1.0 GENERAL

1.1 SECTION INCLUDES

.1 Formwork for cast-in place concrete, with shoring, bracing and anchorage.

.2 Openings for other work.

.3 Form accessories.

.4 Form stripping.

1.2 RELATED SECTIONS

.1	Concrete Reinforcement.	Section 03200
.2	Cast-in-Place Concrete: Supply of concrete accessories for placement by this section.	Section 03300
.3	Supply of mechanical items for placement by this section.	Division 15
.4	Supply of electrical items for placement by this section.	Division 16

1.3 REFERENCES

.1 ACI 301 - Structural Concrete.

.2 ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

.3 ACI 347 - Guide to Formwork for Concrete.

.4 ASME A17.10 - Safety Code for Elevators and Escalators.

.5 CAN/CSA-A23.1 - Concrete Materials and Methods of Concrete Construction.

.6 CAN/CSA-O86.1 - Engineering Design in Wood (Limit States Design).

.7 CSA O151 - Canadian Softwood Plywood.

.8 CAN/CSA O188.0 - Standard Test Methods for Mat-Formed Wood Particleboards and Waferboard.

.9 CSA O437 Series - Standards on OSB and Waferboard.

.10 CSA S269.1 - Falsework for Construction Purposes.

.11 CAN/CSA-S269.3 - Concrete Formwork.

.12 COFI (Council of Forest Industries of British Columbia) - Exterior Plywood for Concrete Formwork.

.13 PS 1 - Construction and Industrial Plywood.

1.4 DESIGN REQUIREMENTS

.1 Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

.2 Conform to CSA S269.1.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with CAN/CSA-O86.1, ACI 347 standards.

2.0 PRODUCTS

2.1 WOOD FORM MATERIALS

.1 Form Materials: At the discretion of the Contractor.

2.2 FORMWORK ACCESSORIES

.1 Form Ties: At the discretion of the Contractor

.2 Form Release Agent:

.1 Colourless mineral oil which will not stain concrete, or absorb moisture.

.2 Non-toxic, biodegradable, low VOC.

.3 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 40ºC, flashpoint minimum 150ºC, open cup.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verify lines, levels and centres before proceeding with formwork.

.2 Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

.1 Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION - FORMWORK

.1 Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

.2 Fabricate and erect false work in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.

.3 Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

.4 Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

.5 Align joints and make watertight. Keep form joints to a minimum.

.6 Obtain approval before framing openings in structural members which are not indicated on Drawings.

.7 If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Contract Administrator.

3.4 APPLICATION - FORM RELEASE AGENT

.1 Apply form release agent on formwork in accordance with manufacturer's recommendations.

.2 Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

.3 Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

.1 Provide formed openings where required for items to be embedded in passing through concrete work.

.2 Locate and set in place items which will be cast directly into concrete.

.3 Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

3.6 FORM CLEANING

.1 Clean forms as erection proceeds, to remove foreign matter within forms.

.2 Clean formed cavities of debris prior to placing concrete.

.3 Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

.4 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

.1 Construct formwork to maintain tolerances required by ACI 301.

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

.3 Camber slabs and beams <2 mm/m in accordance with ACI 301.

3.8 FORM REMOVAL

.1 Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

.2 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

.3 Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

- END OF SECTION -

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2 RELATED SECTIONS

.1 Concrete Forms. Section 03100

.2 Cast-in-Place Concrete. Section 03300

1.3 REFERENCES

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

.2 CAN3-A23.3 - Design of Concrete Structures.

.3 CSA G30.3 - Cold-Drawn Steel Wire for Concrete Reinforcement.

.4 CSA G30.5 - Welded Steel Wire Fabric for Concrete Reinforcement.

.5 CSA G30.14 - Deformed Steel Wire for Concrete Reinforcement.

.6 CSA G30.15 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

.7 CAN/CSA-G30.18 - Billet-Steel Bars for Concrete Reinforcement.

.8 CAN/CSA-G40.21 - Structural Quality Steels.

.9 CAN/CSA-G164 - Hot Dip Galvanizing of Irregularly Shaped Articles.

.10 CSA W186 - Welding of Reinforcing Bars in Reinforced Concrete Construction.

.11 RSIC (Reinforcing Steel Institute of Canada) - Reinforcing Steel Manual of Standard Practice.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01330: Submittals.

.2 Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules.

.3 Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.

.4 Detail lap lengths and bar development lengths to CAN3-A23.3.

1.5 QUALITY ASSURANCE

.1 Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Province of Manitoba.

.2 Reinforcing steel supplier shall confer with contractor as to desired construction joint locations and supply dowels and bar lengths to accommodate these joints.

.3 Welders' Certificates: Submit to Section 01400, Manufacturer's Certificates, certifying welders employed on the Work, verifying CSA qualification within the previous 12 months.

2.0 PRODUCTS

2.1 REINFORCEMENT

.1 Reinforcing Steel: CAN/CSA-G30.18, new billet steel, Grade 400, deformed bars, unfinished.

.2 Stirrup Steel: ASTM A82, unfinished.

2.2 ACCESSORIES

.1 Tie Wire: Minimum 16 gauge annealed type.

.2 Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

2.3 FABRICATION

.1 Fabricate concrete reinforcing in accordance with:

.1 CAN/CSA-A23.1.

.2 RSIC - Reinforcing Steel Manual of Standard Practice.

.2 Locate reinforcing splices not indicated on drawings, at point of minimum stress.

.3 In concrete beams, bend horizontal reinforcing 24” around corners, or use extra corner bars 36” x 36”.

.4 Top steel in beams shall be lapped at center span; bottom steel shall be lapped at support.

3.0 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 All reinforcing steel shall be cleaned of all dirt, grease and other deleterious materials prior to placing.

.4 Accommodate placement of formed openings.

.5 Maintain concrete cover around reinforcing as follows:

.1 Walls (exposed to weather or backfill) 50 mm

.2 Footings and Concrete Formed Against Earth 75 mm

.3 Slabs on Fill 20 mm

3.2 FIELD QUALITY CONTROL

.1 Quality Control - Field inspection. Section 01400

.2 Contact Contract Administrator for steel reinforcement inspection minimum 2 working days prior to concrete placement; allow time for adjustments prior to scheduled concrete pour.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Floors and slabs on grade.

1.2 RELATED SECTIONS

.1	Concrete Forms.	Section 03100
.2	Concrete Reinforcement.	Section 03200
.3	Concrete Curing.	Section 03390
.4	Mechanical items for casting into concrete.	Division 15
.5	Electrical items for casting into concrete.	Division 16

1.3 REFERENCES

.1 ACI 301 - Structural Concrete.

.2 ACI 302 - Guide for Concrete Floor and Slab Construction.

.3 ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete

.4 ACI 305R-10, Guide to Hot Weather Concreting.

.5 ACI 306R-10, Guide to Cold Weather Concreting

.6 CAN/CSA A5 - Cementitious Materials Compendium.

.7 CAN/CSA A23.1 - Concrete Materials and Methods of Concrete Construction.

.8 CAN/CSA A23.2 - Methods of Test for Concrete.

.9 CAN/CSA A23.5 - Cementitious Materials Compendium.

.10 CAN/CSA A363 - Cementitious Materials Compendium.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01330: Procedures for submittals.

.2 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.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with ACI 301.

.2 Acquire cement and aggregate from same source for all work.

.3 Conform to ACI 305R when concreting during hot weather.

.4 Conform to ACI 306R when concreting during cold weather.

2.0 PRODUCTS

2.1 CONCRETE MATERIALS

.1 Portland Cement: CAN/CSA-A5.

.2 Fine and Coarse Aggregates: CAN/CSA-A23.1.

.3 Water: CAN/CSA-A23.1, clean and not detrimental to concrete.

2.2 ACCESSORIES

.1 Shrinkage Compensating Grout: Premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.

.1 Compressive strength: 50 MPa at 28 days.

.2 Consistency:

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

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

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

d) Dry pack to manufacturer's requirements.

.2 Non-Premixed Dry Pack Grout: Composition of non metallic aggregate, Portland cement with sufficient water for mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa when measured at 28 days.

.3 Vapour Retarder: 6 mil thick clear polyethylene film, type recommended for below grade application.

.4 Where void form is indicated on drawings, use cardboard shear-mat below structural slabs and low density polystyrene below walls and grade beams.

2.3 CONCRETE MIX

.1 Mix and deliver concrete in accordance with CAN/CSA-A23.1-09, Table 5, Alternative 1.

.2 Provide concrete to the following compressive strengths and exposure classifications as defined in CAN/CSA-A23.1-09, Table 1:

.1 Slab: 32 MPa at 56 days, F-2 exposure class

.2 All other concrete: 32 MPa at 28 days, F-1 exposure class

.3 The use of calcium chloride is not permitted.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verify Site conditions to Section 01700.

.2 Verify requirements for concrete cover over reinforcement.

.3 Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

.1 Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

.2 In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

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

3.3 PLACING CONCRETE

.1 Place concrete in accordance with CAN/CSA-A23.1.

.2 Notify Contract Administrator minimum 24 hours prior to commencement of operations.

3.4 CONCRETE FINISHING

.1 Steel trowel surfaces which are scheduled to be exposed.

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

.3 Saw cuts for slab on grade shall be 25 mm deep & 3 mm wide. Cutting to be done not sooner than 12 hours, and not later than 24 hours after the slab is poured. Cuts to be filled with approved bituminous compound or caulking.

3.5 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 Section 03390.

3.6 FIELD QUALITY CONTROL

.1 Section 01400 - Quality Requirement: Field testing.

.2 Provide free access to Work and cooperate with appointed firm.

.3 Three concrete test cylinders will be taken for every 50 or less cu m of each class of concrete placed.

.4 One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

.5 One slump test will be taken for each set of test cylinders taken.

3.7 PATCHING

.1 Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Contract Administrator upon discovery.

.2 Patch imperfections in accordance with ACI 301.

3.8 DEFECTIVE CONCRETE

.1 Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Contract Administrator.

.3 Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Contract Administrator for each individual area.

- END OF SECTION -

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Initial and final curing of horizontal and vertical concrete surfaces.

1.2 RELATED SECTIONS

.1 Cast-In-Place Concrete. Section 03300

1.3 REFERENCES

.1 ACI 301 - Structural Concrete.

.2 ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.

.3 ACI 308 - Guide to Curing Concrete.

.4 ASTM C171 - Sheet Materials for Curing Concrete.

1.4 SUBMITTALS

.1 Submit to Section 01330.

1.5 QUALITY ASSURANCE

.1 Perform Work in accordance with ACI 301.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver curing materials in manufacturer's packaging including application instructions.

2.0 PRODUCTS

2.1 MATERIALS

.1 Membrane Curing Compound: ASTM C309 Type 1 Class A acrylic

.2 Water: Potable, not detrimental to concrete.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verify substrate conditions to Section 01300.

.2 Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION - HORIZONTAL SURFACES

.1 Cure floor surfaces in accordance with A23.1-09, exposure class S-2

3.3 PROTECTION OF FINISHED WORK

.1 Do not permit traffic over unprotected floor surface.

END OF SECTION