Part 1 General

1.1 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-O86S1-05, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.

.3 CSA O121-M1978 (R2003), Douglas Fir Plywood

.4 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.

.5 CAN/CSA-S269.3-M92 (R2008), Concrete Formwork, National Standard of Canada

1.2 SUBMITTALS

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

.2 Submit shop drawings for formwork and falsework.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

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

.5 Indicate sequence of erection and removal of formwork/falsework as directed by Engineer.

1.3 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 01 61 00.

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.

.2 Form ties:

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

.3 Form liner:

.1 Plywood: Douglas Fir to CSA O121, solid one side, square edge.

.4 Form release agent: non-toxic, biodegradable, low VOC.

.5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal, 15 to 24 mm^2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

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

.7 Sealant: to Section 07 92 00 - Joint Sealant.

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 Engineer’s 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 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- A23.1-09/A23.2-09.

.8 Construct and align formwork for elevator hoistway in accordance with CSA B44.

.9 Align form joints and make watertight. Keep form joints to minimum.

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

.11 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.

.12 Clean formwork in accordance with CSA-A23.1-09/A23.2-09, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Re-use formwork and falsework subject to requirements of CSA-A23.1-09/A23.2-09.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Concrete Institute (ACI)

.1 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R-04, Manual of Structural and Placing Drawings for Reinforced Concrete Structures.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A497/A497M-07, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

.2 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.3 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-A23.3-04, Design of Concrete Structures.

.3 CAN/CSA-G30.18-M92 (R2002), Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.

.4 CSA W186-M1990 (R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

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

1.2 SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

.3 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.

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

.4 Detail lap lengths and bar development lengths to CSA-A23.3.

.1 Provide type B tension lap splices.

.5 Quality Assurance: in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.

.1 Mill Test Report: upon request provide Contract Administrator with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request submit in writing to Contract Administrator proposed source of reinforcement material to be supplied.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Contract Administrator.

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

.3 Cold-drawn annealed steel wire ties: to ASTM A497/A497M. minimum 16 gauge annealed type.

.4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1-09/A23.2-09. Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapour barrier puncture.

.5 Mechanical splices: subject to approval of Contract Administrator.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1-09/A23.2-09 and [Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.

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

2.3 SOURCE QUALITY CONTROL

.1 Upon request. provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request, inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.

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

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1-09/A23.2-09.

.2 Do not displace or damage vapour barrier.

.3 Accommodate placement of formed openings.

.4 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.

.5 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C109/C109M-08, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).

.2 ASTM C827-01a (R2005), Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

.3 ASTM C939-09, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-A5-93, Portland Cement.

.2 CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.

.3 CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.

.4 CAN/CSA-A23.2-09, Methods of Test for Concrete.

1.2 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 10 kg of each type of Portland cement.

.2 3 kg of each type of supplementary cementing material.

.3 10 kg of each type of blended hydraulic cement.

.4 5 L of each admixture.

.5 5 L of curing compound.

.6 1 m length of each type of joint filler.

1.3 CERTIFICATES

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

.2 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-A23.1-09.

.4 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1-09.

1.4 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.

Part 2 Products

2.1 MATERIALS

.1 Portland cement: to CAN/CSA-A5 Type 10.

.2 Water: to CAN/CSA-A23.1-09.

.3 Aggregates fine and coarse: to CAN/CSA-A23.1-09.

.4 Shrinkage compensating grout: premixed compound consisting of metallic, non-metallic aggregate, Portland cement, water reducing and plasticizing agents.

.1 Compressive strength: 50 MPa at 28 days.

.2 Consistency:

.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30s.

.2 Flowable: to ASTM C827. Flow table, 5 drops in 3s, (ASTM C109, applicable portion) 125 to 145%.

.3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125 %.

.4 Dry pack to manufacturer's requirements.

.5 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 28 days.

.6 Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 17 MPa in 48 hours and 48MPA in 28 days.

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

2.2 MIXES

.1 Mix and deliver concrete in accordance with CAN/CSA-A23.1-09, Alternative 1.

.2 Cement type as indicated in 2.1

.3 Minimum 28 day compressive strengths and exposure classifications:

.1 As indicated on drawings.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Contract Administrator's approval before placing concrete. Provide 24 h ours 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 of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing.

.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 and pack solidly with non shrink grout to anchor and hold dowels in positions as indicated.

.7 Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

.8 Do not place load upon new concrete until authorized by Contract Administrator.

3.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1-09.

.2 Install vapour retarder under interior slabs on grade. Lap joints minimum 150 mm and seal watertight by sealant applied between overlapping edges and ends.

.3 Repair vapour retarder damaged during placement of concrete reinforcing. Repair with vapour retarder material; lap over damaged areas minimum 150 mm and seal watertight.

.4 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 by Contract Administrator.

.2 Where approved by Contract Administrator, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Contract Administrator.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator 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.

.5 Anchor bolts

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 With approval of Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be [minimum 25 mm larger in diameter than bolts used to manufacturer's recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with non shrink grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.6 Finishing

.1 Screed floors and slabs on grade level, maintaining surface flatness of maximum 6 mm /3 metre.

.2 Provide formed concrete walls, columns, beams with smooth rubbed finish.

.3 Finish concrete in accordance with CAN/CSA-A23.1-09.

.4 Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring, wood flooring, sports flooring. Classification flat.

.5 Refer to Division 9 for flooring finish requirements

.6 In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100, 1:50 nominal.

.7 Toppings

.1 Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

.2 Place required reinforcing and other items to be cast in.

.3 Place topping concrete to CAN/CSA-A23.1-09.

.4 Apply bonding agent to substrate in accordance with manufacturer's instructions.

.5 Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

.6 Place concrete toppings to required lines and levels. Place topping in checkerboard panels, dimension not to exceed 6 metre

.7 Screed toppings level, maintaining surface flatness of maximum 1:100.

.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 by Contract Administrator.

.9 Joint fillers

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Contract Administrator. 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 joints as indicated. Install joint filler.

.3 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces

.4 Install joint devices in accordance with manufacturer's instructions.

.5 Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

.6 Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor.

.7 Install joint covers in one piece longest practical length, when adjacent construction activity is complete.

.8 Apply sealants in joint devices in accordance with Section 07 92 10.

.9 Place concrete continuously between predetermined expansion, control, and construction joints.

.10 Do not interrupt successive placement; do not permit cold joints to occur.

.11 Place floor slabs in sawcut pattern indicated

.12 Saw cut joints within 24 hours after placing. Use 3/16 inch blade, cut into ¼ depth of slab thickness.

3.3 CURING AND PROTECTION

.1 Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

.2 Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

.3 Cure concrete floor surfaces to requirements of CSA A23.1-09.

3.4 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CAN/CSA-A23.1-09 and Section 01 45 00 - Quality Control.

.2 Contractor will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures: Testing Laboratory Services.

.3 Contractor will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.4 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2-09.

.5 Submit proposed mix design of each class of concrete to Contract Administrator for review prior to commencement of work.

3.5 SCHEDULE – CONCRETE TYPES AND FINISHES

.1 All concrete types, strengths and finishes to be as indicated on drawings.

END OF SECTION