steel Institute of Canada.
- .3 Detail placement of reinforcing where special conditions occur.
- .4 Unless noted otherwise provide Class B laps between all bars, including dowels to vertical bars.
- .5 All shop drawings and material lists are to contain a blank area measuring 70 mm high by 100 mm long located near the bottom right hand corner of the drawing or page. This area is to be reserved for the Departmental Representative's review stamp.

1.5 SUBSTITUTES

- .1 Substitution of different size bars permitted only upon written approval of the Departmental Representative.

Part 2 Products**2.1 MATERIALS**

- .1 Reinforcing bars: billet steel, grade 400 deformed bars to CSA-G30.18 unless indicated otherwise. Weldable reinforcing to be Grade 400W.
- .2 Welded steel wire fabric: to ASTM A1064/A1064M-14. Provide in flat sheets only.
- .3 Chairs, bolsters, bar supports, spacers: adequate for strength and support of reinforcing construction conditions.
- .4 Tie Wires: Cold-drawn annealed steel wire ties to ASTM A82.
- .5 Architectural concrete surfaces: special chairs, bolsters, bar supports and spacers to be plastic coated, stainless steel or as indicated. Note that all concrete exposed to view requires an architectural surface.
- .6 Mechanical splices subject to approval of the Departmental Representative.

2.2 FABRICATION

- .1 Fabricate reinforcing to CSA A23.1/A23.2.
- .2 Fabrication tolerances for reinforcing steel to Reinforcing Steel Manual of Standard Practice, by Reinforcing Steel Institute of Canada.
- .3 Obtain Departmental Representative's approval for locations of reinforcement splices.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar list.
- .5 Ship epoxy coated bars in accordance with ASTM A775A/A775M-07b

Part 3 Execution**3.1 FIELD BENDING**

- .1 Do not field bend reinforcement except authorized by the Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel to CSA A23.1/A23.2 and as indicated on reviewed shop drawings.
- .2 Place, support and space reinforcing in alignment to position indicated and as follows:
 - .1 Concrete surfaces exposed to view: consider as architectural concrete and use non-staining supports and spacers.
 - .2 Walls: provide spacers each face at 1200 mm maximum centres. Provide 10M spreader bars between mats and in line with concrete spacers.
 - .3 Pilasters and piers: laterally support along height. Place and support in pairs on opposite faces.
 - .4 Slabs on metal deck: support reinforcement on and secure to supports.
 - .5 Slabs on grade: support all reinforcement on chairs to accurately maintain position and concrete cover over reinforcement.
 - .6 Structural slabs: provide continuous running chairs for slab bottom mat at 1200 mm maximum centers. Provide individual high chairs for top mat at 1000 mm centers each way.

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- .3 Do not cut reinforcement, either before or after concrete is placed, to permit incorporation of other work.
 - .4 Do not relocate bars without approval from Departmental Representative.
 - .5 Remove and replace reinforcement which is visibly damaged or cracked.
 - .6 Clean reinforcing before placing concrete.
 - .7 Obtain Departmental Representative's approval of reinforcing steel and placing before placing concrete.
 - .8 Obtain Departmental Representative's approval before welding reinforcing bars. Weld to CSA W186.
 - .9 Place column and foundation wall footing reinforcing steel only after bearing surface has been inspected and approved by the Geotechnical Consultant.
 - .10 All wall footing reinforcing shall continue through column footings and shall continue to the ends of the footing where footings change direction or stop.
 - .11 All wall reinforcing shall continue through pier reinforcing.
 - .12 All column reinforcing ties shall have 135 degree hooks, alternate hooks.
 - .13 Reinforce slabs on grade and metal deck as detailed on the drawings.
 - .14 Adjust reinforcement immediately before concrete is placed to ensure that bars are in correct position and are securely tied to maintain position.
 - .15 Ensure that reinforcing steel foreman is present at all times concrete is placed to ensure that reinforcing remains in place as tied, and to take necessary remedial action.

3.3 ON-SITE STORAGE AND HANDLING

- .1 Reinforcing steel shall be handled and stored in such a manner to in such a manner to keep it free of dirt, mud and water.
- .2 Reinforcing steel shall be off loaded from the truck directly onto purpose made storage racks.
- .3 Any reinforcing steel which is dirty, muddy and/or rusty shall be cleaned with wire brushes and/or shot blasted to the satisfaction of the Departmental Representative.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00 - Concrete forming and accessories
- .2 Section 03 20 00 - Concrete reinforcing
- .3 Section 03 35 00 - Concrete finishing
- .4 Section 07 21 13 - Board insulation

1.2 REFERENCES

- .1 Abbreviations and Acronyms:
 - .1 Portland Cement: hydraulic cement.
 - .1 Type GU - General use cement.
 - .2 Fly ash:
 - .1 Type F - with CaO content less than 15%. Type CI - with CaO content ranging from 15 to 30%.
 - .2 Type CH - with CaO greater than 20%.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C260/C260M-10a, Standard Specification for AirEntraining Admixtures for Concrete.
 - .2 ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.
 - .3 ASTM C309-1, Standard Specification for Liquid MembraneForming Compounds for Curing Concrete
 - .3 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005.
 - .3 CSA A283-06(R2011), Qualification Code for Concrete Testing Laboratories
 - .4 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2 except where specified otherwise.
 - .5 Contractor shall have on site at all times copies of CSA A23.1/A23.2.

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- .6 Cementing materials shall conform to the respective requirements of CSA A3001, Cementitious Materials for Use in Concrete.

1.3 SUBMITTALS

- .1 For material supplied by this section, the Contractor shall provide information indicating types and quantities of recycled materials and provide information indicating types and quantities of materials that are from locally manufactured sources. Submit this information attached to relevant shop drawings.
- .2 Contractor shall participate and comply with the requirements of the Contractor's construction waste management plan to maximize diversion of recyclable and waste materials from landfill.
- .3 Submit mixture proportions in accordance with CSA A23.1/A23.2 and Clause 2.2 for review. Note that no concrete shall be placed prior to written review of the concrete mixes. Concrete mix design shall be submitted for review by the Departmental Representative 5 days prior to use.
- .4 Provide certification that plant, equipment, and all materials to be used in concrete comply with the requirements of CSA A23.1/A23.2.
- .5 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA A23.1/A23.2.
- .6 At least 4 weeks prior to commencing work, Contractor shall inform Departmental Representative of proposed source of aggregates and SCMs, and provide access for sampling.
- .7 Provide certification that mixture proportions include preventative measures to mitigate potential expansions due to alkali aggregate reactivity in accordance with CSA A23.1/A23.2.
- .8 Provide proof that the ready mixed concrete producer has a current membership with Ready Mix Concrete Association of Ontario (RMCAO) as well as a current Certificate of Conformance for Concrete Production Facilities, issued by RMCAO.

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- .9 Contractor shall submit a plan for curing to the Departmental Representative, for review and approval together with other tender documents. The curing plan shall be prepared in strict accordance with CSA A23.1/A23.2, as applicable, including:
 - .1 Method of protecting the concrete from evaporation of surface moisture from the fresh concrete.
 - .2 Type of curing material to be used.
 - .3 How the surface will be kept moist and the quality control requirements for keeping the surface moist.
 - .4 Time of initiation and duration of curing.
 - .5 Provisions to address potential problems such as high winds, and hot and cold weather.
 - .6 Limitations of access, if any, to the surfaces being cured.

1.4 AS-BUILT DRAWINGS

- .1 Maintain "As Built" conditions on record drawings for all concrete work as specified in Division 01. Clearly denoting the area, time, date and type placed

Part 2 Products

2.1 MATERIALS

- .1 Cement: Type GU to CSA Standard A3001.
- .2 Supplementary cementing materials: to CSA A3001.
- .3 Water: CSA A23.1/A23.2.
- .4 Fine aggregate: FA1 as per CSA A23.1/A23.2.
- .5 Coarse aggregate: 20 to 5 mm maximum nominal size as per CSA A23.1/A23.2.
- .6 Air entraining admixture: to ASTM C260.
- .7 Chemical admixtures: to ASTM C494/C494M.
- .8 Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, of plastic or fluid consistency, having minimum 28 day compressive strength of 50 MPa.
- .9 Chemical adhesive anchor system: Hilti HIT HY150 MAX, Epcon Acrylic 7 or approved equal.

- .10 Welding materials: to CSA W59. Welding electrodes: E49XX.
- .11 Steel sections and plates: angles, plates, etc., to be set in or anchored to concrete to CAN/CSA-G40.21, 300W.
- .12 Shop paint primer to CISC/CPMA 2-75.

2.2 CONCRETE MIXTURES

.1 Unless noted on drawings, proportion normal density concrete in accordance with Alternative 1 (Performance), CSA Standard A23.1/A23.2, for the following elements and applications.

Piers, columns and foundation walls:

- .1 Class F-2 exposure.
- .2 Compressive strength at 28 days: 25 MPa.
- .3 Total air content: 4 -7%.
- .4 Slump at point of discharge into the work: 80 mm.

Footings, 125 mm thick interior slabs on grade and slabs on metal deck:

- .1 Class N exposure.
- .2 Compressive strength at 28 days: 25 MPa.
- .3 Total air content: less than 3 percent.
- .4 Slump at point of discharge into the work: 80 mm.

200 mm thick interior slab on grade:

- .1 Class C-4 exposure.
- .2 Compressive strength at 28 days: 32 MPa.
- .3 Total air content: less than 3 percent.
- .4 Slump at point of discharge into the work: 80 mm.

Exterior concrete (exterior slabs, unheated foundation walls, unheated slabs on grade, curbs, walkway, etc.):

- .1 Class C-2 exposure.
- .2 Compressive strength at 28 days: 32 MPa.
- .3 Total air content: 4 -7%.
- .4 Slump at point of discharge into the work: 80 mm.

Lean concrete:

- .1 Class N exposure.
- .2 Compressive strength at 28 days: 15 MPa.

- .3 Total air content: less than 3%.
- .4 Slump at point of discharge into the work: 80 mm.
- .2 The use of supplementary cementing materials is not permitted in slabs on grade and slabs on metal deck.

2.3 ADMIXTURES

- .1 Use of admixtures subject to review by Departmental Representative.
- .2 Use only compatible admixtures.
- .3 Use of free calcium chloride and chloride bearing admixtures is not permitted.
- .4 If required, add a water reducing admixture to concrete in accordance with manufacturer's specifications. Incorporate admixture as a liquid by automatic mechanical dispenser. Reduce mix water, thereby, but do not change cement content from that required in plain mix design. Take admixtures into account when designing mix, and ensure that they are compatible with each other and with concrete accessories.
- .5 The Contractor shall note that for the concrete walls, the use of a superplasticizer may be required to increase the slump to 150 mm minimum for workability while maintaining design mix strength and water/cement ratio specified. Follow the manufacturer's recommendations.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Obtain Departmental Representative's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Place concrete in accordance with CSA A23.1/A23.2. All concrete to be consolidated using high frequency vibrators. Vibration practices to be in accordance with ACI 309R.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement and consolidation.
- .4 Preparations prior to placing of concrete shall include:
 - .1 Formwork completed and secured.
 - .2 Ice and free standing water removed.
 - .3 Reinforcement secured in place.

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- .5 All anchor rods and other embedded items accurately located and held in position.
 - .6 Maintain accurate records of all concrete placed to indicate date, location of placement, quantity placed, concrete temperature and test specimens cast. Keep these records at site until project is complete.
 - .7 Prior to placing, submit to the Departmental Representative for review the proposed method of curing, and protection of concrete during placing and curing in adverse weather conditions.

3.2 INSERTS

- .1 Embedded steel angles, plates and anchor rods shall be supplied by Structural Steel Contractor to the site and installed by the Foundation Contractor, unless noted otherwise on the drawings.
- .2 All anchor rods and embedded metal shall be carefully set to conform to the dimensions shown on the drawings and shall be rigidly held in place during placing of the concrete.
- .3 No sleeves, ducts, pipes or other openings shall pass through beams or columns except where expressly detailed on the drawings or approved by the Departmental Representative.
- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Departmental Representative before placing of concrete. See architectural, mechanical and electrical drawings for additional inserts to be installed in this section.
- .5 Check locations and sizes of sleeves, openings, etc., shown on structural drawings with Departmental Representative prior to placing concrete. Sleeves, openings, etc., greater than 100 mm square not indicated on structural drawings must be approved by the Departmental Representative.

3.3 HOUSEKEEPING PADS, CURBS

- .1 Accurately place all required concrete bases, curbs and housekeeping pads as shown for architectural, mechanical and electrical equipment, including reinforcing steel indicated on drawings.
- .2 Build in anchor rods as required.
- .3 Finish slabs to match adjacent surfaces.
- .4 Refer to mechanical, electrical and architectural drawings for size, locations and number of pads.

3.4 GROUTING

- .1 Grout underside of steel columns and beam bearing plates with a minimum 40 mm thickness of non-shrink grout mixed in accordance with to the manufacturer's instructions to ensure a smooth level surface at the elevation indicated and having full contact with the underside of the bearing plate. Proposed grout shall be capable of being mixed at a fluid consistency; dry pack placement of the grout is not permitted.
- .2 Provide 24 hours notice prior to grouting base plates.

3.5 INSTALLATION OF REINFORCING STEEL/ANCHOR RODS USING ADHESIVE ANCHOR SYSTEM

- .1 Install reinforcing steel/anchor rods using adhesive anchor system in concrete at locations noted or shown noted or shown on the drawings and/or as required to complete the work. Installation shall be in strict accordance with the manufacturer's written instructions.

3.6 FINISHING

- .1 Finish exposed concrete to CSA A23.1/A23.2.
- .2 Unless specified elsewhere, interior slabs on grade shall receive sufficient passes with a trowel to obtain a dense hard smooth surface free of trowel marks.
- .3 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise detailed.
- .4 All concrete exposed to view requires a smooth form finish.
- .5 Formed concrete surfaces shall be surface finished as soon as practical and not later than 6 hours following formwork removal. Remove all ties, fins and projections. Patch tie holes, indentations and other surface irregularities with sand cement patching mortar $f'c = 30$ MPa. Fill and repair honeycomb and holes. Vertical formed surfaces (ie walls) shall not be more than 3 mm in or out of control line.
- .6 Use wind breaks/sun screens as required to prevent premature drying of concrete slabs prior to finishing. Screens to be used when are temperatures, relative humidity, concrete temperature and wind velocities are such that to create surface moisture evaporation rates in excess of 0.75 kg/(sq. m-h). Protection of concrete shall be in accordance with CSA A23.1/A23.2

3.7 CURING

- .1 Curing of all elements cast under this section shall begin immediately following placing and finishing following the

requirements of CSA A23.1. All 200mm thick slab shall be wet cured for a minimum of 7 days in accordance with CSA A23.1/A23.2.

- .2 Contractor shall obtain the approval of the Owner, for proposed means of monitoring concrete curing conditions. Contractor shall be responsible for confirming completion of curing.

3.8 COLD WEATHER REQUIREMENTS

- .1 As a minimum, the requirements of CSA A23.1/A23.2 shall be followed for cold weather protection.
- .2 All materials and equipment needed for the protection and curing of the concrete in cold weather, as defined by CSA A23.1/A23.2, shall be available on site before the concrete placement begins.
- .3 Cold weather protection and curing shall be applied in order to maintain the concrete temperature at or above 10°C for the time of the curing periods specified in CSA A23.1/A23.2. Measures shall be taken to prevent subsequent frost penetration to the footing level.
- .4 Provide heated enclosures and/or insulated tarps as required to maintain minimum 10 degrees concrete surface temperature for a period of 5 days following concrete placement. Provide controlled cool down period to prevent surface cracking at end of protection period. Ensure that no concrete is placed on or against frozen subgrade, formwork, or reinforcing steel.

3.9 HOT WEATHER CURING

- .1 Hot weather curing and protection shall conform to the requirements of CSA A23.1/A23.2.
- .2 When the air temperature is at or above 25°C, the basic curing period (3 days) shall be accomplished by water spray, or saturated absorptive fabric rather than by curing compounds, in order to achieve cooling by evaporation. Apply curing compound immediately following the basic curing period.

3.10 DEFECTIVE CONCRETE

- .1 All honeycombed concrete and embedded debris shall be removed to sound concrete and the areas patched in a manner acceptable to the Engineer-Architect.

3.11 PATCHING

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- .1 Patch imperfections within 24 hours of stripping of forms. Patch imperfections less than 30 mm deep as follows:
 - .1 Chip down edges perpendicular to surface to Departmental Representative's approval.
 - .2 Wet area and brush on 1:1 cement-sand grout.
 - .3 Patch with 1:2 cement-sand mortar with 10% hydrated lime.
 - .2 Patch existing concrete surfaces where damaged by cutting or drilling.
 - .3 Patch all form tie holes.

3.12 INSPECTION AND TESTING

- .1 Inspection, sampling, testing and reporting of concrete and concrete materials will be carried out by a testing laboratory approved by the Departmental Representative as specified in Division 1. All test methods shall be in accordance with CSA A23.1/A23.2.
- .2 Testing laboratory will cast three test specimens from each 75 m³ of concrete placed, for every placement or when required by the Departmental Representative. Cylindrical specimens shall be tested in compression at 7 and 28 days (2 specimens) unless directed otherwise by the Engineer-Architect.
- .3 Testing laboratory will make at least one slump test and one air content test for each set of test specimens cast.
- .4 Alkali-aggregate reaction tests are to be performed or certification reports supplied verifying the quality of the aggregates to be used.
- .5 Copies of all test reports to be submitted to the Departmental Representative, General Contractor, Ready Mixed Concrete Producer, and the Engineer-Architect.
- .6 Cost of all tests to be borne by the Owner as specified in Division 1.
- .7 CSA A23.1 shall form the basis for acceptance, strengthening or replacement of concrete not meeting specified quality.

- .8 The Contractor shall cooperate with and assist the testing company by providing access to all parts of the work as required.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 03 20 00 - Concrete reinforcing
- .2 Section 03 30 00 - Cast-in-place concrete
- .3 Section 07 92 00 - Joint sealants

1.2 REFERENCES

- .1 ASTM International (ASTM):
 - .1 ASTM C109/C109M-13, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
 - .2 ASTM C309-11, Standard Specification for Liquid MembraneForming Compounds for Curing Concrete.
- .2 CSA Group (CSA):
 - .1 CSA A23.1-09/A23.2-09, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.

Part 2 Products**2.1 MATERIALS**

- .1 Concrete materials and reinforcement: in accordance with Sections 03 20 00 - Concrete Reinforcing and 01 33 00 - Submittal Procedures.
- .2 Concrete curing compound to be high solids, water based curing and sealing compound to ASTM C309. Concrete curing compound shall be compatible with asphalt based adhesives. Unless specified elsewhere herein, apply curing compound to manufacturer's written instructions.
- .3 Non-Metallic Floor Hardener: premixed abrasion resistant hardener.
 - .1 Hardness: 6.5 Moh's Scale. Particle shape: rough, angular. Compressive strength 70 MPa at 28 days to ASTM C-109. Acceptable manufacturers: Sternson Ltd., Master Builders Co. Ltd. Acceptable materials: Colorplete and Colorcron or an approved equivalent.
- .4 Additives, admixtures, hardeners, curing compounds and sealers are to be compatible.
- .5 Joint fillers: see Section 03 10 00.
- .6 Joint sealants: see Section 03 10 00.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Do concrete floor finishing to CSA A23.1 except where specified otherwise.
- .2 Steel trowel concrete slabs to be left exposed or to receive carpeting, resilient flooring and applied floor finishes.
- .3 Concrete slabs to receive toppings, quarry tile, ceramic tile, terrazzo, to be screeded off to true lines and levels shown and left ready to receive finish. Depress slabs to accommodate finish.
- .4 Where floor drains occur, floors to be level around walls and have a minimum 10 mm per metre uniform pitch to drains from a 3 m radius around drains or to walls unless indicated otherwise.
- .5 Slope portions of slabs as indicated on the drawings.
- .6 Ensure formwork and embedded metal parts are not disturbed or displaced during the finishing operation.

3.2 PLAIN FLOOR FINISHES

- .1 Consolidate concrete by vibrating to force coarse aggregate into concrete mix and then screed.
- .2 Float surface with wood or metal floats or with power finishing machine and bring surface to true grade.
- .3 Steel trowel to smooth and even surface in accordance with CSA A23.1, Class A.
- .4 Follow with second steel trowelling to produce smooth burnished surface to within 8 mm tolerance when measured in any direction using a 3 m straight edge.
- .5 Sprinkling of dry cement or dry cement and sand mixture over concrete surfaces is not acceptable.
- .6 Saw cut control joints in slabs-on-grade within 12 hours after finishing. Use 5 mm thick blade, cutting to 1/3 of slab thickness or as shown on drawings. Control joints to be located as shown on the drawings. Fill joints with sealant. Saw cut crack control joints to CSA A23.1.
- .7 All concrete slabs shall be cured as follows:

Method 1 - If air temperature is between 5°C and 26°C, apply curing compound in strict accordance with manufacturer's instructions at the rate of 7 square meters per litre.

Method 2 - If air temperature is 27°C or above, cure the slab by continuous wet curing for a minimum of 5 days. Cover slab with a burlap or non-woven geotextile fabric immediately after finishing of

concrete. Water shall not be allowed to drip, flow, or puddle on the concrete slab. Equipment and materials necessary for water curing shall be on site and ready for use prior to concrete placement. Following the 5 days of wet curing and immediately after surface water is removed, apply curing compound in strict accordance with manufacturer's instructions at the rate of 7 square meters per litre. (Note: Method 2 may be used in place of Method 1)

- .8 After curing and when concrete is dry, seal all slab floor joints at junction with vertical surfaces with joint sealant.

3.3 HARDENED FLOOR FINISH

- .1 All exposed floors to receive hardener.
- .2 A trained service technician from the manufacturers of the concrete floor hardeners shall be on site during the initial period of installation of hardened concrete floors and shall provide a report of findings.
- .3 Finish concrete floors as per Paragraph 3.2.
- .4 Apply floor hardener at a rate of 5 kg/m² in accordance with manufacturer's written instructions.
- .5 Apply first shake of aggregate (3 kg/m²) after floating.
- .6 Float first shake and apply second shake at right angles to first.
- .7 Float second shake to produce medium textured non-slip finish.
- .8 Apply additional floating to produce medium textured non-slip finish.
- .9 On interior slabs, flat steel trowel to produce a fine textured nonslip finish and burnish trowel to within 1 mm tolerance when measured in any direction using 1 m straight edge.
- .10 Saw cut control joints as specified.
- .11 Apply curing compound in accordance with manufacturer's recommendations at the rate of 7 m²/l.

3.4 EXTERIOR PADS

- .1 Float and trowel concrete walkways as per Clause 3.2.
- .2 Immediately after floating, give surface a uniform broom finish to produce regular corrugations not exceeding 2mm deep, by drawing broom in direction normal to center line.
- .3 Provide edging as indicated with 10mm radius edging tool.
- .4 All exterior slabs, stairs, steps, etc., shall be protected with two applications of commercial-grade boiled linseed oil mixed with varsol. The first application shall be a mixture of equal parts of oil and varsol applied on a dry surface at a rate of 10 m² per litre.

The second application shall be from one half to full strength oil applied at a rate of 15 m² per litre after the first treatment has been absorbed.

- .5 All exterior concrete to be cured by continuous wet curing for a minimum of 7 days.

END OF SECTION

SECTION 07 21 13

Board Insulation

Part 1 General

1.1 Related requirements

1. Section

1.2 Reference standards

1. ASTM International
 - 1.1.ASTM C591-13, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - 1.2.ASTM C1126-14, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 - 1.3.ASTM C1289-14, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 1.4.ASTM E96/E96M-13, Standard Test Methods for Water Vapour Transmission of Materials.
2. Canadian General Standards Board (CGSB)
 - 2.1.CGSB 71-GP-24M-AMEND-77 (R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
3. Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - 3.1. Material Safety Data Sheets (SDS).
4. Underwriters Laboratories of Canada (ULC)
 - 4.1.CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
 - 4.2.CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

1.3 Action and informational submittals

1. Submit in accordance with Section 01 33 00 - Submittal Procedures.
2. Product Data:
 - 2.1.Submit manufacturer's instructions, printed product literature and data sheets for board insulation and include product characteristics, performance criteria, physical size, finish and limitations.
3. Shop Drawings:
 - 3.1.Submit drawings stamped and signed by professional engineer registered or licensed in Territory, Canada.
4. Certificates:
 - 4.1.Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
5. Test Reports:
 - 5.1. Submit certified test reports showing compliance with specified performance characteristics and physical properties.
6. Manufacturer's Instructions:
 - 6.1.Submit manufacturer's installation instructions.

1.4 Delivery, storage and handling

1. Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
2. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
3. Storage and Handling Requirements:
 - 3.1. Store materials off ground and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - 3.2. Store and protect specified materials from nicks, scratches, and blemishes.
 - 3.3. Replace defective or damaged materials with new.

Part 2 Products

2.1 Insulation

1. Expanded polystyrene (EPS): to CAN/ULC-S701.
 - 1.1. Compressive strength: 275 kPa min.
 - 1.2. Thickness: 100 mm as indicated.
 - 1.3. Size: refer to Structural Drawings.
 - 1.4. Edges: square.
 - 1.5. Thermal Resistance: RSI 0.88 @ -10C meeting ASTM C578
 - 1.6. Water Vapour Permeance: 143 ng/Pa.s.m² meeting ASTM E96
 - 1.7. Water Absorption: 1% max meeting ASTM D2842
 - 1.8. Product of Acceptance: Terrafoam HS-40 by Beaver Plastics
2. Concrete Faced Insulation to CAN/ULC S701-05
 - 2.1. Thermal Resistance: 0.88 per inch meeting ASTM C518
 - 2.2. Compressive Strength Vertical: 35 kPa meeting ASTM D1621
 - 2.3. Water Absorption: 0.7% meeting ASTM D2842
 - 2.4. Water Vapour Permeance: 1.0 perm meeting ASTM E96
 - 2.5. Thickness: 100mm as indicated on drawings (R20)
 - 2.6. Product of Acceptance: CFI Wall panels by Tech-Crete Processors Ltd.

Part 3 Execution

3.1 Examination

1. Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for board insulation application in accordance with manufacturer's written instructions.
 - 1.1. Visually inspect substrate in presence of Consultant.
 - 1.2. Inform Consultant of unacceptable conditions immediately upon discovery.
 - 1.3. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 Installation

1. Install insulation after building substrate materials are dry.

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Board Insulation
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2. Install insulation to maintain continuity of thermal protection to building elements and spaces.
3. Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
4. Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
5. Do not enclose insulation until it has been inspected and approved by Consultant.

3.3 Perimeter foundation insulation

1. Exterior application: extend boards as indicated. Install on exterior face of perimeter foundation wall with adhesive.
2. Under slab application: extend boards as indicated. Lay boards on level compacted fill.

3.4 Cleaning

1. Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - 1.1. Leave Work area clean at end of each day.
2. Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
3. Waste Management: separate waste materials for in accordance with Section
 - 3.1. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

SECTION 07 26 16

Below Grade Vapour Retarders

Part 1 General

1.1 Related requirements

1. Section 06 10 00.
2. Section 07 21 13
3. Section 07 92 00

1.2 Reference standards

1. Canada Green Building Council (CaGBC)
2. Canadian General Standards Board (CGSB)
 - 2.1. CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
 - 2.2. CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.3 Action and informational submittals

1. Submit in accordance with Section 01 33 00 - Submittal Procedures.
2. Product Data:
 - 2.1. Submit manufacturer's instructions, printed product literature and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.
 - 2.2. Submit 2 copies of WHMIS SDS in accordance with Section
3. Certificates:
 - 3.1. Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
4. Sustainable Design Submittals:
 - 4.1. Construction Waste Management:
 - 4.1.1. Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - 4.2. Recycled Content:
 - 4.2.1. Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.

1.4 Delivery, storage and handling

1. Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
2. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
3. Storage and Handling Requirements:
 - 3.1. Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - 3.2. Store and protect specified materials specified materials from nicks, scratches, and blemishes.
 - 3.3. Replace defective or damaged materials with new.

Part 2 Products

2.1 Sheet vapour barrier

1. Polyethylene film: to CAN/CGSB-51.34, 0.254 mm thick.

2.2 Accessories

1. Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
2. Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealants.
3. Staples: minimum 6 mm leg.

Part 3 Execution

3.1 Examination

1. Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for vapour retarder installation in accordance with manufacturer's written instructions.
 - 1.1. Visually inspect substrate in presence of Consultant.
 - 1.2. Inform Consultant of unacceptable conditions immediately upon discovery.
 - 1.3. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 Installation

1. Ensure services are installed and inspected prior to installation of retarder.
2. Use sheets of largest practical size to minimize joints.
3. Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.3 Exterior surface openings

1. Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.4 Perimeter seals

1. Seal perimeter of sheet vapour barrier as follows:
 - 1.1. Apply continuous bead of sealant to substrate at perimeter of sheets.
 - 1.2. Lap sheet over sealant and press into sealant bead.
 - 1.3. Install staples through lapped sheets at sealant bead into wood substrate.
 - 1.4. Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 Lap joint seals

1. Seal lap joints of sheet vapour barrier as follows:
 - 1.1. Attach first sheet to substrate.
 - 1.2. Apply continuous bead of sealant over solid backing at joint.
 - 1.3. Lap adjoining sheet minimum 150 mm and press into sealant bead.

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- 1.4. Install staples through lapped sheets at sealant bead into wood substrate.
- 1.5. Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 Cleaning

1. Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - 1.1. Leave Work area clean at end of each day.
2. Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
 - 2.1. Remove insulation material spilled during installation and leave work area ready for application of wall board.
3. Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - 3.1. Remove recycling containers and bins from site and dispose of materials at appropriate facility.