Part 1 General

1.1 DEFINITIONS

.1 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.

.2 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.3 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste, and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.4 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.5 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.6 Separate Condition: Refers to waste sorted into individual types.

.7 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.2 STORAGE, HANDLING AND PROTECTION

.1 Store materials to be reused, recycled and salvaged in locations as directed by Contract Administrator.

.2 Unless noted otherwise, materials from removal become Contractor’s property.

.3 Protect, stockpile and store salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facilities.

.5 Protect structural components not removed for demolition from movement or damage.

.6 Protect surface drainage, mechanical and electrical from damage and blockage.

1.3 SUBMITTALS

.1 Submittals in accordance with Section E4 - Submittal Procedures.

.2 Submittal Required:

.1 Facilities, certified scrap dealer, and landfill intended to dispose materials.

.2 Submit seven (7) days prior to disposal of materials.

1.4 REMOVE AND DISPOSAL

.1 Remove surplus materials and temporary facilities from site.

.2 Dispose of non-contaminated waste materials, litter, debris, and rubbish off site.

.3 Do not burn or bury rubbish and waste materials on site.

.4 Do not dispose of volatile or hazardous wastes in storm or sanitary drains.

.5 Do not discharge wastes into stream or waterway.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 APPLICATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCES

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete

.2 CAN/CSA-O86-14, Engineering Design in Wood.

.3 CSA O121-08(R2003), Douglas Fir Plywood.

.4 CSA O151-09 (R2014), Canadian Softwood Plywood.

.5 CSA O153-13 Poplar Plywood.

.6 CAN/CSA-O325-07(R2012), Construction Sheathing.

.7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.

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

.9 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada

.10 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 DESIGN REQUIREMENT

.1 Design of concrete formwork and all temporary shoring systems are responsibility of the Contractor.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section E4 - Submittal Procedures.

.2 If requested, submit shop drawings for formwork and falsework signed and sealed by professional engineer registered or licensed in the Province of Manitoba, Canada.

.3 If requested, submit WHMIS MSDS - Material Safety Data for product provided.

.4 Submit shop drawings indicating 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.

.5 If requested, submit shop drawings indicating formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Protect all materials and Work from frost and adverse weather.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse or recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Divert wood materials from landfill to a recycling facility.

.4 Divert plastic materials from landfill to a recycling facility.

.5 Divert unused form release material from landfill to an official hazardous material collections site.

.6 Clean up and remove all rubbish and surplus materials from site.

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.

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

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

.1 Spiral pattern to show in hardened concrete.

.3 Steel forms: Minimum 1.9 mm well matched, tight fitting, and adequately stiffened to support weight of concrete without deflection.

.4 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.

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

.5 Form liner:

.1 Plywood: medium density overlay Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151.

.6 Form release agent: non-toxic, biodegradable.

.7 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

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

.9 Sealant: N/A.

.10 Void form: Moisture resistant Dynavoid® 40166 or approved equivalent for structural slab and Dynavoid® 40264 or approved equivalent for grade beams and pile caps. The void form must be structurally sufficient to support weight of wet concrete until final set.

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 approval from Contract Administrator 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. Do not apply form release agent where concrete surfaces are to receive special finishes that are affected by the agent.

.6 Apply form release agent on formwork in accordance with manufacturer's recommendations prior to placing reinforcing steel, anchoring devices, and embedded parts.

.7 Erect formwork to result in exposed concrete surfaces free of unsightly cold joints, blemishes, bug holes, honeycombing and cracking.

.8 Provide bracing to ensure stability of formwork.

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

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

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

.12 Align form joints and make watertight.

.1 Keep form joints to minimum.

.13 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

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

.15 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.

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

.17 Ensure piles project into grade beams and pile caps as indicated on Drawings.

.18 Remove all loose concrete from tops of piles. Ensure tops of piles are sound concrete.

.19 Construct formwork to maintain the following maximum tolerances:

.1 Horizontal and vertical lines – 10 mm in 20 m.

.2 Building dimensions and position of columns, walls, partitions: 6 mm.

.3 Cross sectional dimensions of columns or beams: ±3 mm.

.4 Camber, beams: 0.2% of span.

.5 Camber, slabs: 0.1% of span for all spans over 3 m.

.20 Do not re-use formwork that contains surface defects that could impair the appearance of finished concrete.

.21 Do not patch formwork.

3.2 REMOVAL AND RESHORING

.1 Unless specified on drawings, leave formwork in place for following minimum periods of time after placing concrete.

.1 Three (3) days for walls and sides of beams.

.2 Five (5) days for beam soffits, slabs, and other structural members, or three (3) days when replaced immediately with adequate shoring to standard specified for falsework.

.2 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.

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

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

.5 Do not wedge pry bars or hammers against concrete surfaces.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCES

.1 SP-66-04, ACI Detailing Manual 2004.

.2 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.3 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.4 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

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

.6 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.7 CAN/CSA-A23.3-14, Design of Concrete Structures.

.8 CSA-G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.

.9 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.10 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.11 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.12 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.

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

1.3 SHOP DRAWINGS

.1 Submit in accordance with Section E4 - Submittal Procedures.

.2 For LEED projects, submit shop drawings with accompanying LEED Requirements and Environmental Procedures.

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

.4 Details in accordance with ACI 315 unless specifically detailed otherwise.

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

.6 Unless noted otherwise on drawings, bar splices to be 40 bar diameters or 400 mm minimum for horizontal slices and 30 bar diameters or 350 mm minimum for vertical splices.

.7 Provide corner bars at corners and intersections of grade beams and walls, in accordance with the structural drawings.

.8 Include details of all doweling.

.9 All shop drawings to be reviewed and checked by the Contractor prior to submission to the Contract Administrator.

.10 Review of shop drawings by the Contract Administrator in no way relieves the Contractor responsibility for the accuracy of the shop drawings.

1.4 QUALITY ASSURANCE

.1 If requested, submit two copies of the following:

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

.2 Perform welding to CSA W186.

.3 Welders qualified under CSA W47.1.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store materials off ground in clean, dry, and well-ventilated area.

.2 Protect materials from deterioration or contamination.

.3 Replace defective or damaged materials with new.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Divert unused metal materials to metal recycling facility.

.4 Clean up and remove all rubbish and surplus materials from site.

Part 2 Products

2.1 MATERIALS

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

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

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

.4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.

.5 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.

.6 Welded steel wire fabric: to ASTM A185/A185M.

.1 Provide in flat sheets only.

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

.8 Tie wire: minimum 1.5 mm annealed type, or patented system approved by the Contract Administrator.

.9 Mechanical splices: subject to approval of the Contract Administrator.

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

.11 Galvanized reinforcement: to ASTM A123/A123M, minimum zinc coating 610 g/m^3.

2.2 FABRICATION

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

.2 Locate the reinforcement splices at points of minimum stress. Location of splices to be approved by the Contract Administrator.

.3 Upon approval of the Contract Administrator, weld reinforcement in accordance with CSA W186. Do not weld reinforcing at any location without written approval of the Contract Administrator.

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

.5 Do bending cold unless approved by the Contract Administrator.

.6 Dowels columns and walls into foundations using the same reinforcing as that in columns and walls unless noted otherwise on drawings.

.7 Provide horizontal L shape corner bars of same cross section and spacing as horizontal bars in walls and grade beams.

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 in accordance with the reviewed shop drawings and/or contract drawings.

.2 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 When paint is dry, apply thick even film of mineral lubricating grease.

.3 Cleaning reinforcing to CSA A23.1.

.4 Support and space reinforcement in alignment and position as follows:

.1 Concrete slab on grade: support reinforcement on support bars or concrete brick.

.2 Concrete structural slab and topping: support reinforcement on bar chairs.

.3 Provide minimum clear cover as follows unless detailed on drawings:

Concrete Cover

Exposure condition	Exposure class		
	N	F-1, F-2, S-1, S-2	C-XL, C-1, C-3, A-1, A-2, A-3
Cast against and permanently exposed to earth (foundations and piles)	-	75 mm	75 mm
Formed surfaces exposed to earth (piers, pile caps, grade beams, foundation walls, retaining walls)	40 mm	40 mm	60 mm
Slabs, walls, joints, stoops	20 mm	40 mm	60 mm
Sidewalks, curbs and gutters, splash pads and sump pits	-	-	30 mm
Ratio of cover to nominal bar diameter	1.0	1.5	2.0
Ratio of cover to nominal maximum aggregate size	1.0	1.5	2.0

.5 Place reinforcing to CSA A23.1. Refer to structural drawings for minimum splices. Splices to be class B unless noted otherwise.

.6 Use non-corrosive supports for reinforcing when concrete is exposed.

.7 Support chairs to not exceed 1200 mm spacing.

.8 Do not re-bend or straighten reinforcing steel after initial fabrication.

.9 Ensure reinforcement does not move during concrete pour.

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

.11 Ensure minimum cover to reinforcing steel for fire rating as specified on the drawings.

3.3 FIELD QUALITY CONTROL

.1 The Contract Administrator will periodically visit the site.

.2 Field services by the Contract Administrator do not in any way relieve the Contractor's responsibility to carry out work as specified in the Contract documents.

.3 Notify the Contract Administrator for an inspection 24 hours prior to concrete placement. Correct all identified deficiencies prior to pour.

.4 Contractor is responsible for reinforcing size, location and proper placement.

.5 Remove and replace reinforcement not in accordance with the drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCES

.1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M-15a, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D412-15a2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.6 ASTM D624-00 (2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.7 ASTM D1751-04 (2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.8 ASTM D1752-04a (2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.9 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.10 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.11 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.12 CSA A283-06 (R2011), Qualification Code for Concrete Testing Laboratories.

.13 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 ABBREVIATIONS AND ACRONYMS

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

.1 Type GU, GUb and GUL - General use cement.

.2 Type MS and MSb - Moderate sulphate-resistant cement.

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

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

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

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

.2 Fly ash:

.1 Type F - with CaO content less than 15%.

.2 Type CI - with CaO content ranging from 15 to 20%.

.3 Type CH - with CaO greater than 20%.

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

1.4 DESIGN REQUIREMENTS

.1 Contractor shall be responsible for design of concrete formwork and shoring systems.

1.5 SHOP DRAWINGS AND SUBMITTALS

.1 Provide submittals in accordance with Section E4 - Submittal Procedures.

.2 For LEED projects, submit shop drawings with accompanying LEED requirements and Environmental Procedures.

.3 If requested, at least 4 weeks prior to beginning Work, provide test data and certification by a qualified and independent inspection and testing laboratory that following materials will meet specified requirements:

.1 Joint filler.

.2 Waterstops.

.3 Supplementary cementing material.

.4 Blended hydraulic cement.

.5 Admixtures.

.6 Fine and coarse aggregates.

.4 Submit all concrete mix designs to the Contract Administrator for review 2 weeks prior to beginning Work.

.5 Do not proceed without written approval when deviations from mix design or parameters are found.

.6 Submit shop drawings indicating proposed location and details for all construction joints to the Contract Administrator for review prior to concrete pour.

.7 Provide two copies of WHMIS MSDS.

1.6 QUALITY ASSURANCE

.1 If requested, provide the Contract Administrator, 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 will meet specified requirements.

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

.1 Hot weather concrete.

.2 Cold weather concrete.

.3 Curing.

.4 Finishes.

.5 Joints.

.3 The Contractor shall arrange and pay for tests to be performed by a testing laboratory approved by the Contract Administrator. The tests shall include the following:

.1 Concrete tests:

.1 One set of 3 standard test specimens to be made for each class of concrete in any one day pour of more than 5 cubic meters for compressive strength tests.

.2 For pours of more than 60 cubic meters, add one set per each additional 60 cubic meters for compressive strength tests.

.3 For Work containing less than 5 cubic meters, one set of 3 standard test specimens shall be prepared for compressive strength tests.

.4 For cold weather concrete, one additional standard test specimens shall be prepared and cure the specimens on site under same conditions as concrete it represents for compressive strength tests.

.5 Concrete for tests to be sampled at the point of deposit of the concrete into the forms.

.6 Test specimens shall be cast, cured, and tested in accordance with CSA A23.2 by personnel from the testing laboratory.

.7 For each set of test specimens, a slump test and air content test (for air entrained concrete) shall be included.

.2 Test result reports shall include:

.1 Project name.

.2 Date and time of sampling.

.3 Date specimens received in the laboratory.

.4 Supplier, truck number, and time that concrete truck departs from the plant.

.5 Specified strength, slump, maximum aggregate, and air content.

.6 Cement type.

.7 Admixtures.

.8 Exact location in structure of sampled specimens.

.9 Slump.

.10 Maximum aggregate size.

.11 Air content, if applicable.

.12 Concrete strength and age at test.

.13 Technical information such as fails, curing, etc.

.3 Concrete will be considered satisfactory if the strength test result is no more than 3.5 MPa below the specified strength.

.4 Failure to comply with the requirements of this specification will result in the structure being considered potentially deficient. In such case, the Contract Administrator shall have the right to require one or more of the following:

.1 Changes in the mix proportions for the remainder of the Work.

.2 Additional curing on those portions of the structure represented by test specimens that failed to meet specified requirements.

.3 Non-destructive testing of concrete: to CSA A23.1/A23.2.

.4 Test cores drilled from portions of the structure in question in accordance to CSA A23.2.

.5 Load testing of the structure or structural element in question in accordance with CSA A23.3.

.6 Reinforce by additional construction or replace as directed by the Contract Administrator at the contractor's expense when concrete is judged inadequate by structural analysis or be results of load tests.

.7 Such other tests as the Contract Administrator may specify.

.8 Note that cores should not be drilled from the tension zone of a structural member.

.9 The Contractor pay for all costs of evaluation tests and additional engineering analysis that are required to demonstrate the adequacy of the structure where it does not meet the requirements of this specification and drawings or where concrete has been placed before formwork and reinforcement have been inspected and approved.

.5 Do not use contaminated materials.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching. Reject all concrete with hauling time exceed 120 minutes.

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

.2 Store and protect materials from damage by frost and weather.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 –Waste Management and Disposal.

.2 Divert unused concrete materials from landfill to local facility.

.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.

.5 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.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 Clean up and remove all rubbish and surplus materials from site.

Part 2 Products

2.1 MATERIALS

.1 Portland Cement: to CSA A3001.

.1 Concrete piles to have CSA Type 50 sulphate resistant cement.

.2 Concrete:

.1 Concrete shall have nominal compressive strength and meet the requirement for hardened concrete as specified in the following table.

EXP. CLASS	SUPPLY AND USE	MAX W/C	STRENGTH	CEMENT TYPE	SLUMP	MAX AGG. SIZE	AIR ENTRAINMENT	MAX FLY ASH CONTENT
S-1	PILE FOUNDATION	0.4	35MPa @28 DAYS	HS	100 mm ±20 mm	19 mm	5%-8%	25%

.3 Water: to CSA A23.1.

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

.5 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494 ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.

.3 Do not use Calcium Chloride or any admixture containing Chloride iron.

.4 Admixtures must be used in strict accordance with the manufacturer's instruction.

.6 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.7 Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 50 MPa at 28 days.

.8 Waterstops: ribbed extruded PVC of sizes indicated with shop welded corner and intersecting pieces:

.1 Tensile strength: to ASTM D412, method A, Die "C".

.2 Elongation: to ASTM D412, method A, Die "C", minimum 275%.

.3 Tear resistance: to ASTM D624, method A, Die "B", minimum 30 kN/m.

.9 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.10 Polyethylene film: 10 mm to CAN/CGSB-51.34.

.11 Bonding adhesive: Polymer resin emulsion, for mixing with cement and water. For bonding two concretes: to CSA A23.1.

.12 Curing compound: Chlorinated liquid rubber type, membrane forming.

.13 Do not change concrete mix or source material without written approval of the Contract Administrator.

Part 3 Execution

3.1 PREPARATION AND CONCRETE PLACEMENT

.1 Notify the Contract Administrator 24 hours prior to placing of concrete.

.2 Place concrete in accordance with CSA A23.1.

.3 Prior to placing of concrete submit a proposed method for protection of concrete during placing and curing in adverse weather to the Contract Administrator for approval.

.4 Use cold weather concrete, curing protection methods in accordance with CSA A23.1 when the ambient temperature falls below 5^{o}C.

.5 When the ambient temperature rises above 25^{o}C, use hot weather concrete, curing and protection methods.

.6 During concreting operations:

.1 Development of cold joints not allowed.

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

.7 Clean previously placed concrete with steel brush and dampen prior to placing the next layer.

.8 Protect previous Work from staining.

.9 Pumping of concrete is permitted only after approval of equipment and mix.

.10 Ensure reinforcement and inserts are not disturbed during concrete placement.

.11 Place concrete in approximately horizontal layers such that each lift can be vibrated into the previous lift.

.12 Place concrete directly into its final position in forms. Do not spread concrete with vibrators.

.13 Maximum vertical free fall of concrete shall not exceed 1200 mm in unexposed Work or 800 mm in exposed Work. Confine concrete with a suitable vertical drop pipe to prevent segregation.

.14 Place concrete as a continuous operation, stopping only at construction joints indicated on the drawings or approved proposed locations.

.1 At centre of span of structural suspended slab, beams, and joists.

.2 Immediately above or below floor construction joints in walls and columns.

.3 Maximum spacing of 12 m in walls and grade beams.

.4 Construction joints in walls must be watertight.

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

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

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

.18 Honeycombing or embedded debris in concrete that exceed 150 mm in any direction are not acceptable. Notify the Contract Administrator upon discovery of such defects.

.19 Remove and replace defective concrete as directed by the Contract Administrator.

3.2 INSTALLATION/APPLICATION

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

.2 Sleeves and inserts:

.1 Provide formed openings where required for pipes, conduits, sleeves and other embedded passing through concrete members.

.2 Sleeves and openings greater than 100 × 100 mm not indicated on drawings must be reviewed by the Contract Administrator.

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

.4 Maximum size of electrical conduit in structural slab is 1/3 of slab thickness and the conduit shall be located within middle third of the thickness.

.5 Where there are more than two conduits adjacent to each other in structural slab, they shall be separated with at least 100 mm spacing.

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

.7 Do not use aluminum inserts or conduits.

.3 Anchor bolts:

.1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete. No wet set is allowed.

.2 Grout anchor bolts in preformed holes drilled after concrete has set only with written approval or specified in the drawings.

.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 are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Finishing and curing:

.1 Curing concrete to CSA A23.1.

.2 Basic curing: keep concrete surface continuously moist until concrete temperature due to hydration has peaked and dropped several degrees, or for three days at a minimum temperature of 10°C.

.3 Additional curing: immediately following basic curing and before concrete has dried, cure for an additional four days, maintaining the temperature of the air in contact with concrete above 10°C.

.4 Acceptable curing methods:

.1 Ponding or continuous sprinkling.

.2 Absorptive mat or fabric kept continuously wet.

.3 Damp sand, earth, or similar moist materials.

.4 Continuous steam vapour mist bath not exceeding 70°C.

.5 Curing compound.

.6 Waterproof paper or plastic film.

.7 Other moisture-retaining method approved by the Department Representative.

.5 Use procedures as noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

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

.7 Concrete floor to have finish hardness equal to or greater than Mohs hardness to CSA A23.1/A23.2.

.8 Provide float finish unless otherwise indicated.

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

.10 Protect freshly placed concrete against damage from adverse weather conditions.

.11 Exposed concrete walking surfaces not to receive an integral hardener: coat with curing compound of curing method that provides permanent seal.

.12 In areas with an exposed concrete floor surface, apply the hardener and dust-proofing agent strictly to the manufacturer’s instruction.

.13 Water for curing shall be clean and free from contamination or discoloring agent.

.14 If moist curing is not used, then sprayed curing compounds are to be used.

.15 Curing compounds

.16 Do not use curing compound on concrete surfaces that are expected to receive topping or other type of bonded finish.

.17 Curing compounds to be of liquid membrane type and shall be applied in strict accordance with the manufacturer’s instructions.

.18 Curing compounds used for exposed concrete must not discolor the concrete.

.19 Apply sprayed curing compounds on horizontal surfaces immediately after the disappearance of surface moisture.

.6 Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat sealed butt joints in field.

.7 Use factory welded corners and intersections unless otherwise approved by the Contract Administrator.

.7 Joint fillers:

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

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

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

.8 Grouting:

.1 Grout beneath steel base and bearing plates after the steel has been erected. This grout is to be expanding type and be mixed and placed as per the manufacturer’s instruction.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1 Straightedge Method FF = 25: FL = 20.

.2 Variation of linear building lines from established position in plan: 6 mm.

.3 Variation in cross-sectional dimensions: ±6 mm.

.4 Variation from the level or from grades indicated for surfaces of slab shall not exceed 3 mm in a 3 m straight edge immediately after trowelling.

.5 Remove and replace concrete that does not meet the requirement at no additional cost to the City.

3.4 PROTECTION

.1 Protection for concrete to CSA A23.1.

.2 Protect fresh concrete from adverse weather conditions. All forms and reinforcing in contact with fresh concrete must have surface temperature of greater than 5^{o}C.

.3 Do not place concrete on frozen ground.

.4 Do not place concrete on soil that is subjected to change in moisture. Soil must be either all dried or wetted so that its moisture content is normal and equal to that of the surrounding soil.

.5 Provide and use tarpaulins or other protection material when necessary to completely cover or enclose all freshly placed concrete.

3.5 FIELD QUALITY CONTROL

.1 The Contract Administrator will periodically visit the site.

.2 Field inspection by the Contract Administrator does not in any way relieve the Contractor of his contractual responsibility.

3.6 HOT WEATHER CONCRETE

.1 When the ambient temperature is at or above 25^{o}C or when there is a probability that the ambient temperature rising to or above 25^{o}C during concrete placement, the temperature of concrete when deposited is not to be more than 25^{o}C. To accomplish this, the mixing water, if necessary the aggregate, is be cooled.

.2 When pour are massive or where surfaces are to be trowel finished, or wood floated, use a retarder that will slow the initial set of the concrete.

.3 When the ambient temperature is at or above 25^{o}C, exposed surface of the concrete are to be shaded from direct sun ray and sheltered from direct wind.

.4 Moist cure concrete instead of using curing compounds.

3.7 COLD WEATHER CONCRETE

.1 When the ambient temperature is at or below 5^{o}C or when there is a probability that the ambient temperature dropping to or below 5^{o}C during concrete placement, the temperature of concrete during placing shall be between 15^{o}C and 25^{o}C.

.2 Placed concrete shall be protected and maintained at a temperature of at least 10^{o}C for not less than 3 days or not less than 20^{o}C for 2 days and all concrete to be maintained above freezing for a minimum of 7 days.

.3 Concrete shall be protected from alternate freezing and thawing for a minimum of 14 days.

.4 Protected and heated concrete to be brought gradually to ambient air temperature at a drop of not more than 15^{o}C per 24 hour period.

.5 Heating enclosure shall be clear of concrete and forming surfaces for air circulation.

.6 Frozen concrete will be rejected.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The Contract Documents apply to and govern the Work of this section.

1.2 MEASUREMENT PROCEDURES

.1 Measure bored piles in units, including supply and installation.

.2 Measure steel casing in units as required.

1.3 REFERENCE STANDARDS

.1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.

.2 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.3 ASTM A252-10, Standard Specification for Welded and Seamless Steel Pipe Piles.

.4 ASTM A283/A283M-18, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

.5 ASTM A615/A615M-18e1, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

.6 ASTM A706/A706M-16, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

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

.8 ASTM A929/A929M-18, Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe.

.9 ASTM A1008/A1008M-18, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

.10 AWS D1.4/D1.4M-18, Structural Welding Code – Steel Reinforcing Bars.

.11 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.12 CAN/CSA-G30.18-09 (R2014), Billet Steel Bars for Concrete Reinforcement.

.13 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.14 CAN/CSA-S16-14, Design of Steel Structures.

.15 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section E4 - Submittal Procedures.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheet.

.3 Shop Drawings:

.1 Indicate: reinforcing.

.4 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycle in accordance with Section 01 74 19- Waste Management and Disposal.

.2 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.

.3 Divert unused concrete materials from landfill to local facility as approved by Contract Administrator .

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00- Cast-in-Place Concrete.

.2 Reinforcing steel: to ASTM A706/A706M and/or CAN/CSA-G30.18.

.3 Steel core sections: to CSA-G40.20/G40.21, type 350W.

.4 Seamless steel pipe shell: to ASTM A252, Grade 2, diameters and mass per metre as indicated, plain ends.

.5 Steel casing: to ASTM A36/A36M or ASTM A929/A929M, corrugated steel.

.6 High carbon steel cutting edge collar: to ASTM A53/A53M, welded to bottom of first pipe shell.

.7 Wide welded plate sleeves: to ASTM A1008/A1008M, and as indicated.

.1 External 300 mm forming connections between lengths of steel pipe formed from flat plate.

.8 Welding materials: to CSA W48 and AWS D1.4/D1.4M .

.9 Grout: in accordance with Section 03 30 00- Cast-in-Place Concrete.

2.2 SOURCE QUALITY CONTROL

.1 Mill report to CAN/CSA-S16.

.2 Concrete tests: to CSA-A23.1/A23.2.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Bore holes to diameters and depths as indicated on drawings.

.2 Protective steel casing:

.1 Push down/Vibrate shell to founding level as indicated.

.2 Splice shell by welding piles together by shielded electric welding.

.1 To prevent distortion, tack opposite points first and then opposite sections.

.2 Ensure top member is held in vertical alignment during splicing operation.

.3 Remove material from inside of shell by method approved by Contract Administration.

.3 Check each bored shaft for toxic and explosive gases and provide appropriate protective measures for personnel working in shaft.

.4 A qualify personnel to inspect pile excavation prior to placing of concrete.

.1 Remove loose material, foreign matter and water as directed by Contract Administrator.

.5 Install steel reinforcement in accordance with Section 03 20 00- Concrete Reinforcing and as indicated.

.6 Fill pile excavations with concrete to elevations as indicated.

.1 Place concrete in one continuous pour in accordance with Section 03 30 00- Cast-in-Place Concrete.

.7 Steel protective casing may be removed at option of Contractor, unless otherwise specified.

.8 Where steel protective casing is to be removed, provide concrete with minimum slump of 125 mm and with retarder to prevent arching or setting of concrete.

.1 Withdraw casing in conjunction with concrete placing, keeping bottom of casing 600 mm below level of concrete.

.2 Do not vibrate concrete internally.

.9 Where steel protective casing is left in place, fill void space between casing and shaft excavation with concrete.

.10 Use tremie pipe or concrete pumping with approval Contract Administrator.

3.3 DEFECTIVE PILES

.1 Cased concrete shaft piles rejected where:

.1 Soil has entered casing.

.2 Water has entered casing.

.3 Casing is damaged, out of tolerance or alignment.

.2 Defective pile, as directed by Contract Administrator to be cut off at elevation specified by Contract Administrator and filled with sand.

3.4 FIELD QUALITY CONTROL

.1 Field Records: maintain driving record for each shell, including elevation of bedrock, driven depth of pile, cut-off elevation of shell and protruding core.

3.5 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION