Part 1 General

1.1 REFERENCE STANDARDS

.1 Work shall conform to the current edition of codes and standards specified in this section.

.2 CSA Group (CSA)

- .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA O86, Engineering Design in Wood.
- .3 CSA O121, Douglas Fir Plywood.
- .4 CSA O151, Canadian Softwood Plywood.
- .5 CSA O153, Poplar Plywood.
- .6 CSA O325, Construction Sheathing.
- .7 CSA O437 Series, Standards for OSB and Waferboard.
- .8 CSA S269.1, Falsework and Formwork.
- .9 CSA S269.3, Concrete Formwork.

.3 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: in accordance with Section 01 31 19- Project Meetings, convene pre-installation meeting one week prior to beginning concrete works.

- .1 Ensure key personnel, site supervisor, testing laboratories, concrete producer, speciality contractor - finishing, forming, Departmental Representative attend.
  - .1 Verify project requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in formwork liners and coatings and include product characteristics, performance criteria, physical size, finish, and limitations.
- .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06- Health and Safety Requirements, 01 35 43- Environmental Procedures.

.3 Submit shop drawings for formwork and falsework.

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Saskatchewan, Canada.
- .2 Prepare Shop Drawings in accordance with CSA S269.1 for formwork and falsework.

.3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.4 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

.5 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.

.6 Indicate sequence of erection and removal of formwork and falsework.

.7 Include the following information on falsework Shop Drawings:

.1 Longitudinal, lateral, vertical, dead, live and impact loads used in design.

.2 Safe bearing capacity of soil underneath mud sills.

.3 Maximum column, post and support loads.

.4 Deflection diagrams for beams with deflection of 10 mm or more.

.5 Deflection diagrams indicating initial and final elevation of deck surfaces, roofs and soffits.

.6 Grade of structural steel.

.7 Indicate steel posts, girders, beams, connections, bracing and welding, providing sufficient detail for safe performance of falsework.

.8 Fully detailed steel frame shoring.

.9 Species, grades and sizes of wood.

.10 Type and weight of equipment (moving or stationary) supported by falsework.

.11 Sequence, methods and rate of concrete placement.

.12 Proprietary equipment, adequately identified for checking purposes.

.13 Full details and locations of splices.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00- Quality Control.

.2 Retain a professional engineer registered or licensed in Saskatchewan, Canada, with experience in formwork and falsework design of comparable complexity and scope, to perform following services as part of Work of this Section:

.1 Design of formwork and falsework:

.2 Review, stamp, and sign fabrication and erection Shop Drawings, design calculations and amendments.

.3 Conduct on-site inspections and prepare and submit inspection reports verifying this part of Work is in accordance with Contract Documents and reviewed Shop Drawings.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section with manufacturer's written instructions and 01 61 00 - Common Product Requirements.

.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:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect formwork from damages.

.3 Replace defective or damaged materials with new.

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 O86, CSA O153, CSA O121, and CSA O437 Series.

.2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.

.3 Rigid insulation board: to CAN/ULC-S701.

.4 Void forms: 150 mm deep, cardboard or expanded polystyrene (EPS) on minimum 50 mm sand screed. Place 6 mm tempered hardboard over void form and cover with 0.152 mm polyethylene. Do not support pile cap, grade beam, or wall reinforcing steel on void form. Suspend reinforcing steel from the formwork.

.2 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.

.3 Form ties:

.1 For concrete not designated 'Architectural': removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.2 For Architectural concrete; snap ties complete with plastic cones and light grey concrete plugs.

.4 Form release agent: Proprietary, non-volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete, derived from agricultural sources, non-petroleum containing, low VOC, non-toxic, biodegradable.

.5 Falsework materials: to CSA-S269.1.

.6 Waterstops: Expanding sodium bentonite/butyl rubber type, complete with manufacturer’s water-based latex adhesive.

.7 Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer’s installation instructions. Type and size as indicated on Drawings

.8 Epoxy bonding agent: two component epoxy adhesive.

.9 Sealant: to Section 07 92 00- Joint Sealants.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels, and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain Departmental Representative approval for use of earth forms framing openings not indicated on drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1.

.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.6 Do not place shores and mud sills on frozen ground.

.7 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.8 Fabricate and erect formwork in accordance with CSA S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.

.9 Align form joints and make watertight.

.1 Keep form joints to minimum.

.10 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.

.11 Use 20 mm chamfer strips on external corners and 20 mm fillets at interior corners, joints, unless specified otherwise.

.12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.13 Construct forms for architectural concrete, and place ties as indicated.

.1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.14 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.15 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Walls and piers: concrete curing temperatures of:

.1 21°C to 35°C = 2 days.

.2 16°C to 21°C = 3 days.

.3 10°C to 16°C = 4 days.

.2 Beam soffits, slabs, and other structural members: concrete curing temperatures of:

.1 21°C to 35°C = 14 days.

.2 16°C to 21°C = 17 days.

.3 10°C to 16°C = 21 days.

.2 Remove formwork when concrete has reached 75 % of its 28 day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000 mm apart.

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

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00- Cleaning.

.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.

END OF SECTION

Part 1 General

Part 2 REFERENCE STANDARDS

.1 Work shall conform to the current edition of codes and standards specified in this section.

.2 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual.

.3 ASTM International (ASTM)

.1 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A641/A641M, Standard Specification for Zinc–Coated (Galvanized) Carbon Steel Wire.

.3 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.4 ASTM A 884/A 884M, Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.

.5 ASTM A 1064/A 1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.4 CSA Group (CSA)

.1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A23.3, Design of Concrete Structures.

.3 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.4 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.5 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC- 2004, Reinforcing Steel Manual of Standard Practice.

2.1 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: in accordance with Section 01 31 19- Project Meetings, convene pre-installation meeting one week prior to beginning concrete works.

ACTION AND INFORMATIONAL SUBMITTALS

.2 Submit in accordance with Section 01 33 00- Submittal Procedures.

.3 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 When Chromate solution used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures 01 35 29.06- Health and Safety Requirements.

.4 Shop Drawings:

.1 Submit drawings.

.1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice SP-66.

.2 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.3 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

.1 Provide type B unless otherwise indicated.

.4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.

.5 Quality Assurance Submittals:

.1 Submit in accordance with Section 01 45 00- Quality Control.

.2 Mill Test Report: upon request, submit to Departmental Representative certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work .

.3 Upon request, submit in writing to Departmental Representative proposed source of reinforcement material.

2.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements 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:

.1 Store materials off ground, in dry location, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 3 Products

3.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Departmental Representative.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.

.3 Weldable Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.

.4 Cold-drawn annealed steel wire ties: to ASTM 1064/A 1064M.

.5 Deformed steel wire for concrete reinforcement: to ASTM 1064/A 1064M.

.6 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only.

.7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.8 Tie wire: 1.5 mm diameter annealed wire, epoxy coated.

.9 Mechanical splices: subject to approval of Departmental Representative.

.10 Plain round bars: to CSA-G40.20/G40.21.

3.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with SP-66, CSA-A23.1/A23.2, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain Departmental Representative written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement clearly identified in accordance with bar bending details and lists.

Part 4 Execution

4.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

4.2 PLACING REINFORCEMENT

.1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.

.2 Place reinforcing steel as indicated on placing drawings in accordance with CSA-A23.1/A23.2.

.3 Use plain round bars as slip dowels in concrete.

.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 Apply thick even film of mineral lubricating grease when paint is dry.

.4 Prior to placing concrete, obtain Departmental Representative approval of reinforcing material and placement. Confirm schedule by giving Departmental Representative 48 hour notice of completion of reinforcing steel placing. Allow after completion of placing reinforcing steel 4 hours for site review of reinforcing steel and formwork.

.5 Maintain cover to reinforcement during concrete pour.

4.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.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 11- Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International

- .1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
- .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
- .4 ASTM C 881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- .5 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .6 ASTM C C1059/C1059M, Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.
- .7 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- .8 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .9 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .10 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 CSA Group

- .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
- .3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005),

1.2 ABBREVIATIONS AND ACRONYMS

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement types:

- .1 GU, GUb and GUL - General use cement.
- .2 MS and MSb - Moderate sulphate-resistant cement.

.3 MH, MHb and MHL - Moderate heat of hydration cement.

.4 HE, HEb and HEL - High early-strength cement.

.5 LH, LHb and LHL - Low heat of hydration cement.

.6 HS and HSb - High sulphate-resistant cement.

.2 Fly ash types:

.1 F - with CaO content maximum 8%.

.2 CI - with CaO content 15 to 20%.

.3 CH - with CaO minimum 20%.

.3 GGBFS - Ground, granulated blast-furnace slag.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: in accordance with Section 01 31 19- Project Meetings, convene pre-installation meeting one week prior to beginning concrete works.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures, 01 35 29.06- Health and Safety Requirements.

.3 Site Quality Control Submittals:

.1 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters found.

.2 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.3 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00- Quality Control.

.2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture meet specified requirements.

.3 At least 4 weeks prior to beginning Work, inform Departmental Representative of source of fly ash.

.1 Changing source of fly ash without written approval of Departmental Representative is prohibited.

.4 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

.5 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.2 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Modifying maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2. is prohibited.

.2 Deviations submitted for review by Departmental Representative.

.3 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.7 SITE CONDITIONS

.1 Placing concrete during rain or weather events that could damage concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.

.2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.

.3 Placing concrete upon or against surface at temperature below 5°C is prohibited.

.4 Hot weather protection:

.1 Protect concrete from direct sunlight when ambient temperature above 27°C.

.2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.

.5 Protect from drying.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

2.3 MATERIALS

.1 Portland Cement: GU, HS.

.2 Blended hydraulic cement: Type GUb, HSb to CSA A3001.

.3 Supplementary cementing materials: with minimum 20 % fly ash replacement, by mass of total cementitious materials to CSA A3001.

.4 Water: to CSA A23.1.

.5 Aggregates: to CSA A23.1/A23.2.

.6 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.3 Integral Waterproofing Admixture: to ASTM C494, Type S, complex hydrous silicate, water and vapor proofing liquid admixture.

.1 Basis-of-Design Product: Subject to compliance with requirements, provide, Specialty Products Group; Vapor Lock 20/21 or comparable product by one of the following:

.1 Kim Kryton

.2 Xypex Admix

.2 Properties:

.1 Water Seepage or Permeability: Not to exceed 6×10^{-8} cm/s according to ASTM D5084.

.7 Grout: Premixed non-shrink non-metallic grout with minimum strength at 4 days of 20 MPa and at 28 days of 40 MPa.

.8 Pre-moulded joint fillers:

.1 Bituminous impregnated fibre board: to ASTM D1751.

.2 Sponge rubber: to ASTM D1752, Type I, flexible grade.

.9 Weep hole tubes: plastic.

.10 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.

.11 Polyethylene film: 15 mil thickness to CGSB-15.34 under slabs and footings on grade.

.12 Concrete Bonding Agents: Epoxy to ASTM C881/C881M, Type V.

2.4 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.2 Provide concrete mix to meet following plastic state requirements:

.1 Uniformity: as per CSA A23.1/A23.2

.2 Workability: free of surface blemishes, loss of mortar, segregation, colour variations.

.3 Provide concrete mix to meet following hard state requirements:

All concrete in contact with subgrade soil:

.1 Cement type HS/HSb

.2 Minimum compressive strength at 28 days: 32 MPa

.3 Maximum W/C ratio: 0.45

.4 Maximum aggregate size: 20 mm

.5 Air content category: 1 (5-8%)

.6 Integral Waterproofing Admixture

.7 Chemical admixtures in accordance with ASTM C494 and ASTM C1017

All other concrete:

.8 Cement type GU/GUb

.9 Minimum compressive strength at 28 days: 32 MPa

.10 Maximum W/C ratio: 0.45

.11 Maximum aggregate size: 20 mm

.12 Air content category: none

.13 Chemical admixtures in accordance with ASTM C494 and ASTM C1017

For concrete topping:

.14 Cement type GU/GUb

.15 Minimum compressive strength at 28 days: 25 MPa

.16 Maximum W/C ratio: 0.55

.17 Maximum aggregate size: 10 - 14 mm

.18 Air content category: none

.19 Chemical admixtures in accordance with ASTM C494 and ASTM C1017

Part 3 Execution

3.1 PREPARATION

.1 Obtain Departmental Representative’s written approval before placing concrete.

.1 Provide 72 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00- Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling to facilitate placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete permitted only after approval of equipment and mix.

.5 Disturbing reinforcement and inserts during concrete placement is prohibited.

.6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air content, temperature and test samples taken.

.10 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.

.2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated reviewed by Departmental Representative.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on drawings.

.6 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 in co-ordination with appropriate trade prior to placing concrete.

.2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.

.1 Formed holes: 100 mm minimum diameter.

.2 Drilled holes: 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 Forming and Accessories. If wood forms used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Dovetail anchor slots: in accordance with Section 04 05 00- Common Work Results for Masonry.

.1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.

.2 Install continuous vertical anchor slots at 600mm on centre 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 and curing:

.1 Finish concrete to CSA A23.1/A23.2.

.2 Use procedures as reviewed by Departmental Representative to remove excess bleed water. Ensure surface not damaged.

.3 Use curing compounds compatible with applied finish on concrete surfaces.

.4 Finish concrete floor to CSA A23.1/A23.2, Table 21, Class A.

.5 Provide steel trowelled, smooth, burnished finish where slabs to be left exposed or to receive carpeting, resilient flooring, floor paint or other applied floor finishes. Burnish to smooth, even finish without ridges, trowel marks, voids, or other imperfections that may transmit through flooring material.

.6 Provide screed, swirl-trowelled, or scratch finish where bonded topping, terrazzo, ceramic floor tile or other hard surface or bonded topping is to be applied. Provide depressions to accommodate bonded topping, terrazzo, etc.

.7 Provide broomed non-slip surface to exterior concrete paving, sidewalks, curbs, ramps, and stairs.

.8 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

.8 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized Departmental Representative.

.2 When more than one piece required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation and expansion joints as indicated.

.4 Install joint filler.

.5 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.

.9 Dampproof membrane:

.1 Install dampproof membrane under concrete slabs-on-grade inside building.

.2 Lap dampproof membrane minimum 150 mm at joints and seal.

.3 Seal punctures in dampproof membrane before placing concrete.

.4 Use patching material minimum 150 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1, Table 21, Class A.

3.4 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows in accordance with Section 01 45 00- Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 days.

.5 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials carried out by a designated testing laboratory as outlined in Section 01 45 00- Quality Control.

.1 Ensure testing laboratory certified to CSA A283.

.3 Concrete testing shall be in accordance to CSA A23.2 and shall consist of three test cylinders taken for every 50 cubic metres or less of each class of concrete placed each day. One cylinder shall be tested at 7 days, the remaining two cylinders shall be tested at 28 days.

.4 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.6 Inspection or testing by Departmental Representative not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

3.5 DEFICIENCIES

.1 Concrete not meeting the requirements of the Specifications and the 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 Departmental Representative. Finished lines, dimension, 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 Departmental Representative.

.4 Concrete of insufficient strength or improper consistency shall be, as required by the Departmental Representative, 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 Departmental Representative and in accordance with CSA A23.1/A23.2. The test results shall be indicative of the in-place concrete.

.3 Load testing of the structural elements in accordance with CSA A23.3.

.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 Departmental Representative.

3.6 CLEANING

.1 Clean in accordance with Section 01 74 00- Cleaning.

.2 Waste Management: separate waste materials in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Prepare Construction Waste Management plan in accordance with Section 01 74 19- Waste Management and Disposal.

.2 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.

.3 Provide appropriate area on job site where concrete trucks and be safely washed.

.4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.

.5 Disposal of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location to pose health or environmental hazard is prohibited.

.6 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.7 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.

.8 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C309, Liquid Membrane- Forming Compounds for Curing Concrete.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-25.20, Surface Sealer for Floors.

.3 CSA Group (CSA)

.1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures 01 35 29.06- Health and Safety Requirements. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.

.3 Include application instructions for concrete floor treatment s.

.3 Samples:

.1 Minimum 4 weeks prior to beginning Work, submit 2 samples for review and acceptance of materials proposed for use as follows:

.1 5 L of chemical hardeners.

.2 5 L of sealing compounds.

.3 5 L of curing compound.

.4 5 L of concrete stains.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Minimum 4 weeks prior to starting concrete finishing work, provide proposed quality control procedures for review by Departmental Representative on following items:

.1 Hardening.

.2 Sealing.

.3 Curing.

.4 Finishes.

.3 Mock-Ups:

.1 Provide site mock-up for concrete finishes indicating methods and materials, and procedures proposed to achieve concrete finishes in accordance with Section 01 45 00- Quality Control, and to comply with following requirements, using materials indicated for completed work:

.1 Build mock-ups in location and of size as directed by Departmental Representative.

.2 Obtain Departmental Representative's acceptance of mock-ups before starting construction; mock-up to be used throughout construction period and used as standard of acceptance for subsequent architectural concrete work.

.3 Mock-up may form part of permanent structure when accepted by Departmental Representative repair or replace unacceptable mock-ups at no additional cost to Owner.

.4 In presence of Departmental Representative, damage part of exposed face for each finish, colour, and texture, and demonstrate materials and techniques proposed for repairs to match adjacent undamaged surfaces.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of crates, packaging materials padding, pallets, in accordance with Section 01 74 19- Waste Management and Disposal.

1.5 SITE CONDITIONS

.1 Temporary lighting: Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq. m of floor being treated.

.2 Electrical power: Provide sufficient electrical power to operate equipment normally used during construction

.3 Work area: Make work area water tight protected against rain and detrimental weather conditions.

.4 Temperature: Maintain minimum 10 degrees C ambient temperature for 7 days before installation and minimum 48 hours after completion of work and maintain relative humidity maximum 40% during same period.

.5 Moisture: Ensure concrete substrate within moisture limits prescribed by flooring manufacturer.

.6 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:

.1 Departmental Representative will arrange for ventilation system to be operated during installation of concrete floor treatment materials. Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00- Temporary Utilities.

.3 Provide continuous ventilation during and after coating application.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Section 01 61 00- Common Product Requirements.

.2 Submit written declaration components used compatible and not adversely affect finished flooring products and their installation adhesives.

2.2 CHEMICAL HARDENERS

.1 Type 1 - Sodium silicate.

.2 Water: potable.

2.3 SEALING COMPOUNDS

.1 Surface sealer: acrylic carnauba wax, colour<empty/>.

.2 Surface sealers not contain lead aromatic solvents mercury cadmium halogenated solvents formaldehyde hexavalent chromium and their compounds.

.3 VOC limit: maximum 100 g/L to SCAQMD Rule 1113 Sealants: maximum VOC limit 250 g/L to SCAQMD Rule 1168.

2.4 CURING COMPOUNDS

.1 Waterborne membrane forming curing membrane to ASTM C309, Type 2 White Type 1 Clear Class B.

.1 Verify compatibility with subsequent finishes.

2.5 CONCRETE STAINS

.1 Select low VOC, water-based concrete stains.

2.6 MIXES

.1 Mixing ratios in accordance with manufacturer's written instructions.

Part 3 Execution

3.1 EXAMINATION

.1 Verify site conditions, substrate, slab surfaces ready to receive work and elevations as recommended by manufacturer's written instructions indicated on shop drawings.

3.2 PREPARATION OF EXISTING SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.

.2 Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.

.3 Use strong solvent mechanical stripping to remove chlorinated rubber or existing surface coatings.

.4 Use respiratory equipment protective clothing eye protection during stripping of chlorinated rubber or existing surface coatings.

3.3 CONCRETE STAINING

.1 Coordinate with Section 03 30 00 for wet curing. Liquid curing compounds not permitted under staining.

.2 Cure concrete for minimum 60 days.

.3 Clean and prepare concrete in accordance with manufacturers written instructions.

.4 Apply 2 coats of chemical stain materials in accordance with manufacturers written instructions; obtain Departmental Representative’s acceptance after application of both first and second coats.

.5 Apply recommended cure/seal materials in accordance with manufacturer’s written instructions, in number of coats to achieve flat semi-gloss floor lustre.

3.4 APPLICATION

.1 Apply concrete finishing floor hardener in accordance with manufacturer's written instructions.

.2 After floor treatment dry, seal control joints and joints at junction with vertical surfaces with sealant.

.1 Sealants: _____

.3 Apply floor treatment in accordance with Sealer manufacturer's written instructions.

.4 Clean over spray. Clean sealant from adjacent surfaces.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.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 11- Cleaning.

PROTECTION

.3 Protect finished installation in accordance with manufacturer's instructions.

3.6 SCHEDULE

.1 Refer to drawings

END OF SECTION