
Part 1 General

1.1 GENERAL CONDITIONS

- .1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

- .1 Form for all cast-in-place concrete indicated on drawings and subsequently remove all such forms.

1.3 RELATED WORK

- | | | |
|----|--------------------------------|------------------|
| .1 | Concrete Reinforcing | Section 03 20 00 |
| .2 | Cast-in-Place Concrete | Section 03 30 00 |
| .3 | Concrete Finishing | Section 03 35 00 |
| .4 | Structural Steel for Buildings | Section 05 12 23 |

1.4 DESIGN AND CODE REQUIREMENTS

- .1 Formwork and supporting falsework shall be designed and constructed in accordance with the requirements of CAN/CSA S269.3-M92 (R2008) and CAN/CSA -A23.1-09 as applicable to the work.
- .2 Assume full responsibility for the design and for the adequacy and safety of all formwork and falsework.
- .3 Retain a professional engineer to design falsework which consists of shoring more than one tier in height or which is a framed structure.
- .4 The design and erection of formwork and related supporting works shall comply with construction safety legislation and regulations.

1.5 HANDLING AND STORAGE

- .1 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.
- .2 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign matter. Handle and erect the fabricated formwork so as to prevent damage.

Part 2 Products

2.1 QUALITY AND STRENGTH

- .1 The quality and strength of formwork material shall comply with the requirements set forth in this Specification and CAN/CSA A23.1-09.

2.2 FINISHES

- .1 Form materials for concrete surfaces which will be exposed to view, or which require smooth and uniform surfaces for applied finishes or other purposes, shall consist of square edges, smooth panels of plywood, metal or plastic to approval of the Consultant. The panels shall be square and made in a true plane, clean, free of holes, surface markings and defects.
- .2 Square edged, tongue and groove or shiplap lumber may be used to form concrete which will not be exposed to view or which does not require smooth uniform surface for other purposes.

2.3 MATERIALS

- .1 Form plywood: exterior grade, Douglas Fir conforming to CSA Standard O121-08. Plywood shall be resin coated one side (in contact with concrete). Use sound undamaged plywood with clean true edges. Make up or patching strips between panels shall be kept to a minimum.
- .2 Lumber for forms, falsework, shoring and bracing: conform to CAN/CSA O141-05 (R2009) for Softwood Lumber, and the applicable authorized grading authority. All lumber shall be a grade to which allowable unit stresses may be assigned in accordance with the National Building Code. All lumber shall be grade marked by the authorized grading authority.
- .3 Form Ties: Fabricated units having a minimum working strength when assembled of 21 MPa and shall be adjustable in lengths to permit tightening and alignment of forms. Ties shall be made with breakback ends or other means of removing the tie end to a depth of at least 25 mm from the concrete surface, after the forms are removed. Flat tie for Architectural exposed concrete to include plastic cones leaving no metal within 20 mm of surface.
- .4 Form release agent: Proprietary material which will not stain the concrete or impair the natural bonding or colour characteristics of coating intended for use on the concrete.
- .5 Waterstops: Purpose made polyvinyl chloride; 12 MPa minimum tensile strength, -46⁰ C. to +70⁰ C working temperature range, conforming to CGSB 41 GP 35M, Type 2.
- .6 Pre-moulded joint fillers:
 - .1 Bituminous impregnated fibreboard: ASTM D1751-73.
 - .2 Vinyl Foam: to ASTM D1752-67 (1973) Type I, flexible grade.
 - .3 Standard Cork: to ASTM D1752-67 (1973) Type II.

Part 3 Execution

3.1 CONDITION OF SURFACES

- .1 Examine the excavations and foundations for adequate working room and support for the work of this section.
- .2 Verify lines, levels and centre lines before proceeding with the work and ensure that dimensions agree with drawings.
- .3 Report to the Consultant discrepancies in other work which affect the work of this section.

3.2 PREPARATION

- .1 Coat the inside surfaces of forms with a form release agent, used in accordance with the manufacturer's instructions.
- .2 Apply the agent prior to placing reinforcing steel, anchoring devices and embedded parts.

3.3 ASSEMBLY AND ERECTION

- .1 Construct the formwork and shoring and bracing to meet the design and code requirements, accurately so that the resultant finished concrete shall conform to the shapes, lines and dimensions shown on the drawings, within the specified tolerances.
- .2 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.
- .3 Review locations of ties and form panels for exposed concrete work with the Consultant.
- .4 Check and correct formwork as required, both horizontally and vertically, during the placing of the concrete.
- .5 Construct formwork to maintain the following maximum tolerances:
 - .1 Deviation from horizontal and vertical lines:
 6 mm in 3000 mm
 20 mm in 12000 mm.
 - .2 Deviation of building dimensions indicated on Drawings and position of columns, walls and partitions:
 6 mm.
 - .3 Deviation in cross sectional dimensions of columns or beams or in thickness of slabs and walls:
 ± 6 mm.
- .6 Obtain Consultant's approval for use of earth forms.

3.4 JOINTS IN FORMS

- .1 Make form joints tight in order to prevent leakage of mortar.
- .2 Clean all edges and contact surfaces before erection.
- .3 Where required, install pvc waterstop to manufacturer's instructions and without displacing reinforcement. Do not distort or pierce waterstop.

3.5 SHORING AND BRACING

- .1 Provide bracing to ensure the stability of the formwork as a whole.
- .2 Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.
- .3 Arrange forms to allow stripping without removal of the principal shores, where these are required to remain in place.

3.6 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. Accurately locate and set in place items which are to be cast directly into the concrete. Co-ordinate the work of other sections and co-operate with the trade involved in the forming and setting of openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts. No such forming or setting of openings, slots, recesses, chases, sleeves, or parts shall be done unless specifically shown on the drawings or approved prior to installation.
- .2 Obtain Consultant's approval before framing openings in concrete beams or columns not specifically detailed on structural drawings.
- .3 Provide temporary ports or openings where required to facilitate cleaning and inspection. Openings at the bottom of forms shall be located so that flushing water will drain from the forms.
- .4 Close the temporary ports or openings with tight fitting panels, flush with the inside face of the forms, neatly fitted so that the joints will not be apparent in exposed concrete surfaces.
- .5 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval in writing or all modifications from the Consultant before placing concrete.

3.7 FIELD QUALITY CONTROL

- .1 Inspect and check the completed formwork, shoring and bracing to ensure that the work is in accordance with the formwork design, and that the supports, fastenings, wedges, ties and parts are secure. The Engineer responsible for the design of the formwork shall assist in this inspection.

- .2 Inform the Consultant when the formwork is complete and has been cleaned. Obtain the approval of the engineer responsible for the design of the formwork and the general approval of the Consultant before placing concrete.

3.8 CLEANING

- .1 Clean the forms as erection proceeds to remove foreign matter.
- .2 Remove cuttings, shavings and debris from within the forms.
- .3 Flush the completed forms with water or air jet to remove remaining foreign matter. Ensure that water and debris drain to the exterior through the clean-out ports.

3.9 WINTER CONSTRUCTION

- .1 Remove ice and snow from within the forms.
- .2 The use of de-icing salts will not be permitted.
- .3 Unless formwork and concrete construction proceed within a heated enclosure, do not use water to clean out completed forms. Use compressed air or other means to remove foreign matter.

3.10 REMOVAL OF FORMWORK

- .1 Notify the Consultant before removing formwork.
- .2 Remove formwork progressively and in accordance with the reference code requirements, and so that no shock loads or imbalanced loads are imposed on the structure.
- .3 Do not remove forms and shoring before concrete has attained sufficient strength to ensure safety of structure. If evidence to verify concrete strength is not available, the forms and shores shall not be removed before the following minimum intervals after concrete is placed.
 - .1 Grade beams - 4 days.
 - .2 Slabs - 21 days.
- .4 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.
- .5 Leave forms loosely in place, against vertical surfaces, for protection until complete removal is approved by Consultant.
- .6 Store removed forms, for exposed architectural concrete, in a manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .7 Re-shore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.

- .8 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.
- .9 Re-use of formwork and falsework is subject to the requirements of CAN/CSA A23.1-09.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

- .1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made a part of this section.

1.2 WORK INCLUDED

- .1 Furnish and install all bonded reinforcement and associated items required and/or indicated on the Drawings for all cast-in-place concrete and reinforced masonry work.

1.3 RELATED WORK

- | | | |
|----|----------------------------------|------------------|
| .1 | Bored Piles | Section 31 63 00 |
| .2 | Concrete Forming and Accessories | Section 03 10 00 |
| .3 | Cast-in-Place Concrete | Section 03 30 00 |
| .4 | Concrete Finishing | Section 03 35 00 |

1.4 INSPECTION AND TESTING

- .1 Upon request, provide certified copy of mill test report of steel supplied, showing physical and chemical analysis.

1.5 REFERENCE STANDARDS

- .1 Do reinforcing work in accordance with CAN/CSA A23.1-09 and welding of reinforcement with CSA W186-M1990 (R2007).

1.6 SUBMITTALS

- .1 Prepare, check and submit reinforcing steel and mesh placing drawings and bar bending and cutting schedules for all steel reinforcement shown or specified in accordance with Submittal Procedures Section 01 33 00.
- .2 All drawings and schedules shall be prepared and checked under the direct supervision of a qualified professional engineer who is experienced in this work.
- .3 Clearly indicate bar sizes, spacing, location and quantities of reinforcement, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings; to ACI - 315 Manual of Standard Practice and Metric Supplement 1977 by Reinforcing Steel Institute of Ontario.
- .4 Design and detail lap lengths and bar development lengths to CAN3 A23.3-04, unless specified on drawings.

- .5 Review of shop drawings for size and arrangement of principal and auxiliary members only. Such review will not relieve the Contractor of responsibility for general and detail dimension and fit, or any errors or omissions.

1.7 SUBSTITUTES

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

1.8 DELIVERY AND STORAGE

- .1 Reinforcing steel, welded wire fabric and accessories shall be delivered, handled and stored in a manner which prevents contamination from bond reducing or foreign matter and damage to its fabricated form.

Part 2 Products

2.1 MATERIALS

- .1 *All reinforcing steel:* unless noted otherwise on the drawings or herein shall be deformed bars of new billet steel conforming to the current CAN/CSA G.30.18-09 Grade 400, plain finish for all bars. Minimum splice for 10 M bars to be 450 mm. Minimum lap splice for all other bars to be 36 bar diameters or 675 mm, whichever is greater.
- .2 *Weldable reinforcing bars:* high strength ductile, deformed bars to CSA G30.18-09, Grade 400.
- .3 *Column ties and beam stirrups:* shall conform to the current CAN/CSA G30.18-09, Grade 300.
- .4 *Welded wire fabric:* to CSA G30.5-M1983. Provide in the flat sheets only.
- .5 *Tie wires:* shall be 1.29 mm or heavier annealed wire or a patented system approved by the Consultant.
- .6 *Reinforcing steel supports:* shall conform to ACI Standard 315 unless otherwise approved by the Consultant.
- .7 *Mechanical splices:* subject to the approval of the Consultant.

2.2 FABRICATION

- .1 Fabricate bends, splices and ties and supply bar supports and accessories in accordance with the requirements of CAN-A23.3-04. Spacing and arrangements of supports in accordance with ACI 315.
- .2 All intermediate grade reinforcing bars shall be bent cold without hickeying. All high strength steel shall be preheated.
- .3 Reinforcing bars shall not be straightened or rebent.

- .4 Location of reinforcement splices not shown on the drawings subject to approval by the Consultant and shall, for beams and slabs be away from points of maximum stress in the steel.
- .5 *Welding of reinforcing bars:* use only weldable bars, preheat and weld to CSA W186-1990 (R2007).

Part 3 Execution

3.1 EXAMINATION

- .1 Examine the work upon which this section depends and report any discrepancies to the Consultant.
- .2 Commencement of the work shall imply acceptance of conditions.

3.2 PLACING

- .1 Reinforcement of the size and shapes shown on the drawings shall be accurately placed in accordance with the approved shop drawings, the structural drawings and the requirements of the current National Building Code.
- .2 Clear distances between parallel bars shall be not less than 1.4 times the diameter of the bar, or 30 mm or 1.4 times the maximum size of the coarse aggregate. Bars placed in two or more layers shall be placed directly above and below each other.
- .3 Reinforcing steel shall, where not otherwise shown on the structural drawings, be protected by the clear cover of concrete over the reinforcement as follows:
 - .1 Where concrete is formed against earth, not less than 75 mm.
 - .2 Where concrete placed against forms is to be exposed to the weather or be in contact with the ground, not less than 50 mm for bars larger than 15 M, and not less than 40 mm for bars 15 M and smaller.
 - .3 In slabs and walls not exposed to the ground or weather, not less than 20 mm.

The foregoing clear covers shall be maintained within 5 mm.

- .5 Reinforcement shall be adequately supported by metal chairs, spacers or hangers and secured against displacement within the tolerance permitted and in accordance with the latest ACI Standard 315.
- .6 For slabs on grade, footings or similar construction, concrete blocks may be used in place of metal chairs.
- .7 Unless detailed otherwise, all exterior slabs, walks and pads abutting building foundations to be dowelled with 15 M at 400 on centre, extending minimum 750 into slab.

- .8 Review with the Consultant, placement of reinforcement prior to concreting.
- .9 Notify the Consultant twenty-four (24) hours prior to placing concrete.

3.3 CLEANING

- .1 All materials shall be clean and free of all form oil or deleterious materials.
- .2 All deleterious material shall be removed from the surface of the reinforcing steel in a manner acceptable to the Consultant.

3.4 WELDING

- .1 Do welding to meet requirements of CSA W186-M1990 (R2007). Have welding performed by workmen qualified under CSA W47.1-09. Welding only by written authority of the Consultant.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

- .1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

- .1 Cast-in-Place Concrete required for this work is indicated on drawing and includes, but is not necessarily limited to:
 - .1 Concrete Beams
 - .2 Concrete Slabs
 - .3 Concrete Toppings
 - .4 Finishing of all Formed Concrete Surfaces.

1.3 RELATED WORK

- | | | |
|----|----------------------------------|------------------|
| .1 | Bored Piles | Section 31 63 00 |
| .2 | Concrete Forming and Accessories | Section 03 10 00 |
| .3 | Concrete Reinforcing | Section 03 20 00 |
| .4 | Concrete Finishing | Section 03 35 00 |
| .5 | Structural Steel for Buildings | Section 05 12 23 |

1.4 QUALITY ASSURANCE

- .1 Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all work performed under this Section.
- .2 For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeyman concrete finishers.
- .3 Perform cast-in-place concrete work to requirements of CAN/CSA-A23.1-09 - "Concrete Materials and Methods of Concrete Construction".

1.5 PRODUCT HANDLING

- .1 Use all means necessary to protect cast-in-place concrete materials before, during and after installation and to protect the installed work and materials of all other trades.
- .2 In the event of damage, immediately make all repairs and replacements necessary to approval of the Consultant and at no additional cost to the Owner.

1.6 INSPECTION AND TESTING

- .1 Inspection and testing will be performed by a firm approved by the Consultant and paid for by the Contractor. Unless approved otherwise, the testing agency must perform all aspects of testing including cylinder preparation.
- .2 Provide free access to all portions of work and co-operate with appointed firm.
- .3 Submit proposed mix design for each class of concrete to Consultant for approval two (2) weeks prior to commencement of work.
- .4 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.
- .5 One concrete test, consisting of three test cylinders, will be taken for every 50 cubic meters or less of each class of concrete placed. One cylinder to be tested at seven (7) days, the remaining two cylinders to be tested at twenty-eight (28) days.
- .6 One (1) additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions of concrete it represents.
- .7 One (1) slump test and one (1) air content test will be taken for each set of test cylinders taken.
- .8 Testing of concrete will be performed in accordance with CAN/CSA-A23.2-09 "Method of Test for Concrete".
- .9 Test results will be issued to the Contractor, Consultant and Owner. Test reports are to be numbered consecutively beginning with number one.
- .10 Required retesting will be paid for by the Contractor.
- .11 The Consultant may order additional testing any time even though the required tests indicate the strength requirements have been met. In this instance, the Owner will pay for those tests that meet the specified requirements and the Contractor will pay for those that do not.
- .12 Non-destructive methods for testing concrete shall be according to CAN/CSA A23.2-09.

1.7 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Submittal Procedures Section 01 33 00.

Part 2 Products

2.1 CONCRETE MATERIALS

- .1 *Cement:* Normal - Symbol 10 and Sulphate Resistant - Symbol 50 Portland Type, to CSA A3000-08 - "Portland Cements".

- .2 *Fine and Coarse Aggregates:* conforming to CAN/CSA-A23.1-09 - "Concrete Material and Methods of Concrete Construction".
- .3 *Water:* clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

2.2 ADMIXTURES

- .1 *Air Entrainment:* to ASTM C260-06 - "Air-Entraining Admixtures for Concrete".
- .2 *Chemical:* to ASTM C494-08a - "Chemical Admixtures for Concrete"; water reducing, strength increasing type WN - normal setting.
- .3 *Pozzolanic Mineral:* to CSA A3000-08 "Supplementary Cementing Materials and Their Use in Concrete Construction", fly ash permitted only as approved by Consultant.

2.3 ACCESSORIES

- .1 *Vapour Barrier:* 6 mil polyethylene film, to CGSB 70-GP-1a, Type 1 - low permeance heavy duty.
- .2 *Curing Compounds:* shall conform to the requirements of the latest issue of ASTM Standard C309.
- .3 *Non-shrink Grout:* premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 20 MPa at 3 days and 50 MPa at 28 days. CPD Non Shrink Grout by CPD Construction Products or approved equivalents.
- .4 *Void Form:* **to comply with either of the following:**
 - .1 Biodegradable Void Form: biodegradable, 150 mm deep, structurally sufficient to support weight of wet concrete and other superimposed loads without collapsing until concrete has gained sufficient strength to support these loads after which time the form must promptly degrade. Do not wrap void form. Do not place void form on poly ground sheet. The onus is entirely on the Contractor and Supplier to ensure that the void form is installed to perform as intended.
 - .2 Compressible Void Form: GeoVoid (below slabs) or Geospan (below grade beams) compressible void form by Plasti-Fab designed for 150 mm soil heave, installed to supplier's specifications.
- .5 *Joint Filler:* pre moulded bituminous impregnated cane fibre board Flexcell as manufactured by Sternson or approved equal.
- .6 *Vertical Joint Sealant:* non-sag polyurethane sealant designed for use on vertical surfaces. Vulkem 116 as manufactured by Mameco Ltd. or approved equal. Install strictly in accordance with manufacturer's recommendations.

- .7 *Horizontal Joint Sealant:* three component chemically curing, self-levelling, polyurethane joint sealant, THC-900 as manufactured by Tremco. Colour selection by Consultant. Install strictly in accordance with manufacturer's recommendations.
- .8 *Concrete Expansion Anchors:* to be Hilti Kwik-Bolt or approved equivalent. Sized as per drawings. Minimum embedment length of all Hilti Kwik-Bolt to be 150 mm unless noted otherwise.
- .9 *Concrete Inserts with Bolt Extension:* Concrete inserts to be Hilti HKD Anchors or approved equivalent, sized as detailed on drawings. Bolt extensions to be mild steel threaded extensions sized as detailed on drawings.
- .10 *Concrete Patching Material:* pre-packaged, polymer modified, cementitious product containing graded natural aggregate, EMACO R300 - Rapid Setting Mortar as manufactured by Master Builders.
- .11 *Bonding Agent:* Approved high polymer polyvinyl acetate emulsion applied in strict accordance with manufacturer's recommendations for proposed application. Daraweld-C, Acrylbond by Allied or approved equal. Mix bonding agent with Portland cement, sand and water to manufacturer's recommendation to achieve a uniform slurry and scrubbed into the surface. Ensure surface is free from all laitance, dirt, dust, debris, grease or other substances. Clean surface with acid etching and hosing down. Neutralize acid if necessary.
- .12 *Cement Grout Capsules:* reinforcing steel detailed to be installed in pre-placed concrete to be anchored using Lafarge Fondu Cement Grout Capsules M3RR.

2.4 CONCRETE MIXES

- .1 Mechanical mix concrete in accordance with the requirements of CAN/CSA A23.1-09.
- .2 All concrete shall have the following minimum properties.

Based on 2005 National Building Code

Location	Exposure Class	Comp. Strength (MPa) and Age	Aggregate	Air Entrainment	Slump
1. Piling	S-2	32 @ 56 d	40	3 – 6	80 \pm 30
2. Grade Beams	S-2	32 @ 56 d	20	4 – 7	80 \pm 30
3. Structural Slabs	N	25 @ 28 d	20	0	80 \pm 30
4. Interior Topping	N	25 @ 28 d	10	0	80 \pm 30
5. Exterior Grade Supported Slabs	C-2	32 @ 28 d	20	5 – 8	80 \pm 30

Minimum cement content for Type 50 cement to be 280 kg/m³.
Maximum free water/cement ratio for Type 50 cement to be 0.5.

Semi-lightweight concrete to have unit weight of 2075 \pm 75kg/m³.
Lightweight concrete to have unit weight of 1850 \pm 75 kg/m³.

All slabs finished with dry shake hardener to contain no artificially entrained air.

- .3 Submit proposed mix design to Inspection and Testing Firm and to Consultant two (2) weeks prior to commencement of work. Provide certification that mix proportions selected will produce concrete of specified quality and that strength will comply with CAN/CSA A23.1-09.
- .4 Each load of ready-mixed or transit-mixed concrete delivered to the project site shall be accompanied by duplicate delivery slips providing the following information:
 - .1 Name of ready-mix batch plant
 - .2 Serial number of ticket
 - .3 Date and truck number
 - .4 Name of contractor
 - .5 Specific designation of project
 - .6 Specific class of concrete
 - .7 Amount of concrete in cubic metres
 - .8 Time of loading or first mixing of aggregate, cement and water.
- .5 Use accelerating admixtures in cold weather only when approved by Consultant. If approved, the use of admixture will not relax cold weather placement requirements. Use calcium chloride only as approved by the Consultant.
- .6 Use set-retarding admixtures during hot weather only when approved by the Consultant.
- .7 Use of plasticizers only when approved by Consultant.

Part 3 Execution

3.1 INSPECTION

- .1 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- .2 Verify that all items to be embedded in concrete are in place.
- .3 Verify that concrete may be placed to the lines and elevations indicated on the Drawings, with all required clearance from reinforcement.

3.2 DISCREPANCIES

- .1 In the event of discrepancy, immediately notify the Consultant.
- .2 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION

- .1 Remove all wood scraps and debris from the formed areas in which concrete will be placed.

- .2 Thoroughly clean the forms to ensure proper placement and bonding of concrete.
- .3 Thoroughly wet the forms, except in freezing weather, or oil them; remove all standing water.
- .4 Thoroughly clean all transporting and handling equipment.

3.4 PLACING CONCRETE

- .1 Place concrete in accordance with requirements of CAN/CSA A23.1-09 and as indicated on Drawings.
- .2 Notify Consultant and Inspection and Testing Firm a minimum of twenty-four (24) hours prior to commencement of concreting operations.
- .3 Ensure all anchors, seats, plates and other items to be cast into concrete are placed, held securely and will not cause undue hardship in placing concrete.
- .4 Maintain accurate records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.
- .5 Ensure reinforcement, inserts, embedded parts, formed joints and fitments are not disturbed during concrete placement.
- .6 Prepare previously placed concrete by cleaning with steel brush.
- .7 Pour concrete continuously between predetermined construction and control joints. All construction joints subject to approval of the Consultant.
- .8 Approval to place concrete shall be contingent on the formwork and reinforcing steel placement and evidence that the Contractor can place the planned casting without stopping.
- .9 Pour slabs on grade in checkerboard pattern or saw cut, as indicated on Drawings. Saw cut control joints within twenty-four (24) hours after finishing. Use 6 mm thick blades, cutting 20 mm into depth of slab thickness. Vacuum clean saw cut prior to installation of sealant.
- .10 Excessive honeycomb or embedded debris in concrete is not acceptable. Remove and replace defective concrete. Excessive honeycomb is when eraser end of a pencil fits into cavity.

3.5 COLD WEATHER REQUIREMENTS

- .1 When the air temperature is at or below 5⁰ C. or when there is a probability of it falling to this limit during the placing or curing period, cold weather requirements shall be applicable.
- .2 Provide heating equipment or heating plant on the job ready for use when concrete is being placed during cold weather. Such equipment shall be adequate for the purpose of maintaining the required temperature during the placing and curing of the concrete. The

methods used for heating shall be approved by the Consultant. Equipment inducing carbon monoxide gas in the building shall not be accepted.

- .3 Concrete shall not be placed on or against reinforcement, formwork, ground or any surface that is at a temperature less than 5⁰ C.
- .4 The temperature of the concrete at all surfaces shall be maintained at not less than 15⁰ C for three (3) days, or at not less than 10⁰ C for five days after placing. Means shall be provided to humidify the air within enclosures and to keep the concrete and formwork continuously moist if dry heat is used. The concrete shall be kept above freezing temperature for a period of seven (7) days, and shall be kept from alternate freezing and thawing for at least fourteen (14) days after placement.
- .5 At the end of the specified protection period the temperature of the concrete shall be reduced gradually at a rate not exceeding that shown in CAN/CSA A23.1-09.
- .6 Accelerator or so-called anti-freeze compounds shall **not** be permitted unless otherwise approved in writing by the Consultant.
- .7 All protective coverings shall be kept clear of the concrete and form surfaces to permit free circulation of air and shall be maintained intact for at least twenty-four (24) hours after artificial heat is discontinued.

3.6 HOT WEATHER REQUIREMENTS

- .1 When the air temperature exceeds 27⁰, hot weather requirements shall be applicable.
- .2 Time of initial mixing to complete discharge shall not exceed 1 hour and 15 minutes and concrete placed shall not exceed 27⁰.
- .3 Concrete forming surfaces and reinforcing steel shall be sprinkled with cool water just prior to placing concrete. Standing water or puddles shall be removed prior to concrete placement.
- .4 Special wind protection will be required as directed by the Consultant.
- .5 Columns, walls, beams and slabs shall be kept continuously damp for twenty-four (24) hours by normal curing procedures as outlined by this Specification. Slabs cured by the applications of sealing, shall have curing compound applied immediately after finishing of the slab but before evaporation of surface moisture.
- .6 The use of water reducing agents shall be subject to the approval of the Consultant when hot weather conditions prevail.

3.7 CONSTRUCTION JOINTS AND WATERSTOPS

- .1 The location and detail of all construction joints not detailed on the structural drawings shall be approved by the Consultant.

- .2 Where fresh concrete is to be placed against concrete which has set or has partially set, the surface of the set or partially set concrete shall be roughened, cleaned of all laitance, and thoroughly soaked with water prior to the placement of fresh concrete.

3.8 DEFECTIVE CONCRETE

- .1 Concrete not meeting the requirements of the Specifications and drawings shall be considered defective concrete.
- .2 Concrete not conforming to the lines, details and grade specified herein or as shown on the drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Consultant. Finished lines, dimensions and surfaces shall be correct and true within tolerances specified in the Formwork Section of these Specifications.
- .3 Concrete not properly placed resulting in excessive honeycombing and all honeycombing and other defects in critical areas of stress, shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Consultant.
- .4 Concrete of insufficient strength or improper consistency shall be, as required by the Consultant, subject to one or more of the following:
 - .1 Changes in mix proportions for the remainder of the work.
 - .2 Cores drilled and tested from the areas in question as directed by the Consultant and in accordance with CAN/CSA A23.2-09. The test results shall be indicative of the in-place concrete.
 - .3 Load testing of the structural elements in accordance with CAN3 A23.3-04.
 - .4 The changes in the mix proportions and the testing shall be at the Contractor's expense.
 - .5 Concrete failing to meet the strength requirements of this Specification shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Consultant.

3.9 PATCHING CONCRETE

- .1 After the removal of the forms concrete surfaces may be subject to inspection by the Consultant.
- .2 All exposed metal form ties, nails, wires, shall be removed, fins broken off and all loose concrete removed.
- .3 Form tie pockets shall be thoroughly wetted and patched with patching concrete followed by proper curing.
- .4 Honeycombed and other defective surfaces shall be chipped away to a depth of not less than 25 mm with the edges perpendicular to the surface, thoroughly wetted and patched with patching concrete followed by proper curing.

- .5 Patching concrete shall be thoroughly compacted into place and finished in such a manner as to match the adjoining concrete. The design mix of the patching concrete shall be approved by the Consultant.

3.10 ANCHOR BOLTS AND WELDMENTS

- .1 Set anchor bolts and weldments to the following tolerances:
 - .1 Alignment: $\pm 3\text{mm}$ of location, plumb and true.
 - .2 Projection: $\pm 6\text{mm}$ of elevations called for.

3.11 BASE PLATES GROUTING

- .1 Mix and place as per Manufacturer's specifications. Pack grout tightly under plates and leave no voids. Neatly finish edges.

3.12 EQUIPMENT PADS

- .1 Provide concrete pads for equipment where and as indicated on Drawings.
- .2 Insert bolts and sleeves and pack solidly with non-shrink grout, in accordance with setting details and templates.
- .3 Steel trowel top surfaces smooth. Tool edges.

3.13 CONCRETE TOPPING

- .1 All concrete toppings indicated on drawings are to be bonded toppings.
- .2 Concrete toppings are to be bonded by either of the following methods unless specifically directed:
 - .1 Application of cement/bonding agent/sand grout to prepared base course in accordance with CAN/CSA A23.1-09, Clause 7.6.4.2.2 (b).
 - .2 Application of approved bonding agent to prepared base course.
- .3 The following toppings are to be bonded specifically by application of approved bonding agent:
 - .1 All toppings cast over existing slabs.
 - .2 All interior toppings.
- .4 New concrete slabs which are to receive toppings are to be prepared in accordance with CAN/CSA A23.1-09, Clause 23 and Section 03 35 00.

3.14 SIDEWALKS

- .1 Unless specifically detailed otherwise on drawings or in specifications, sidewalks shall be constructed to the following details.
- .2 Use forms for edges of concrete walls to provide straight lines and smooth curves.

- .3 Locate asphalt impregnated fibreboard joint filler at 4.5 metre centres and where walks abut walls and other vertical surfaces. Joint filler to be full area of concrete section.
- .4 Slabs to be 125 thick cast over 6 mil poly and 200 compacted granular fill. Reinforce with 10 M at 300 mm on centre each way at mid-depth of slab.
- .5 Install tooled joints at 1.5 metres on centre.
- .6 Round all edges, including edges of control joints and tooled joints, with 12 mm radius edging tool.
- .7 Provide exposed surfaces of all sidewalks with medium broomed finish.
- .8 Slope walks and slabs as detailed on drawings.

END OF SECTION

Part 1 General

1.1 GENERAL CONDITIONS

- .1 The General Conditions of the Contract, Supplementary General Conditions and General Requirements are hereby made part of this section.

1.2 WORK INCLUDED

- .1 Finish separate floor toppings, slabs on fill and monolithic floor slabs.
- .2 Apply concrete hardener, sealer.
- .3 Cure finished surfaces.

1.3 RELATED WORK

- .1 Cast-in-Place Concrete Section 03 30 00

Part 2 Products

2.1 COMPOUNDS/HARDENERS/SEALERS

- .1 *Curing Compound:* chlorinated liquid rubber to CGSB 90-GP-1a, Type 1.
- .2 *Non-metallic Surface Sealer:* premixed natural mineral type; "Eurocure 700, by Elsro Ltd., "Flor Seal" by Sternson Ltd., "Master Seal" by Master Builders, "Sealtight CS-309" by W. R. Meadows or approved equal.
- .3 *Horizontal Joint Sealer:* three component, chemically curing, self-levelling polyurethane joint sealant. THC-900 as manufactured by Tremco. Color selection by Consultant. Install strictly in accordance with manufacturer's recommendations.
- .4 *Bonding Agent:* Approved high polymere polyvinyl acetate emulsion applied in strict accordance with manufacturer's recommendations for proposed application. Daraweld - C or approved equal.

Part 3 Execution

3.1 FLOOR FINISHING

- .1 Finish concrete floor surfaces in accordance with CAN/CSA A23.1-09.
- .2 Uniformly spread, screed and float concrete. Do not use grate tampers or mesh rollers. Do not spread concrete by vibration. Bring surfaces to levels indicated on Drawings.
- .3 Unless otherwise noted, all concrete floors which are noted in Architect's Room Finish Schedule as exposed concrete, or as receiving carpeting, resilient flooring or hardener are to be final finished to a hard, smooth dense trowelled surface free from blemishes. Final

finish to achieve a "flat" floor in accordance with CAN3 A23.1-09, Table 22 Class A straight edge method to produce floor surface of pleasing characteristics.

3.2 TOPPINGS

- .1 All new concrete slabs which are to receive topping or thick set tile finish are to be screeded and mechanically floated to achieve surface flatness with maximum variation of 8 mm in 3 M. Depress slabs to accommodate finish where required. Provide a scratch finish in accordance with CAN/CSA A23.1-09, Clause 7.5.6.2 to all concrete slabs receiving topping or thickset tile finish.
- .2 All concrete slabs which are to receive a concrete topping shall be cleaned free of oil and loose material.
- .3 Place dividers, edge strips, reinforcing, expansion joint assemblies and other cast-in items shown.
- .4 Just prior to placing topping, apply cement bonding agent slurry coat in accordance with CAN/CSA A23.1-09, Clause 7.6.4.2.2 (b) or approved bonding agent to base slab.
- .5 Apply bonded concrete topping over prepared concrete base slab to CAN/CSA A23.1-09.
- .6 All concrete toppings to receive insulation or roofing system shall be final finished by hand or mechanical floating to within a tolerance of 8 mm in 3 M.
- .7 All concrete toppings to serve as floor surfaces are to be final finished in accordance with Item 3.1 Floor Finishing.

3.3 CURING AND PROTECTION

- .1 All equipment needed for the curing and protection of the concrete shall be on hand and ready for use before actual placing is started.
- .2 All exposed non-formed surfaces shall be kept continuously moist for a minimum of seven consecutive days after placement of the concrete. The water for curing shall be clean and free from any materials that will cause staining or discolouration of the concrete. A liquid, membrane forming, curing compound shall be used under circumstances where the application of moisture is impracticable and where such compounds will not jeopardize the appearance of the concrete nor the bonding of future floor finishes.
- .3 Special curing techniques shall be employed when the concrete is subject to drying conditions such as high temperatures, low relative humidity and high winds. Concrete wall and column forms shall be kept continuously moist.
- .4 Freshly placed concrete shall be protected from the effects of direct sunshine, drying winds, cold, excessive heat and running water by the use of adequate tarpaulins or other suitable material to cover completely or enclose all freshly finished surfaces until the end of the curing period specified.

END OF SECTION