PART 1 General

1.1 RELATED WORK

.1	Cast in Place Concrete	Section 03 30 00
.2	Concrete Reinforcement	Section 03 20 00
.3	Concrete Floor Finishes	Section 03 34 50

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 QUALITY ASSURANCE

.1 Do concrete formwork and falsework to:

.1 Provincial Building Code - current edition.

.2 CSA Standard CSA-A23.1-04 (CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION).

.3 CSA Standard CSA-A23.2-04 (METHODS OF TEST AND STANDARD PRACTICES 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-A23.1-04.

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 to the approval of the Contract Administrator at no extra cost to the City.

PART 2 Products

2.1 FORMWORK MATERIALS

.1 Form Material:

.1 Exposed surfaces - metal, plywood or plywood lined. Plywood to CSA Standard O121-M1978 or CSA Standard O153-M1980 (R2003).

.2 Unexposed surfaces - metal, plywood to CSA Standard O121-M1978 or CSA Standard O153-M1980, or wood lumber to CSA Standard CAN/CSA O86.1-01 (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 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 [1"] [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 by the Contract Administrator.

PART 3 Execution

3.1 FORMWORK

.1 Lines and Levels:

.1 Verify lines, levels, and column centers 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 re-shoring 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-A23.1-04.

.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 by the Contract Administrator.

.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.

PART 1 General

1.1 RELATED SECTIONS

.1	Cash Allowance	Section 01 21 13
.2	Concrete Formwork	Section 03 10 00
.3	Concrete Reinforcement	Section 03 20 00
.4	Cast in Place Concrete	Section 03 30 00

1.2 DEFINITIONS

.1 **"The Contractor"** shall mean the Contractor responsible for the cast-in-place work.

.2 **"The Contract Administrator"** shall mean the architectural/structural consultant responsible for preparation of contract documents for this project.

.3 **"The Testing Agency"** shall mean the testing agency responsible to the City.

1.3 REFERENCE STANDARDS

.1 Testing of concrete shall conform to the requirements of the following standards unless otherwise required by this specification:

.1 Current Edition of Provincial Building Code

.2 CSA-A23.1-04 Concrete Materials and Methods of Concrete Construction

.3 CSA-A23.2-04 Methods of Test for Concrete

.2 Where the standard is referred to in this specification it shall mean the documents specified in this clause.

PART 2 Products

2.1 APPOINTMENT OF TESTING AGENCY

.1 The City shall hire a CSA approved testing agency who shall test all concrete and grout as per this specification.

.1 Testing paid for by Cash Allowance.:
- .1 Review of initial mix designs.

.2 Testing paid for by the Contractor:
- .1 Review of Contractor requested mix design changes.
- .2 Any waiting time incurred by the testing agency in excess of ½ hour.
- .3 Any additional costs due to overtime, shift work, holiday or weekend work, except that holiday or weekend pickup will be paid for by the City when the concrete was placed on a regular workday.
- .4 Costs for testing required by the Contractor for stripping.
- .5 Cost for retesting or additional testing of concrete whose tests have failed to meet the specified requirements.

PART 3 Execution

3.1 RESPONSIBILITY OF THE CONTRACTOR

.1 The Contractor shall co-operate fully with the testing agency.

.2 The Contractor shall give the testing agency at least 4 hours prior notice of a concrete placement.

.3 It is the Contractor's responsibility to provide a finished product that meets the specification. If initial tests indicate that the concrete failed to meet the specification, the Contract Administrator shall decide if any additional testing is necessary. This testing shall be done by a CSA approved testing agency, but need not be the City's agency. The proposed additional testing shall have prior approval of the Contract Administrator. Core strengths must equal specified strength if tested dry or 85% specified if tested wet, with wet or dry tests as per the standard.

3.2 RESPONSIBILITY OF THE TESTING AGENCY

.1 The testing agency has the authority to, and is expected to reject any concrete not meeting the specifications.

.2 If the testing agency becomes aware that concrete is being placed without their being notified, or if insufficient notice is received, then the testing agency shall notify the Contract Administrator immediately.

.3 Low 7 day and 28 day strength tests shall be brought immediately to the attention of the Contract Administrator and the Contractor.

.4 All tests shall be numbered consecutively and the cylinders marked as follows: 7 day = A, two 28 days marked B and C.

.5 All field cured cylinders shall be marked "F".

3.3 REGULAR TESTING

.1 Shall conform to the standard, except each test shall consist of 3 cylinders. One for 7 day strength and two for 28 day strengths. The tests shall record concrete temperature, air temperature, slump, air content, location of pour, mix number, specified strength, and element type.

3.4 FIELD CURED CYLINDERS

.1 Shall conform to the standard, except the cylinder shall be stored adjacent to the element it represents. The cylinder is to be left undisturbed at this location until picked up by the testing agency.

PART 1 General

1.1 RELATED WORK

.1	Concrete Formwork	Section 03 10 00
.2	Cast-in-Place Concrete	Section 03 30 00
.3	Concrete Unit Masonry	Section 04 22 00

1.2 QUALITY ASSURANCE

.1 Reinforcement work shall conform to the following standards:

.1 Provincial Building Code - current edition

.2 CSA Standard CSA-A23.1-04 (CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION).

.3 CSA Standard CSA-A23.2-04 (METHODS OF TEST FOR CONCRETE).

.4 CSA Standard CAN3.23.2-04 (DESIGN OF CONCRETE STRUCTURES FOR BUILDINGS).

.5 ASTM A775-86 (STANDARD SPECIFICATION FOR EPOXY COATED REINFORCING CONCRETE CONSTRUCTION).

.6 CSA Standard W186-M1990 (WELDING OF REINFORCING BARS IN REINFORCED CONCRETE CONSTRUCTION).

.7 Reinforcing Steel Institute of Ontario (RSIO) Manual and Standard Practice.

1.3 QUALIFICATION OF WORKERS

.1 Welding of concrete reinforcement shall be performed by workers who are approved by the Canadian Welding Bureau in accordance with CSA Standard W47.1-92 (CERTIFICATION OF COMPANIES FOR FUSION WELDING OF STEEL STRUCTURES).

1.4 SUBMITTALS

.1 Mill Tests:

.1 Upon request, provide the Contract Administrator with a certified copy of mill tests of steel supplied, showing physical and chemical analysis.

.2 The City will engage a CSA certified laboratory to test all reinforcing as detailed in this specification.

.2 Shop Drawings:

.1 Prepare shop drawings for concrete reinforcement, bar support and accessories in accordance with Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada, ANSI/ACI 315-80, and ACI 315R-80, manual of Engineering and Placing Drawings for Reinforced Concrete.

.2 Upon request submit shop drawings in accordance with the General Requirements.

.3 Clearly indicate bar sizes, grades, spacing, location and quantities of reinforcing mesh, bar supports and accessories and identifying code marks to permit correct placement without reference to structural drawings.

.4 Placing drawings and bar lists will be reviewed for number and size of bars only and this review shall in no way relieve the Contractor of his responsibility for carrying out the Work in accordance with the drawings.

.5 Substitution of imperial reinforcing sizes and grades will only be accepted if placing drawings showing imperial sizes are submitted to the Contract Administrator for review. Approval must be obtained before any work is commenced.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Store reinforcement in a manner to prevent excessive rusting and fouling with dirt, grease, form-oil and other bond-breaking coatings.

.2 Reinforcement at the time concrete is placed shall be free from excessive rusting, mud, oil or other coatings that adversely affect its bonding capacity.

PART 2 Products

2.1 CONCRETE REINFORCEMENT

.1 All concrete reinforcement shall conform to the following standards:

.1 Deformed bars to CSA Standard G30.18-M92 (BILLET-STEEL BARS FOR CONCRETE REINFORCEMENT).

.2 Reinforcement that will be welded to CSA Standard CSA W186-M 1990.

.3 Welded Wire Mesh to CSA Standard G30.18 (WELDED STEEL WIRE FABRIC FOR CONCRETE REINFORCEMENT).

.4 Wire for reinforcement to CSA Standard G30.18.

.2 Bar supports shall conform to ACI 316 (MANUAL OF STANDARD PRACTICE FOR DETAILED REINFORCED CONCRETE STRUCTURES) unless approved by the Contract Administrator.

2.2 FABRICATION

.1 Fabricate reinforcing to CSA Standard CSA-A23.1-04 and reviewed shop drawings.

.2 Fabricate reinforcing steel within the following tolerances:

.1 Sheared length plus or minus 25mm.

.2 Depth of truss bar plus or minus 10mm.

.3 Outside dimension of stirrups, ties and spirals, plus or minus 10mm.

.4 Other bends plus or minus 25mm.

.3 Colour code each bar to correspond with code mark appearing on bar list.

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

PART 3 Execution

3.1 INSTALLATION

.1 Reinforcement shall be accurately placed and supported by bar supports and side form spacers to assure proper concrete cover and spacing within allowable tolerances before and during placing of concrete.

.2 Bar supports shall be sufficient in number and strength to carry the reinforcement they support and prevent displacement by workers or equipment before and during concreting. They shall be spaced so that any sagging between supports will not intrude on the specified concrete cover, or as required by the Contract Administrator.

.3 Use concrete blocks for bar support in slab-on-grade. Lifting of reinforcing or welded wire mesh into specified position during the concrete pour will not be allowed.

.4 Bars shall be placed on the following tolerances unless noted otherwise:

.1 Clear concrete protection of reinforcement, 5mm plus or minus.

.2 Where the depth of a flexural member, thickness of a wall or smallest dimension of a column is:

.1 200mm or less, 5mm plus or minus.
.2 Larger than 200mm, but less than 600mm, 10mm plus or minus.
.3 600mm or larger, 20mm plus or minus.
.4 Lateral spacing of these bars shall be within 30mm plus or minus of the specified spacing.

.3 For longitudinal location of bends and ends of bars 50mm plus or minus.

.4 As Item 3 at discontinuous ends of members 20mm plus or minus.

.5 Specified spacing between bars 10mm.

.5 Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the specified tolerances, the resulting arrangement of bars shall be subject to approval of the Contract Administrator.

.6 Bar support devices contacting surfaces exposed to the exterior, or to view, shall be non-corroding.

MINIMUM REINFORCEMENT WHERE NOT SHOWN OR INDICATED

.7 Concrete walls, 10M at 300mm each way, centered.

.8 Slab-on-grade, 10M at 400mm each way, centered.

.9 Sidewalk, 10m at 400mm each way, centered.

.10 Edges of slabs and walls, 2-15m continuous, lap 400mm.

.11 Opening in slab and wall over 300mm sq. 2-15m parallel to all edges, extending 600mm beyond corners.

3.2 CONSTRUCTION REVIEW

.1 No concrete shall be placed until the Contract Administrator has completed his review of reinforcing in place, or a site rebar placement inspection has been waived based on the Contract Administrator's discretion. The Contractor shall provide a minimum of 24 hours notice of the time when the reinforcement will be substantially in place and ready for the Contract Administrator's review.

3.3 EPOXY COATED STEEL

.1 Where noted on structural drawings, reinforcing shall be coated with a fusion bonded epoxy coating in accordance to ASTM A775-86.

.2 With each batch of coating material, provide a written certification properly identifying batch number, material, quantity represented, date of manufacture, name and address of manufacturer and a statement that supplied coating material is the same composition as that prequalified. A batch is defined as quality of coating material designated by the manufacturer in his production quality control program.

.3 Coat cut ends of bars of epoxy coated reinforcing with epoxy patching material.

.4 Use epoxy coated and/or plastic accessories and tie wire with epoxy coated reinforcement.

3.4 DAMAGE AND REPAIR TO EPOXY COATED REINFORCING

.1 Repair coating damage with patching material if damaged area per 300mm is greater than nominal cross-sectional area of the bar. Damaged areas per 300mm, which are smaller than the nominal cross-section area of the bar, need not be repaired.

.2 Limit repair of coating damage to bars on which total of damaged coating area does not exceed 5% of surface area of the bar within each bent area, or 3% of surface area of the bar within the total straight portion of coated bar.

.3 Coated bars that do not meet the requirements of this specification shall be rejected. At coating applicators option, coated bars having defects shall be replaced or alternately, stripped of coating, re-cleaned, and recoated in accordance with the requirements of this specification.

PART 1 General

1.1 RELATED SECTIONS

.1	Cash Allowance	Section 01 21 13
.2	Concrete Formwork	Section 03 10 00
.3	Testing of Concrete	Section 03 11 00
.4	Concrete Reinforcement	Section 03 20 00
.5	Concrete Floor Finishes	Section 03 34 50
.6	Masonry Procedures	Section 04 05 10
.7	Structural Steel	Section 05 10 00

1.2 DESCRIPTION OF WORK INCLUDED

.1 Provide all labour, materials, equipment and services necessary to supply and install cast in place concrete work shown or indicated in all the contract drawings and specifications including concrete toppings, bases, footings, sumps, curbs, posts, manholes, pits, paving, sidewalks, equipment bases or curb, etc.

.2 Install all anchor bolts, embedded metal, inserts hangers, reglets, dovetail anchors, etc., supplied by applicable trades for casting into concrete and assume responsibility for correct positioning within the agreed tolerance and in accordance to drawings supplied by the trade.

.3 Install all openings, blockouts, etc. required by other trades and assume responsibility for correct positioning within the agreed tolerance and in accordance to drawings supplied by the trade.

1.3 WORK INSTALLED BUT FURNISHED BY OTHERS

.1 Anchor bolts, hangers, sleeves and other inserts for to be cast into concrete shall be supplied by applicable trades. Build in and/or set these items and assume full responsibility for correct positioning.

1.4 QUALITY ASSURANCE

.1 Concrete work shall conform to the following standards:

.1 Provincial Building Code - current edition.

.2 CSA Standard CSA-A23.1-04 (CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION).

.3 CSA Standard CSA-A23.2-04 (METHODS OF TEST FOR CONCRETE).

1.5 TESTING

.1 A testing agency will be selected and paid for in accordance to the General Requirements. The Contractor shall coordinate with the testing agency for performing all required testing.

.2 Concrete testing will be as required by CSA-A23.1-04 unless noted otherwise. Testing methods shall conform to CSA-A23.2-04.

.3 Provide samples of materials on request.

.4 Take at least one concrete test (3 cylinders) for each 100 cubic meters or fraction thereof, of each type of concrete placed in any one day. One moist cured cylinder to be tested in 7 days and two tested in 28 days. Take one slump test and one test for air entrainment for each concrete test.

.5 The test report shall indicate specifically:

.1 Name of Project.

.2 Date of sampling.

.3 Test results.

.4 Name of supplier.

.5 Delivery truck number.

.6 Identification of sampling and testing technicians.

.7 Exact location in the structure of the concrete sampled.

.8 Design strength of concrete sampled.

.9 Admixtures, cement type, maximum aggregate size.

.10 Air temperatures and concrete temperature.

.11 Slump and air content.

.6 If additional testing is required to demonstrate the adequacy of any concrete that does not meet the requirements for strength, or which has been placed before formwork and reinforcement have been reviewed by the Contract Administrator, the Contractor shall pay the cost of such testing.

1.6 SUBMITTALS

.1 Concrete Mix Design:

.1 Submit concrete mix designs for each type of concrete required for the Contract Administrator’s review.

.2 Concrete Test Results:

.1 One copy of the results to be submitted directly from the testing agency to the City, the Contractor, and the Contract Administrator.

.3 Transit-Mix Delivery Slips and Placing Records:

.1 Keep a record at the job site showing time and place of each pour of concrete, together with a transit-mix delivery slip certifying contents of pour. Make the record available to the City for their inspection upon request. Upon completion of this portion of work, submit placing records and delivery slips to the City.

.4 Curing Procedures:

.1 Submit details of proposed methods of concrete curing and provisions for weather protection to the Contract Administrator for review.

.5 Construction Joints:

.1 Plan locations and details of construction joints to be as noted on the drawings. For miscellaneous areas not specifically noted follow requirements of Standards referenced above. Submit such details for the Contract Administrator's review.

.6 Miscellaneous Inserts:

.1 Indicate non-slip nosing sizes, locations, colour, installation, etc.

PART 2 Products

2.1 MATERIALS

.1 Materials shall conform to the following requirements:

.1 Portland Cement to CSA Standard CAN/CSA-A5-M93.

.2 Aggregate: Natural stone to CSA Standard CSA-A23.1-04.

.3 Water: Potable and to CSA Standard CSA-A23.1-04.

.4 Air entraining agents to CSA Standards CAN3-A266.1-M78.

.5 Chemical admixtures to CSA Standard CAN3-A266.2-M78 and CSA Standard CAN3-266.4-M78. Calcium chloride is not permitted.

.6 Pozzolanic mineral admixtures to CSA Standard CAN3-A266.3-M78.

.7 Curing materials to CSA Standard CSA-A23.1-04.

.2 Grout shall be non-expanding and non-shrink type with a minimum strength of 35 Mpa at 28 days.

.3 Damproof Membrane: 6 mil micrometer polyethylene file to CAN/CGSB-S1-34-M86 for placement under concrete slab where indicated on Architectural drawings.

2.2 MIX PROPORTIONING

.1 All concrete for this Project is designated as “Ultimate Strength Type Concrete”.

.2 Concrete for all parts of the Work shall be homogeneous and when hardened shall have the required strength, resistance to deterioration, durability, resistance to abrasion, water-tightness, appearance and other specified properties.

.3 Concrete mixes shall be proportioned by the supplier to meet the requirements for cement type, compressive strength, class of exposure, maximum aggregate size, slump, air content, and admixtures specified herein. All concrete shall be normal weight. Proportioning, mixing and delivery to the site shall meet the requirements of CSA Standard CSA-A23.1-04.

.4 Any required chemical admixtures are to be added to concrete according to manufacturer’s recommendations. Obtain Contract Administrator’s approval before using chemical admixtures other than those specified.

.5 Do not add calcium chloride to concrete.

.6 Concrete requirements specified may require the use of superplasticizers, set retardants or silica fume. Costs associated with the use of such materials shall be included in the contract price.

2.3 ACCESSORIES

.1 **Ribbed waterstops:** extruded PVC of sizes indicated:

.1 **Tensile strength:** to ASTM D412-83, Die "C" method, minimum 11.4 MPa.

.2 **Elongation:** to ASTM D412-83, Die "C" method, minimum 275%.

.3 **Tear resistance:** to ASTM D624-81, Die "B" method, minimum 48 kN/m.

.2 **Premoulded joint fillers:**

.1 **Flexcell or equal:** to ASTM D1751-83.

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

2.4 ACCEPTABLE PRODUCTS

.1 Ribbed waterstops

.1 Goodrich.

.2 Greenstreak.

.3 Sternson Durajoint*.

.4 Vinylex.

.5 CPD Waterstop.

.2 Joint fillers:

.1 Elsro "201".

.2 Meadows "3250-101".

.3 Sternson "Flexcell".

.4 Websen "Expander Joint".

2.5 SUPPLIERS

.1 **American Abrasive:**
Waco Western Hardware Ltd.
567 Henry Avenue, Winnipeg, Manitoba R3A 0T8
Phone: (204) 772-9226

.2 **Elsro:**
Steel Industrial Products
1325 Ellice Avenue, Winnipeg, Manitoba R3G 0G1
Phone: (204) 786-6426

.3 **Greenstreak:**
Steel Industrial Products
1325 Ellice Avenue, Winnipeg, Manitoba R3G 0G1
Phone: (204) 786-6426

.4 **Meadows:**
Steel Industrial Products
1325 Ellice Avenue, Winnipeg, Manitoba R3G 0G1
Phone: (204) 786-6426

.5 **Sternson:**
G.D. Johnson Ltd.
542 Plinquet Street, Winnipeg, Manitoba R2J 2W6
Phone: (204) 233-4107

.6 **Wooster:**

.1 Darr Distributors Limited
35 Trottier Bay, Winnipeg, Manitoba R3T 3R3
Phone: (204) 478-4413

.2 Waco Western Hardware Ltd.
567 Henry Avenue, Winnipeg, Manitoba R3A 0T8
Phone: (204) 772-9226

PART 3 Execution

3.1 MIXING AND PLACING

.1 Concrete shall be machine mixed. Mixing and placing shall be in accordance with CSA Standard CSA-A23.1-04.

.2 Concrete shall be conveyed from the mixer to the place of deposit by methods that will ensure the required quality of concrete. Equipment for conveying the concrete shall be of such size and design as shall ensure a practically continuous flow of concrete at the delivery end without separation of materials.

.3 Concrete shall be deposited in the forms as close as practical to its final position to avoid re-handling. The vertical height of free fall shall not exceed 3000mm unless special precautions approved by the Contract Administrator are utilized.

.4 Placing shall be continuous throughout each division and the concrete shall be so placed and worked that a uniform texture will be produced.

.5 Placing shall be continuous until the extent of the pour, as approved by the Contract Administrator, is complete. Placing shall be sufficiently rapid to ensure the bonding of successive layers.

.6 No concrete shall be placed later than two hours after initial batching. No re-tempered concrete shall be allowed.

3.2 SAWCUTS

.1 Joints in slab on grade shall be located as indicated on the drawings. The depth of joints shall be a minimum of 1/4 of the thickness of the slab. Coordinate sawcut pattern with tile size. Proposed layout to be submitted to the Contract Administrator for review prior to pouring of concrete slabs.

.2 Sawcuts to be made continuously during day, night or weekend until complete within twelve (12) hours of slab pour or as soon as slab can be cut when saw can run over concrete surface without leaving tread marks or without raveling, whichever is later.

3.3 COMPACTION

.1 Concrete shall be consolidated by means of sufficient vibrators of adequate size operated by competent workmen.

.2 The use of vibrators to transport concrete shall not be allowed.

.3 Concrete shall be thoroughly worked around reinforcement, around embedded items and into corners of forms, eliminating all air or stone pockets that may cause honeycombing, pitting or planes of weakness.

3.4 CURING

.1 After concrete has sufficiently set, its exposed surfaces shall be kept continuously moist for a period of at least seven (7) days after placing, or an approved compound shall be applied in strict accordance with the manufacturer's specifications. Concrete shall be protected from harmful effects of sunshine, drying winds, cold, running or surface water and mechanical shock.

.2 When the air temperature is below 5 deg. C or when, in the opinion of the Contract Administrator, there is a possibility of it falling below 5 deg. C no concrete shall be placed until after the Contract Administrator has approved the provisions made to ensure proper curing of concrete. These provisions shall conform to the requirements of CSA Standard CSA-A23.1-04.

.3 The Contract Administrator must approve any protective curing methods used.

.4 Adequate equipment shall be provided for heating the concrete materials and protecting the concrete from freezing or near freezing temperatures. No frozen materials or materials containing ice shall be used. All concrete materials and all reinforcement, forms, existing concrete and ground with which the concrete is to come into contact, shall be free from frost. Whenever the temperature of the surrounding air is below 5 deg. C all concrete placed in the forms shall have a temperature of between 15 deg. C and 32 deg. C and adequate means shall be provided for maintaining a temperature of not less than 21 deg. C for 3 days or 10 deg. C for 5 days except when high early strength concrete is used, the temperature shall be maintained at not less than 21 deg. C for 2 days or 10 deg. C for 3 days or for as much more as is necessary to ensure proper curing of the concrete. Under no circumstances may dry heat be used. Means shall be taken to humidify the air within the enclosure and to ensure that the moisture requirements for curing are maintained. No dependence shall be placed on calcium chloride or other chemicals for the prevention of freezing.

.5 In extreme weather conditions, either hot or windy or freezing, all slab surfaces shall receive a protective covering to prevent respectively, excessive evaporation or freezing.

3.5 LOADING

.1 The Contractor shall not permit the new structure to be unduly loaded with materials, but shall distribute them to the approval of the Contract Administrator.

3.6 INSERTS

.1 The Contractor shall notify all trades sufficiently in advance to ensure that provision is made for openings, inserts and fasteners. He shall cooperate with all trades in the forming and setting of all slots, sleeves, bolts, dowels, hangers, inserts, conduits, clips, etc., whether they are in his scope of work or not.

.2 Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings having dimensions greater than 100mm x 100mm not indicated on structural drawings must be approved by Contract Administrator.

.3 No sleeves, ducts, pipes or other openings shall pass through joists, beams, or columns, except where expressly detailed on structural drawings or approved by Contract Administrator.

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

.5 Check locations and sizes of sleeves and openings shown on structural drawings with architectural, mechanical and electrical drawings.

.6 Set special inserts for strength testing as indicated and as required by Non-Destructive Method for Testing Concrete.

.7 Anchor bolts:

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

.2 With Contract Administrator's approval, grout, or epoxy anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be at least 100mm in diameter. Drilled holes to be a minimum 25 mm larger in diameter than bolts used, or as per the anchor supplier’s specifications/ recommendations.

.3 Protect anchor bolt holes from water accumulations.

.4 Set bolts and fill holes with non-shrink grout, or epoxy in place as per anchor supplier’s specifications.

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

.8 Drainage holes and weep holes:

.1 Form weeping holes and drainage holes in accordance with Section 03 10 00. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.9 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 800 mm or where concrete walls are masonry faced.

.10 Non-slip nosing:

.1 Install nosing 1000 mm long or to suit stair (50 mm short of edge of stair length on both sides) centred on tread.

.11 Electrical conduit shall be placed after the reinforcement is placed.

3.7 CONSTRUCTION JOINTS

.1 Location and detail of construction joints not indicated on the drawings shall be submitted to the Contract Administrator for review.

.2 Construction joints shall be located and designed so as to least impair the strength and appearance of the structure. The reinforcement shall continue through the joint unless noted otherwise.

.3 All vertical construction joints in below grade exterior foundation walls shall have a vertical key and a sealed groove as detailed on the drawings.

.4 Where necessary, bearing strength at the joint shall be provided by mortises or keys formed in the concrete by inclined reinforcement or by other means satisfactory to the Contract Administrator.

.5 Construction joints in columns or walls shall be located at the underside of the floor members.

.6 At least 2 hours shall elapse after depositing concrete in columns or walls before depositing concrete in the floor system.

.7 Construction joints shall be located at or near the one-third span point in slabs, beams or girders. Provision shall be made for shear transfer through the joint by the use of inclined reinforcement and keys, or as directed by the Contract Administrator.

.8 Special care shall be taken when compacting for the new concrete at construction joints.

.9 The existing concrete surface at construction joints shall be wetted thoroughly prior to placement of new concrete.

.10 Unless shown otherwise or specifically approved by the Contract Administrator, the maximum length of wall or grade beam placed without a control joint shall be 12 000mm.

3.8 DAMPROOF MEMBRANE

.1 Place the damproof membrane on a prepared sub-base under all concrete slabs on grade inside the building, where indicated on the Architectural drawings. Lap joints 150mm minimum.

3.9 WATERSTOPS

.1 Supply and install pre-moulded waterstops in construction joints where indicated. Weld joints to make watertight. Install waterstops in accordance with manufacture's printed instructions and to Contract Administrator's approval.

3.10 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 isolation/expansion joints as indicated. Install joint filler.

.3 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.11 SLAB ON GRADE

.1 All drainage, waterline, conduits and other sub-surface piping shall be in place, inspected, approved, backfilled, and the entire sub-grade compacted before concrete slabs are poured.

.2 All slabs shall to be screed level to elevations shown. Reinforce concrete slabs with 10M at 400 o.c. each way unless noted otherwise. Lap all bars 300mm.

3.12 PATCHING AND CUTTING

.1 Honeycomb, exposed reinforcement and other defects of a minor nature may be patched with the approval of the Contract Administrator. Cut out defect to sound concrete and fill with mortar to the same proportions of cement and sand as in the concrete.

.2 Holes drilled through in place concrete to be approved by the Contract Administrator prior to drilling. Care shall be taken to ensure that no reinforcement is cut.

3.13 CONCRETE SPECIFIED ON OTHER DRAWINGS

.1 Check with Architectural, Civil, Landscape, Mechanical and Electrical drawings for the extent and location of all miscellaneous concrete work in connection with other disciplines.

.2 The Contractor shall construct all pits, bases, pads, light standard foundations etc., required by these other drawings. The Contractor will provide detailed drawings and setting plans for this work and will be responsible for detailed supervision. No extras to the contract will be allowed for failure to properly size, locate or construct any items.

3.14 ACCEPTANCE OF STRUCTURE FOR STRENGTH

.1 The strength of the structure will be considered potentially deficient if it fails to comply with any requirements which control the strength of the structure including, but not necessarily limited to the following:

.1 Low strength concrete as defined in CSA Standard CSA-A23.1-04.

.2 Reinforcing steel size, quantity, position, quality or arrangement at variance with the requirements of drawings and specifications.

.3 Improper curing.

.4 Inadequate protection of concrete from extremes of temperatures during the stages of hardening and strength development.

.5 Mechanical injury from fire, construction overload or premature removal of forms.

.6 Poor workmanship likely to result in deficient strength.

.7 Failure to have the Contract Administrator to review and comment on work and reinforcement before placing.

.8 Concrete that differs from the required dimensions or locations.

.2 If any analysis by the Contract Administrator indicates that the completed structure is suitable for its intended use, it may be accepted.

.3 To aid in the analysis, the Contract Administrator may order the Contractor to have an independent testing firm obtain cores, x-rays, or similar non-destructive tests, as per CSA Standard CSA-A23.2-04.

.4 If such tests are impractical or inconclusive, the Contract Administrator may order a load test as defined in CSA Standard CSA-A23.2-04.

.5 Concrete judged inadequate by structural analysis or by the results of a load test shall be reinforced by additional construction or replaced as directed by the Contract Administrator, all at the Contractor’s expense.

3.15 EXPOSED CONCRETE

.1 Attach reveals and chamfers to formwork as shown on drawings or as dictated by good industry practice. Place strips at pour lines and form panel joints where appropriate. Organized form panels will not be acceptable. Install reglets where required and as shown on drawings.

.2 Uniformly space form ties to create a regular repetitive pattern in consultation with the Contract Administrator.

.3 Grind off or otherwise remove fins, unsightly ridges and other imperfections flush with the general surface.

.4 Fill all holes greater than 12mm with cement mortar of the same general composition as used in concrete.

.5 Insert plugs in tie holes according to manufacturer's instructions, to give a minimum of 6mm reveal.

.6 Prepare a 300mm x 300mm concrete sample showing the quality of finish produced by the formwork, for approval by the Contract Administrator. Upon acceptance, this sample will establish the standard for exposed plain concrete.

.7 Finish exposed concrete in accordance with CSA-A23.1-04.

.8 Rub exposed sharp edges of concrete with carborundum to produce a 3mm radius edge unless otherwise detailed.

PART 1 General

1.1 RELATED SECTIONS

.1 Concrete Reinforcement — Section 03 20 00

.2 Cast-in-Place Concrete — Section 03 30 00

1.2 REFERENCE STANDARDS

.1 Do concrete floor finishing in accordance with CSA-A23.1-04 except where specified otherwise.

PART 2 Products

2.1 MATERIALS

.1 **Concrete materials:** in accordance with Section 03 20 00 and Section 03 30 00.

.2 **Floor hardeners:** premixed, dry shake, abrasion resistant, surface hardeners as specified in 2.2 herein.

.3 Use compatible additives, admixtures and hardeners.

2.2 FLOOR HARDENER - NON METALLIC, NATURAL

.1 A ready to use natural aggregate surface hardener to be applied at the rate of 50 kg/10 m^2 minimum or in accordance with manufacturer's instructions for heavy duty application.

.2 Seal floor with manufacturer recommended product.

.3 **Acceptable products:**

.1 Master Builders Co. Ltd.: Mastercron*, with sealer.

.2 Sternson Construction Products: Diamag 7 with sealer.

.3 Elsro #785 Genflor, with #702 Clear Acrylic Sealer.

PART 3 Execution

3.1 WORKMANSHIP

.1 Concrete slabs which are to receive bonded topping shall be cleaned free of dirt, oil, loose material.

.2 Steel trowel concrete slabs to be left exposed or to receive carpeting, resilient flooring and applied floor finishes.

.3 Concrete slabs to receive toppings, quarry tile, ceramic tile to be screed off to true lines and levels shown and left ready to receive finish. Depress slabs to accommodate finish.

.4 Steel trowel concrete slabs and concrete curbs to receive epoxy finish (by the City).

.5 Where floor drains occur, floors to be level around walls and have a minimum 5 mm per metre uniform pitch to drains, unless indicated otherwise.

.6 Manufacturer's representative shall be present on site to monitor application of concrete hardener.

.7 A specialty consultant will be retained by the City to monitor flatness and levelness of the concrete floor.

3.2 PLAIN FLOOR FINISH

.1 Float surface with wood or metal floats or with power finishing machine and bring surface to grade.

.2 Steel trowel in accordance with CSA-A23.1-04.

.3 Do not sprinkle dry cement or dry cement and sand mixture over concrete surfaces.

3.3 FLOOR SURFACES SERVICED BY FLOOR DRAINS

.1 In areas where floor drains are installed, grade the entire floor surface towards the drains. The slope shall be verified by flooding such that water on all areas of the floor surface will drain by gravity without leaving pools or puddles on the floor surface. (VERIFY SLOPE WITH CONTRACT ADMINISTRATOR IMMEDIATELY AFTER TIME OF POUR).

3.4 HARDENED FLOOR FINISH

.1 Finish concrete floors as per Paragraphs 3.2, and apply floor hardener in accordance with manufacturer's printed instructions for heavy duty industrial application.

.2 Seal floor with "non-coloured" sealers only.

3.5 CURING

.1 Curing compound shall meet the moisture retention requirements of ASTM C 309-81, "Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete" (i.e., 0.55 kg/m^2 at 72 hours), when tested in accordance with ASTM C 156-80 at the coverage rate recommended by the manufacturer.

.2 Concrete shall be protected from premature or excessive drying, temperature extremes, and damage immediately following finishing. Minimal moisture loss at relatively constant temperature shall be maintained.

.3 Curing shall be a minimum of seven (7) days or until 70 percent of the specified concrete strength has been obtained.

.4 During curing period, concrete shall be protected from damage by equipment, temperature change, stored materials, curing procedures, rain, and running water.

3.6 TOLERANCES

.1 Surfaces tolerances shall be determined in accordance with flatness/levelness determinations by random sampling defined in ASTM E 1155M. Tolerance surveys will proceed within 72 hours following final finishing.

.2 The minimum flatness/levelness rating achieved shall be F_F/25 and F_L/25.

.3 Where random surveys indicate specified tolerances are not achieved, the contractor shall be responsible for any corrective grinding and shall assume any costs of additional tolerance surveys to confirm adequacy. Any corrective measures/rectifications must be approved by the Contract Administrator.

.4 Contractor shall provide the City with 5-7 days of advance notice of floor slab installation and finishing, so that the City may arrange for a testing agency to be present to test the flatness/levelness of the floor slabs in accordance with ASTM E 1155M.