

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 35 00 – Concrete Finishing

1.2 WORK INCLUDED

- .1 Provide all labour, Materials, equipment and services necessary to supply, erect, and strip all formwork and falsework for poured-in-place concrete shown or indicated on the Contract Drawings and Specifications.

1.3 REFERENCE STANDARDS

- .1 Do concrete formwork and falsework to:
 - .1 Provincial Building Code - current edition.
 - .2 CSA Standard CSA-A23.1-94 (CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION).
 - .3 CSA Standard CSA-A23.2-94 (METHODS OF TEST FOR CONCRETE).
 - .4 CSA Standards S269.1 - 1975 (FALSEWORK FOR CONSTRUCTION PURPOSES).
 - .5 ACI SP4 Chapter 5 (FORMWORK FOR CONCRETE).
 - .6 ACI Standard 347 (RECOMMENDED PRACTICE FOR CONCRETE FORMWORK).

1.4 TOLERANCES

- .1 The tolerances for all concrete Work shall conform to the requirements of CSA Standard CSA-A23.1-94 Section 10.

1.5 PRODUCT HANDLING

- .1 Protect formwork Materials before, during and after installation and protect installed Work and Materials of other trades.
- .2 In the event of damage, immediately make required repairs or replacements necessary at no extra cost to the City.

Part 2 Products

2.1 MATERIALS

- .1 Form Material:
 - .1 Exposed surfaces - metal, plywood or plywood lined. Plywood to CSA Standard O121-M1978 or CSA Standard O153-M1980.
 - .2 Unexposed surfaces - metal, plywood to CSA Standard O121-M1978 or CSA Standard O153-M1980, or wood lumber to CSA Standard CAN/CSA O86.1-94 (ENGINEERING DESIGN IN WOOD - LIMIT STATES DESIGN).
 - .3 Plywood and wood formwork Materials shall conform to CSA Standard S269.1, be free from warp and sawn straight so that lines and shapes will be accurately retained.
 - .4 Unlined forms for unexposed surfaces shall be made with a good grade of lumber or plywood and fitted so that there will be no leakage of mortar.

- .5 Use metal forms, plywood lined forms or plywood forms of sufficient structural strength for exposed surfaces. Plywood for lining shall be GIS exterior grade fir plywood with a waterproof glue.
- .2 Ties and Spreaders:
 - .1 Use metal form ties which are adjustable in length to permit tightening of forms. Use only the snap-off type of form which will permit no metal within 25mm of the concrete surface after removal. Twisted wire form ties will not be accepted.
- .3 Form Release Agent:
 - .1 Form release agent shall be a pre-approved chemical agent, not an oil.
- .4 Void Form:
 - .1 Void form shall be of a deteriorating Material that will result in a total void thickness as noted on the Drawings. If a non-biodegradable Material is used the thickness must be adjusted to insure the required void volume is achieved. Contractor to submit technical data on void Material for approval.

Part 3 Execution

3.1 FORMWORK

- .1 Lines and Levels:
 - .1 Verify lines, levels and column centres before proceeding with Work and ensure that dimensions agree with Drawings.
 - .2 Coordinate and cooperate with all other trades in forming and setting of recesses, chases, sleeves, inserts, bolts and hangers.
- .2 Design:
 - .1 Build forms sufficiently strong and rigid to sustain the weight or fluid pressure of the concrete without noticeable deflection. Ensure forms are sufficiently tight to prevent leakage or mortar.
 - .2 The Contractor shall be responsible for design and construction of falsework. The method and scheduling of reshoring shall be submitted to the Contract Administrator for review prior to fabrication.
- .3 Construction:
 - .1 Construct forms so that the finished concrete will conform to the shape and dimensions specified.
 - .2 Construct forms so that they may be dismantled and removed without damaging the concrete.
 - .3 Set shores on wedges or use adjustable shores so they may be removed without causing undue strains in the concrete.
 - .4 Provide temporary openings at the bottom of column and wall forms to facilitate cleaning and inspection. Use water to flush out debris and close the openings with patch, flush on the inside.
- .4 Treatment of Forms:
 - .1 Use a non-staining form release agent free from volatile constituents for treating forms.
 - .2 Place form release agent prior to placing metal reinforcement.
 - .3 Untreated forms shall be kept wetted down to prevent shrinkage prior to placing concrete and shall be surface wetted at time of placing.
- .5 Alignment:
 - .1 Provide suitable means for checking the alignment and elevation of forms during

- placing. Check these items frequently during placing.
- .2 Carry out corrective wedging as required until concrete is in place.
 - .3 The Contract Administrator shall have the right to order concrete removed which has become misaligned during placing.
 - .4 Align forms to ensure that movements and deflections of the finished product are confined within the following Specifications and tolerances.
 - .1 The tolerances for all concrete Work shall conform to the requirements of CSA Standard CSA-A23.1-94.
 - .2 Variation in sizes and locations of sleeves, floor openings and wall openings -- 10mm.
 - .3 Variation for steps in a flight of stairs - rise 4mm, tread 8mm in consecutive steps - rise 2mm, tread 4mm.
 - .5 Formwork for slabs and beams shall be cambered as shown on the Drawings. For calculation of such cambers, allowance for settlement, closure of form joints, elastic shortening of forms and shoring, must be made and added to camber requirements.
 - .6 Stripping:
 - .1 Formwork shall not be removed until the concrete has gained sufficient strength to carry dead loads and all possible construction loads liable to be imposed upon it. Notify the Contract Administrator before removing any formwork.
 - .2 Remove forms in a manner to prevent spalling and other damage to the concrete surface. Forms shall be removed without hammering or prying against the concrete. Completely remove the forms from under steps and similar spaces, through temporary openings if necessary.
 - .3 Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.
 - .7 Re-use of Formwork:
 - .1 Forms may be re-used after adequate cleaning, providing the faces have not cracked or become roughened. Such formwork shall be trimmed and properly patched.

3.2 INSERTS

- .1 All sleeves, openings, etc., shown on Structural Drawings must be checked with the Architectural, Mechanical and Electrical Drawings. Sleeves, openings, etc., not shown on the Structural Drawings must be approved.
- .2 Set ties, anchor bolts, pipe hangers and other inserts, openings and sleeves, in concrete floors and walls, as required by other trades.
- .3 No sleeves, ducts, pipes or other openings shall pass through beams or columns, except where detailed on the Structural Drawings.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes the concrete formwork Materials and procurement and installation of the following concrete accessories:
 - .1 Strip Drain and Drain Grates
 - .2 Stair Nosing
 - .3 Detectable Warning Surfaces

1.2 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00– Concrete Reinforcing.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA O121-2008, Douglas Fir Plywood.
 - .3 CSA O151-09, Canadian Softwood Plywood.
 - .4 CSA O153-M1980(R2008), Poplar Plywood.
 - .5 CSA-O325-07, Construction Sheathing.
 - .6 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .7 CSA-O86-09, Engineering Design in Wood.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada.
- .2 ACI 301-10 - Specifications for Structural Concrete for Buildings.
- .3 ASCC (American Society of Concrete Contractors) - "Guide for Surface Finish of Formed Concrete".

1.4 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

1.5 SUBMITTALS FOR REVIEW

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Shop Drawings for formwork and falsework.
 - .1 Upon request submit Drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.
- .3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, Materials, arrangement of joints, architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework

- Drawings. Comply with CAN/CSA-S269.3 for formwork Drawings.
 - .4 Coordinate Materials to be set into concrete refer to Section 03 30 00.
 - .5 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- 1.6 QUALITY ASSURANCE
- .1 Perform Work in accordance with CSA-A23.1/A23.2.
 - .2 Refer to Section 03 30 00 – Cast in Place Concrete.

Part 2 Products

2.1 MATERIALS

- .1 Formwork Materials
 - .1 For concrete without special architectural features, use wood and wood product formwork Materials to CSA-O121, CAN/CSA-O86, and CSA-O153.
 - .2 For concrete with special architectural features, use formwork Materials to CSA-A23.1/A23.2.
- .2 Form ties:
 - .1 For concrete not exposed, use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25mm diameter in concrete surface.
 - .2 Exposed Architectural Concrete:
 - .1 Space tie and removable plastic cone specified, remove cone and leave tie hole exposed.
 - .2 Supply and install form ties on walls to be exposed concrete finish, in an evenly spaced pattern.
 - .3 Internal form ties shall be so arranged that when the forms are removed, no metal shall be within 40mm (1 ½" inch) of any exposed surface.
- .3 Form Release Agent: Non-toxic, biodegradable, low VOC.
 - .1 Standard of Acceptance: Vegetable based oil unless otherwise recommended by manufacturer.
- .4 Form Stripping Agent: Colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .5 Falsework Materials: To CSA-S269.1.
- .6 In areas of exposed concrete (including underside of slabs) do NOT write or etch on forms.

2.2 MANUFACTURERS

- .1 Strip Drain:
 - .1 Strip Drain: K-100 ACO Strip Drain: <http://www.acodrain.us/k100.html>
<http://acodrain.us/assets/k100-galvanized-steel-edge-rail-channel-system.pdf>

Strip Drain Grate: [http://www.acodrain.us/assets/type-438d-437d-galvanized-steel-longitudinal-grate-\(ada\).pdf](http://www.acodrain.us/assets/type-438d-437d-galvanized-steel-longitudinal-grate-(ada).pdf)

To be installed per manufacturer's specifications. Quantity as per Drawings

- .2 Stair Nosing:
 - .1 Woosters Stair Nosing: <http://www.woosterproducts.com/spec/232.pdf> installed per manufacturer's specifications. Quantity per Drawing.
- .3 Detectable Warning Surface:
 - .1 Wooster Products: <http://www.woosterproducts.com/spec/630A.pdf> installed per manufacturer's specifications. Quantity per Drawing.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Fabricate and erect falsework in accordance with CSA S269.1. Construct formwork to maintain tolerances in accordance with CSA-A23.1.
- .2 Before concrete is placed, thoroughly clean forms, retighten as is necessary and saturate the surface of construction joints and form sides with water as recommended by the manufacturer.
- .3 Deflection of Forms: Max. 1/400 of form span.
 - .1 Forms for architectural concrete should be stiff enough to minimize deflection and make any variations from plane less apparent.
- .4 Architectural Exposed Concrete Finish:
 - .1 Refer to Drawings for concrete members that are exposed finishes.
 - .2 Immediately prior to installation forms to be cleaned and to be inspected to be free of damage, defects, or holes.
 - .3 Forms to be installed tight, square and true.
 - .4 Edges to be clean, sharp and undamaged.
 - .5 Do not make any notations directly on the forms.
 - .6 Patching is not acceptable unless directly by Consultant.
 - .7 Do not tape joints.
 - .8 Arrange operations so that once a pour has begun, concreting is carried on continuously and the concrete at the surface of the pour is maintained plastic until the completion of section.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide Site drainage to prevent washout of soil supporting mud sills and shores.
- .7 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.
- .8 Align form joints and make watertight. Keep form joints to minimum.
- .9 Use 25mm chamfer strips on external corners and/or 25mm fillets at interior corners and

- joints, unless specified otherwise.
- .10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
 - .11 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
 - .12 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other Sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
 - .13 Form Release Agent: Spray on and wipe off excess as recommended by manufacturer.
 - .14 Line Forms For Following Surfaces (as applicable)
 - .1 Surfaces designated as exposed architectural finish.
 - .2 Secure lining taut to formwork to prevent folds.
 - .3 Pull down lining over edges of formwork panels.
 - .4 Ensure lining is new and not reused Material.
 - .5 Ensure lining is dry and free of oil when concrete is poured.
 - .6 Application of form release agents on formwork surface is prohibited where drainage lining is used.
 - .7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
 - .8 Cost of textile lining is included in price of concrete for corresponding portion of Work.
 - .15 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Notify Consultant 24 hours in advance prior to removing formwork.
- .2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.
- .3 Leave formwork in place for following minimum periods of time after placing concrete:

LOCATION	TEMPERATURE IN °C		
	21-35	15-21	10-15
Walls	2 Days	3 Days	4 Days
Grade Beams	2 Days	3 Days	4 Days
Side Forms	2 Days	3 Days	4 Days
Slabs *	7 Days	7 Days	14 Days
Beams *	7 Days	7 Days	14 Days
Structural Shoring *	7 Days	7 Days	14 Days

* formwork below/supporting these elements shall remain in place for the minimums

stated above and then replaced with shoring posts until concrete is twenty-eight (28) days old. Formwork can be removed and replaced with shoring posts earlier, if concrete test cylinders show a strength of 75% of the required twenty-eight (28) day strength.

- .4 Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.
- .5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.
- .6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.
- .7 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .8 Re-use formwork subject to requirements of CAN/CSA-A23.1.

END OF SECTION

- Part 1 General**
- 1.1 SECTION INCLUDES
- .1 Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.
- 1.2 RELATED SECTIONS
- .1 Section 03 10 00 – Concrete Formwork
- .2 Section 03 30 00 – Cast-in-place Concrete
- .3 Section 03 35 00 – Concrete Finishing
- 1.3 REFERENCES
- .1 ACI 301 - Structural Concrete.
- .2 ACI 318 - Building Code Requirements For Structural Concrete and Commentary.
- .3 ACI SP-66 - American Concrete Institute - Detailing Manual.
- .4 ASTM A82 - Steel Wire, Plain, for Concrete Reinforcement.
- .5 ASTM A184/A184M - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- .6 ASTM A185 - Steel Welded Wire Reinforcement, Plain, for Concrete.
- .7 ASTM A496 - Steel Wire, Deformed, for Concrete Reinforcement.
- .8 ASTM A497/A497M - Steel Welded Wire Reinforcement, Deformed, for Concrete.
- .9 ASTM A615/A615M - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- .10 ASTM A704/A704M - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
- .11 ASTM A706/A706M - Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- .12 ASTM A767/A767M - Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.
- .13 ASTM A775/A775M - Epoxy-Coated Reinforcing Steel Bars.
- .14 ASTM D3963D3963M - Fabrication and jobsite handling of Epoxy-Coated Steel Reinforcing Bars.
- .15 AWS (American Welding Society) D1.1 - Structural Welding Code -Steel.
- .16 AWS (American Welding Society) D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- .17 CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.
- .18 CRSI 63 - Recommended Practice For Placing Reinforcing Bars.
- .19 CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.
- .20 CAN/CSA-A23.1 - Concrete Materials and Methods of Concrete Construction.
- .21 CAN3-A23.3 - Design of Concrete Structures.
- .22 CSA G30.3 - Cold-Drawn Steel Wire for Concrete Reinforcement.
- .23 CSA G30.5 - Welded Steel Wire Fabric for Concrete Reinforcement.
- .24 CSA G30.14 - Deformed Steel Wire for Concrete Reinforcement.

- .25 CSA G30.15 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
 - .26 CAN/CSA-G30.18 - Billet-Steel Bars for Concrete Reinforcement.
 - .27 CAN/CSA-G40.21 - Structural Quality Steels.
 - .28 CAN/CSA-G164 - Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .29 CSA W186 - Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .30 RSIC (Reinforcing Steel Institute of Canada) - Reinforcing Steel Manual of Standard Practice.
- 1.4 SUBMITTALS FOR REVIEW
- .1 Section 01 33 00 – Submittal Procedures
 - .2 Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules.
 - .3 Prepare reinforcement Drawings in accordance with [Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada,] [ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure].
 - .4 Detail lap lengths and bar development lengths to CAN3-A23.3. Provide Type [A] [B] [C] tension lap splices.
- 1.5 SUBMITTALS FOR INFORMATION
- .1 Section 01 33 00 – Submittal Procedures
 - .2 Submit certified copies of mill test report of reinforcement Materials analysis.
- 1.6 QUALITY ASSURANCE
- .1 Perform Work in accordance with ACI 318.
 - .2 Design reinforcement under the seal of a Professional Registered in the Province of Manitoba experienced in design of this Work and licensed at the place where the Project is located.
 - .3 Welders' Certificates: Submit to Section 01 45 00 – Quality Control, certifying welders employed on the Work, verifying CSA qualification within the previous 12 months.
- Part 2 Products**
- 2.1 REINFORCEMENT
- .1 Reinforcing Steel: CAN/CSA-G30.18, billet steel, Grade 400, deformed bars, weldable low alloy bars,
 - .2 Reinforcing Steel Mat: ASTM A704, ASTM A615, 414 MPa yield grade; steel bars or rods, unfinished.
 - .3 Stirrup Steel: ASTM A82, unfinished.
 - .4 Welded Steel Wire Fabric: CSA G30.14 - Deformed steel wire.
- 2.2 ACCESSORIES
- .1 Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions

- .2 Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Stainless steel] type; size and shape as required.

2.3 FABRICATION

- .1 Fabricate concrete reinforcing in accordance with:
 - .1 CAN/CSA-A23.1.
 - .2 Weld reinforcement in accordance with CSA W59
 - .3 Galvanized Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with manufacturer's instructions.
 - .4 Locate reinforcing splices not indicated on Drawings, at point of minimum stress.

Part 3 Execution

3.1 PLACEMENT

- .1 Place, support and secure reinforcement against displacement. Do not deviate from required position to CAN/CSA A23.1.
- .2 Do not displace or damage vapour barrier.
- .3 Accommodate placement of formed openings.
- .4 Maintain concrete cover around reinforcing as per Structural Drawings.

3.2 FIELD QUALITY CONTROL

- .1 Section 01 45 00 – Quality Control. Provide a schedule when differing reinforcement types or finishes are required.
- .2 Reinforcement For Foundation Wall Framing Members and Slab-on-Grade: Deformed bars and wire fabric, galvanized finish.

END OF SECTION

Part 1

General

1.1

RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Formwork
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 35 00 – Concrete Finishing
- .4 Section 07 13 00 – Sheet Waterproofing

1.2

REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-95, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50mm or 2" Cube Specimens) or latest.
 - .2 ASTM C260-94, Specification for Air-Entraining Admixtures for Concrete or latest.
 - .3 ASTM C309-94, Specification for Liquid Membrane-Forming Compounds for Curing Concrete or latest.
 - .4 ASTM C332-87(1991), Specification for Lightweight Aggregates for Insulating Concrete or latest.
 - .5 ASTM C494-92, Specification for Chemical Admixtures for Concrete or latest.
 - .6 ASTM C827-95a, Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures or latest.
 - .7 ASTM C939-94a, Test Method for Flow of Grout for Preplaced-Aggregate Concrete or latest.
 - .8 ASTM D412-92, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension or latest.
 - .9 ASTM D624-91 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer or latest.
 - .10 ASTM D1751-83(1991), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) or latest.
 - .11 ASTM D1752-84(1992), Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction or latest.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings or latest.
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction or latest.
 - .3 CGSB 81-GP-1M-77, Flooring, Conductive and Spark Resistant or latest.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A5-93, Portland Cement or latest.

- .2 CAN/CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction or latest.
- .3 CAN/CSA-A23.2-94, Methods of Test for Concrete or latest.
- .4 CAN/CSA-A23.5-M86(R1992), Supplementary Cementing Materials or latest.
- .5 CAN/CSA A363-M88(R1996), Cementitious Hydraulic Slag or latest.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 4 weeks prior to commencing Work, inform Contract Administrator of proposed source of aggregates and provide access for sampling.

1.4 CERTIFICATES

- .1 Submit certificates in accordance with Section 01 33 00 - Submittal Procedures
- .2 A Minimum 4 weeks prior to starting concrete Work, submit to Contract Administrator manufacturer's test data and certification by qualified independent inspection and testing laboratory that following Materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Supplementary cementing Materials.
 - .4 Grout.
 - .5 Admixtures.
 - .6 Aggregates.
 - .7 Water.
 - .8 Waterstops.
 - .9 Waterstop joints.
 - .10 Joint filler.
- .3 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1 or latest.
- .4 Provide certification that Plant, equipment, and Materials to be used in concrete comply with requirements of CAN/CSA-A23.1 or latest.

1.5 QUALITY ASSURANCE

- .1 Minimum 4 weeks prior to starting concrete Work, submit proposed quality control procedures in accordance with Section 01 45 00 - Quality Control for Contract Administrator's approval for following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.

- .6 Formwork removal.
- .7 Joints.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste Materials in accordance with Section 02 07 20 – Selective Site Demolition.
- .2 Use excess concrete for: additional paving, post footing anchorage, flowable fill, retaining wall footing ballast, storm structure covers, underground utility pipe kickers, storm pipe flared end section, toe wash protection.
- .3 Use trigger operated spray nozzles for water hoses.
- .4 Designate a cleaning area for tools to limit water use and runoff.
- .5 Carefully coordinate the specified concrete Work with weather conditions.
- .6 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .7 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible Material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
- .8 Choose the least harmful, most appropriate cleaning method, which will perform adequately.

Part 2 Products

2.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A5 or latest.
- .2 Supplementary cementing Materials: to CAN/CSA-A23.5 or latest.
- .3 Water: to CAN/CSA-A23.1 or latest.
- .4 Aggregates: to CAN/CSA-A23.1 or latest. Coarse aggregates to be high density. All aggregate to be used in concrete mix for concrete slabs that are to receive a polished concrete floor finish are to be from one supplier and one batch.
- .5 Air entraining admixture: to CAN3-A266.1 or latest.
- .6 Chemical admixtures: to CAN3-A266.2 or latest. Obtain approval for accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Concrete retarders: to ASTM C494 or latest water based, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
 - .1 Compressive strength: 50 MPa at twenty-eight (28) days.
- .9 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at twenty-eight (28) days.
- .10 Curing compound: to CAN/CSA A23.1 or latest. white and to ASTM C309 or latest, Type 1 chlorinated rubber.
- .11 Premoulded joint fillers:

- .1 Bituminous impregnated fiber board: to ASTM D1751 or latest.
- .12 Dovetail anchor slots: minimum 0.6mm thick galvanized steel with insulation filled slots.
- .13 Ribbed waterstops: extruded PVC of sizes indicated:
 - .1 Tensile strength: to ASTM D412 or latest, method A, Die "C", minimum 11.4 MPa.
 - .2 Elongation: to ASTM D412 or latest, method A, Die "C", minimum 275%.
 - .3 Tear resistance: to ASTM D624 or latest, method A, Die "B", minimum 48 kN/m.
- 2.2 MIXES
 - .1 Cement:
 - .1 Type 10 Portland cement unless noted.
 - .2 Minimum compressive strength at twenty-eight (28) days: as indicated on Drawings.
 - .3 Nominal size of coarse aggregate: 20mm.
 - .4 Slump at time and point of discharge: 90 to 110mm.
 - .5 Air content: 5 to 7 % all exterior locations and where indicated.
 - .6 Chemical admixtures: following admixtures in accordance with ASTM C494, type, quantity, water reducing strength increasing, air entraining, super plasticizers.
- 2.3 DELIVERY AND STORAGE
 - .1 Concrete hauling time: deliver to Site of Work and discharge within 120 minutes maximum after batching.
- Part 3 Execution**
- 3.1 PREPARATION
 - .1 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
 - .2 Pumping of concrete is permitted only after approval of equipment and mix.
 - .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
 - .4 Prior to placing concrete, obtain approval of proposed method for protection of concrete during placing and curing in adverse weather.
 - .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
 - .6 In locations where new concrete is dowelled to existing Work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with shrinkage compensating grout or epoxy grout to anchor and hold dowels in positions as indicated.
 - .7 Do not place load upon new concrete until authorized.
- 3.2 COLD WEATHER REQUIREMENTS
 - .1 In the event "Possutec 20" as manufactured by Master Builders is used, relaxation of the following will be considered.

- .2 When the air temperature is at or below 5°C or when there is a probability of it falling to that limit during the placing or curing period, cold weather requirements shall be applicable.
- .3 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 acceptable to the Contract Administrator. Equipment inducing carbon monoxide gas free to come into contact with concrete Work shall not be acceptable.
- .4 Concrete shall not be placed on or against reinforcing, form Work, ground or any surface that is at a temperature less than 5°C.
- .5 When being placed the concrete shall have a temperature of not less than 10°C nor more than 30°C.
- .6 The temperature of the concrete at all surfaces shall be maintained at not less than 20°C for three (3) days, or at not less than 10°C for five (5) days after placing.
- .7 Means shall be provided to humidify the air within enclosures and to keep the concrete and form Work continuously moist if dry heat is used.
- .8 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.
- .9 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 Table 17 of CSA CAN3-A23.1-M77.
- .10 Accelerator or so-called antifreeze compounds shall not be permitted unless otherwise approved by Contract Administrator.
- .11 All protective coverings shall be kept clear of the concrete and dorm surfaces to permit free circulation of air and shall be maintained intact for at least twenty-four hours after the artificial heat is disconnected.
- .12 On slip formed Work, newly poured surfaces exposed of exterior weather conditions shall be protected to avoid exposure to adverse effects of wind, rain and low temperatures.

3.3 CONSTRUCTION

- .1 Do cast-in-place concrete Work in accordance with CAN/CSA-A23.1.
- .2 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved.
 - .2 Where approved, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100mm not indicated on Drawings, must receive approval.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications before placing of concrete.
 - .4 Check locations and sizes of sleeves and openings shown on Drawings.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

- .3 Anchor bolts.
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100mm diameter. Drilled holes to be to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with epoxy grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:
 - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 – Concrete Formwork. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .5 Dovetail anchor slots:
 - .1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
 - .2 Install continuous vertical anchor slots at 800mm oc where concrete walls are masonry faced.
- .6 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .7 Finishing: refer to Section 03 35 00 – Concrete Finishing for requirements above and beyond those listed below.
 - .1 Finish concrete in accordance with CAN/CSA-A23.1 or latest.
 - .2 Use procedures acceptable to Contract Administrator and those noted in CAN/CSA-A23.1 or latest to remove excess bleed water. Ensure surface is not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that any compounds used are compatible.
 - .4 Finish concrete floors to CGSB 81-GP-1M Class A or latest.
 - .5 Provide swirl-trowelled finish where floor tile is to be applied.
 - .6 Provide smooth, swirl-trowelled finish for interior floor surfaces, unless otherwise noted.
 - .7 Provide light sandblast finish with no frames for exterior slabs, unless otherwise noted.
 - .8 Rub exposed sharp edges of concrete with carborundum to produce 3mm radius edges, unless otherwise noted.
- .8 Waterstops.
 - .1 Install waterstops to provide continuous water seal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.

- .2 Use only straight heat-sealed butt joints in field. Use factory welded corners and intersections unless otherwise approved.
- .9 Joint fillers.
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .2 Locate and form isolation, construction, expansion joints as indicated on the Drawings. Install joint filler.
 - .3 Use 12mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12mm of finished slab surface unless indicated otherwise.
- 3.4 CURING
 - .1 Cure and protect concrete in accordance with CAN/CSA A23.1.
- 3.5 SITE TOLERANCE
 - .1 Concrete tolerance in accordance with CAN/CSA-A23.1 or latest straight edge method.
- 3.6 FIELD QUALITY CONTROL
 - .1 Inspection and testing of concrete and concrete Materials will be carried out by a Testing Laboratory in accordance with CAN/CSA-A23.1 or latest and Section 01 45 00 - Quality Control.
 - .2 The City will pay for costs of tests as specified.
 - .3 Testing Laboratory may take additional test cylinders during cold weather concreting. Cure cylinders on Site under same conditions as concrete in which they represent.
 - .4 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2 or latest.
 - .5 Inspection or testing by Contract Administrator on the City will not augment or replace Contractor quality control nor relieve the Contractor's contractual responsibility.

END OF SECTION

Part 1 General

1. 1 RELATED WORK

- .1 Section 01 45 00 – Quality Control
- .2 Section 03 30 00 – Cast-In-Place Concrete

1.2 REFERENCES

- .1 American Society for Testing and Materials:
 - .1 ASTM-C779, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces or latest.
 - .2 ASTM G23-81, Ultraviolet Light & Water Spray or latest.
 - .3 ASTM C805, Impact Strength or latest.
 - .4 Curing compounds shall conform to ASTM C309 – “Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete”.
- .2 American Concrete Institute
 - .1 ACI 302. 1R-89, Guide for Concrete Floor and Slab Construction or latest.
- .3 CAN/CSA
 - .1 Do concrete floor finishing to CAN/CSA-A23.1, except where specified otherwise.
 - .2 Concrete curing shall comply with CAN/CSA-A23.1, except where specified otherwise.

1.3 SUBMITTALS

- .1 Comply with pertinent provisions of Section 01 60 00 - Basic Product Requirements.
 - .1 Provide submittal information within thirty-five (35) Working Days after the Contractor has received the City's notice to proceed.
- .2 Product data:
 - .1 Submit concrete finishes manufacturer's Specifications and test data.
 - .2 Submit concrete finishes describing product to be provided, giving manufacturer's name and product name for the specified Material proposed to be provided under this Section.
 - .3 Submit special concrete finishes technical data sheet giving descriptive data, curing time, and application requirements.
 - .4 Submit concrete finishes manufacturer's Material Safety Data Sheet (MSDS) and other safety requirements.

Part 2 Products

2.1 MATERIALS AND MANUFACTURERS

- .1 Curing: use clean, potable water, which shall not contain impurities, which would cause staining.

- .2 Curing compounds: AR-30 by Meadows, Ritecure by Sternson, CPD Clear Cure, and Elsro #705 Clear Curing Compound.
- .3 Cure and seal: SealTight CS-309 by Meadows, Florseal by Sternson, CPD Acrylic Cure and Seal, Elsro #702 Clear Acrylic Sealer.
- .4 Bonding agent: Daraweld "C" by Grace, or SCP AcriStix latex bonding agent.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Concrete slabs, which are to receive bonded toppings, shall be cleaned free of dirt, oil, loose Material and laitance.
- .2 Concrete slabs to receive toppings, quarry tile, or ceramic tile, to be screeded off to true lines and levels shown and left ready to receive finish. Depress slabs to accommodate finish.
- .3 Steel trowel all concrete slabs to be left exposed, or receiving carpeting, resilient flooring and applied floor finishes.

3.2 FLOOR DRAINS

- .1 In area where floor drains are installed, grade the entire floor surface (or as indicated on plans) towards the drain.
- .2 Floors to be level around walls and have a minimum 5mm/m uniform pitch to drains, unless indicated otherwise.
- .3 The slope shall be such that water on all areas of the floor surface will drain by gravity, without leaving pools or puddles on the floor surface.

3.3 PLAIN FLOOR FINISH

- .1 Spread and vibrate concrete 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 in accordance with CAN/CSA-A23.1. Trowel to level, even surface, to within 6mm (1/4") tolerance when measured in any direction using a 3m (10ft) straight edge.
- .4 Continue steel trowelling to produce smooth burnished surface.
- .5 Sprinkling of dry cement, or dry cement and sand mixture over concrete surfaces is not acceptable.
- .6 Apply cure and seal compound to all interior floor surfaces, unless specified otherwise. Do not apply cure and seal to concrete receiving epoxy finishes.
- .7 Apply curing compound to all exterior concrete such as exterior paving, curbs and sidewalks. Note: Cure and seal compounds may not be used until twenty-eight (28) days after placement.
- .8 Wet curing: wet cure exposed concrete floors using polyethylene sheeting and wet burlap over entire floor area, weighted down and taped on all edges for total sealing of wetted down concrete, and keep in place a minimum of seven (7) days. Protect the surface from direct sunlight to avoid overheating.

3.4 SIDEWALK PAVINGS

- .1 Use full depth pre-molded isolation joints at building, stairs, ramps, changes in paving thickness, at existing paving, and at property lines.
- .2 Place sidewalks to provide a slope for drainage of 6mm/300mm (1/8"/12") minimum, in direction of Site drainage and in conformance with the instructions describing the Work on the Drawings.
- .3 Spread and vibrate concrete to force coarse aggregate into concrete mix, and then screed.
- .4 Level concrete with straight edge. Darby or bull-float immediately.
- .5 Float surface, then apply slightly roughened surface by means of a light stiff broom stroke in one direction across width of sidewalk.
- .6 Saw cut 5mm (0.2") saw cut to depth of 1/5 paving thickness at intervals shown but not more than 2500mm (8'-4") each way, once the concrete has set or as identified by Drawings which will be read to supersede this instruction.
- .7 Thickness: refer to Drawings
- .8 In addition to the above requirements, sidewalks on Municipal property shall also meet the Municipal requirements.

END OF SECTION