

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121-M1978(R2003), Douglas Fir Plywood.
 - .4 CSA O151-04, Canadian Softwood Plywood.
 - .5 CSA O153-M1980(R2003), Poplar Plywood.
 - .6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.
 - .7 CSA O437 Series-93(R2006), 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
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets.
- .4 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings Comply with CAN/CSA-S269.3 for formwork drawings.
- .5 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:

- .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series or CSA-O153.
- .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .3 Rigid insulation board: to CAN/ULC-S701.
- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .3 Form release agent: non-toxic, biodegradable, low VOC.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm²/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .5 Falsework materials: to CSA-S269.1.
- .6 Sealant: to Section 07 92 10 - Joint Sealing.

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 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .3 Fabricate and erect falsework in accordance with CSA S269.1.
- .4 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .8 Align form joints and make watertight.
 - .1 Keep form joints to minimum.

- .9 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .10 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .12 Construct forms for architectural concrete, and place ties as indicated and as directed.
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .13 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.
- .14 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 5 days for walls and sides of beams.
 - .2 5 days for columns.
 - .3 7 days for beam soffits, slabs, decks and other structural members, or 7 days when replaced immediately with adequate shoring to standard specified for falsework.
 - .4 3 days for footings and abutments.
- .2 Remove formwork when concrete has reached 70 % of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Space reshoring in each principal direction at not more than 3000 mm apart.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .1 ACI 315-99, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A23.3-04, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .4 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .6 CSA W186-M1990(R2002), Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.
- .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
 - .1 Provide type C tension lap splices unless otherwise indicated.

- .5 Quality Assurance: in accordance with PART 2 - SOURCE QUALITY CONTROL.
 - .1 Mill Test Report: upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel.
 - .2 Upon request submit in writing to Contract Administrator proposed source of reinforcement material to be supplied.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.
- .5 Welded steel wire fabric: to ASTM A185/A185M.
 - .1 Provide in flat sheets only.
- .6 Welded deformed steel wire fabric: to ASTM A497/A497M.
 - .1 Provide in flat sheets only.
- .7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .8 Mechanical splices: subject to approval of Contract Administrator.
- .9 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

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

Part 3 Execution

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 Concrete Forming and Accessories.
- .2 Section 03 20 00 Concrete Forming.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260-01, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M-03, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .5 ASTM D412-98a(2002)e1, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .6 ASTM D624-00e1, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .7 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .8 ASTM D1752-04a, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.Canadian General Standards Board (CGSB)
 - .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(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

1.3 ACRONYMS AND TYPES

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).

- .1 Type GU or GUb - General use cement.
- .2 Type HS or HSb - High sulphate-resistant cement.
- .2 Fly ash:
 - .1 Type F - with CaO content less than 8%.
- .3 GGBFS - Ground, granulated blast-furnace slag.

1.4 DESIGN REQUIREMENTS

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

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets.
- .3 At least 4 weeks prior to beginning Work, submit to Contract Administrator samples of following materials proposed for use:
 - .1 1 m length of each type of joint filler.
 - .2 1 m length of each type of waterstops.
- .4 Submit testing results and reports for review by Contract Administrator and do not proceed without written approval when deviations from mix design or parameters are found.
- .5 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .6 Concrete hauling time: submit for review by Contract Administrator deviations exceeding maximum allowable time of 90 minutes for concrete to be delivered to site of Work and discharged after batching.

1.6 QUALITY ASSURANCE

- .1 Submit to Contract Administrator minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .2 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator.
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.

- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.
- .3 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Contract Administrator verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 90 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Contract Administrator.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Waste Management and Disposal:
 - .1 Divert unused concrete materials from landfill to local facility.
 - .2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site.
 - .4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
 - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

Part 2 Products

2.1 MATERIALS

- .1 Cement: to CAN/CSA-A3001, Type HS.
- .2 Blended hydraulic cement: Type HS6 to CAN/CSA-A3001.
- .3 Supplementary cementing materials: with maximum 20% Type F fly ash replacement, by mass of total cementitious materials to CAN/CSA-A3001.
- .4 Water: to CSA-A23.1.
- .5 Aggregates: to CAN/CSA-A23.1/A23.2.
- .6 Admixtures:

- .1 Air entraining admixture: to ASTM C260.
- .2 Chemical admixture: to ASTM C494
- .7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA-A23.1/A23.2.
 - .1 Compressive strength: 50 MPa at 28 days.
- .8 Curing compound: to CSA-A23.1/A23.2 white and ASTM C309, Type 1-chlorinated rubber.
- .9 Mechanical waterstops: ribbed extruded PVC Arctic Grade of sizes indicated with shop welded prewelded corner and intersecting pieces with legs not less than 300 mm long.
- .10 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
 - .2 Sponge rubber: to ASTM D1752, Type I, firm grade.
 - .3 Self-expanding standard cork: to ASTM D1752, Type II.
- .11 Weep hole tubes: plastic.
- .12 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .13 Dampproofing:
 - .1 Emulsified asphalt, mineral colloid type, unfilled: to CAN/CGSB-37.2.
- .14 Polyethylene film: 0.152 mm thickness to CAN/CGSB-51.34.

2.2 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Provide concrete mix to meet following plastic state requirements:
 - .1 Uniformity:
 - .2 Placeability:
 - .3 Workability: free of surface blemishes loss of mortar colour variations segregation.
 - .4 Finishability: amount of bleeding.
 - .5 Set time:
 - .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: S1.
 - .2 Minimum compressive strength at 56 age: 35 MPa.
 - .3 Intended application: foundation slabs and stairwells.
 - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .5 Concrete supplier's certification.

- .2 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Provide concrete mix to meet following plastic state requirements:
 - .1 Uniformity:
 - .2 Placeability:
 - .3 Workability: free of loss of mortar, segregation.
 - .4 Set time:
 - .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: S1.
 - .2 Minimum compressive strength at 56 age: 35 MPa.
 - .3 Intended application: cast-in-place concrete piles.
 - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .5 Concrete supplier's certification.
- .3 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Provide concrete mix to meet following plastic state requirements:
 - .1 Uniformity:
 - .2 Placeability:
 - .3 Workability: free of surface blemishes loss of mortar colour variations segregation.
 - .4 Finishability: amount of bleeding.
 - .5 Set time:
 - .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: N.
 - .2 Minimum compressive strength at 28 age: 30 MPa.
 - .3 Intended application: stairs and other concrete.
 - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .5 Concrete supplier's certification.
- .4 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Provide concrete mix to meet following plastic state requirements:
 - .1 Uniformity:
 - .2 Placeability:
 - .3 Workability: free of loss of mortar, segregation.

- .4 Finishability: amount of bleeding.
- .5 Set time:
- .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: N.
 - .2 Minimum compressive strength at 28 age: 20 MPa.
 - .3 Intended application: masonry fill.
- .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .5 Concrete supplier's certification.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Contract Administrator's approval before placing concrete.
 - .1 Provide 24 hours notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement. Prior to placing of concrete obtain Contract Administrator approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 Protect previous Work from staining.
- .7 Clean and remove stains prior to application for concrete finishes.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .10 Do not place load upon new concrete until authorized by Contract Administrator.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Sleeves and inserts:

- .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Contract Administrator.
 - .2 Where approved by Contract Administrator, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Contract Administrator. Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
 - .4 Check locations and sizes of sleeves and openings shown on drawings.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:
- .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
- .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.
 - .3 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
 - .4 Install continuous vertical anchor slots at 800 mm on centre where concrete walls are masonry faced.
- .5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .6 Finishing and curing:
- .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .1 Schedule:
 - .2 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
 - .3 Finish concrete floor to meet requirements of CSA-A23.1/A23.2. Class A.
 - .4 Provide swirl-trowelled finish unless otherwise indicated.
 - .5 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .7 Waterstops:
- .1 Install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in way as to hamper performance. Do not displace reinforcement when installing waterstops.
 - .3 Use equipment to manufacturer's requirements to field splice waterstops.
 - .4 Tie waterstops rigidly in place.
 - .5 Use only straight heat sealed butt joints in field.

- .6 Use factory welded corners and intersections unless otherwise approved by Contract Administrator.
- .8 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by 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 construction joints as indicated.
 - .4 Install joint filler.
 - .5 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.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2 straightedge method.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: Conduct test and submit report as described in PART 1 - SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump tests.
 - .3 Air and concrete temperature strength testing for each 40 m³ concrete placed and for each type of concrete placed each day.
 - .4 Set of 3 cylinders for compressive.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Contract Administrator for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 City will pay costs of tests.
- .4 Contract Administrator will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.5 VERIFICATION

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Contract Administrator and provide verification of compliance.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 412-98a, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
 - .2 ASTM D 2240-97e1, Standard Test Method for Rubber Property - Durometer Hardness.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-92, Ready Mixed Organic Zinc-Rich Coating.
 - .3 CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1/A23.2-94, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CAN3-A23.3-94, Design of Concrete Structures for Buildings.
 - .3 CAN3-A23.4-94, Precast Concrete - Materials and Construction.
 - .4 CSA-A251-M1982R1998), Qualification Code for Manufacturers of Architectural and Structural Precast Concrete.
 - .5 CSA-G30.15-M1983(R1991)(R1998), Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
 - .6 CAN/CSA-G30.18-M92(R1998), Billet-Steel Bars for Concrete Reinforcement.
 - .7 CAN/CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .8 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .9 CSA-G279- M1982(R1998), Steel for Prestressed Concrete Tendons.
 - .10 CSA-W47.1-92(R1998), Certification of Companies for Fusion Welding for Steel Structures.
 - .11 CSA-W48.1-M1991(R1998), Carbon Steel Covered Electrodes for Shielded Metal Arc Welding.
 - .12 CSA-W59-M1989, Welded Steel Construction (Metal Arc Welding).
 - .13 CSA-W186-M1990(R1998), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.3 DESIGN REQUIREMENTS

- .1 Design precast elements to CAN3-A23.3 and CAN3-A23.4 to carry handling stresses.
- .2 Design precast elements to carry loads specified by drawings or as indicated, in accordance with 2005 National Building Code of Canada (NBC).
- .3 Design connections/attachments of precast elements to load/forces specified by drawings and 2005 NBC.
- .4 Submit 4 copies of detailed calculations and design drawings for typical precast elements and connections for Contract Administrator for review 4 weeks prior to manufacture.

1.4 PERFORMANCE REQUIREMENTS

- .1 Tolerance of precast elements to CAN3-A23.4, Section 10.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures, and in accordance with CAN3-A23.3 and CAN3-A23.4 .
- .2 Include the following items:
 - .1 Design calculations for items designed by manufacturer.
 - .2 Details of prestressed and non-prestressed members, reinforcement and their connections.
 - .3 Camber.
 - .4 Finishing schedules.
 - .5 Methods of handling and erection.
 - .6 Openings, sleeves, inserts and related reinforcement.
- .3 Ensure each drawing submitted bears stamp and signature of qualified professional engineer registered or licensed in province of Manitoba, Canada.

1.6 QUALIFICATIONS

- .1 Precast concrete elements to be fabricated and erected by manufacturing plant certified by Canadian Standards Association in appropriate categories according to CSA-A251.
- .2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting Bid and to specifically verify as part of Bid that plant is currently certified in appropriate categories, Structural and Prestressed.
- .3 Only precast elements fabricated in such certified plants to be acceptable to City, and plant certification to be maintained for duration of fabrication, erection until warranty expires.
- .4 Welding companies certified to CSA-W47.1.

1.7 WARRANTY

- .1 Contractor hereby warrants that precast element will not spall or show visible evidence of corrosion of embedded steel and cracking, except for normal hairline shrinkage cracks, but for 1 year.

Part 2 Products

2.1 MATERIALS

- .1 Cement, aggregates, water, admixtures: to CAN/CSA-A23.1 and CAN3-A23.4.
- .2 Reinforcing steel: to CAN/CSA-G30.18.
- .3 Prestressing steel tendons and bars: to CAN/CSA-S6 and CSA-G279.
- .4 Welded wire fabric: to CSA-G30.15.
- .5 Hardware and miscellaneous materials: to CAN/CSA-A23.1.
- .6 Forms: to CAN3-A23.4.
- .7 Anchors and supports: to CAN/CSA G40.21 Type 300 W galvanized after fabrication.
- .8 Welding materials: to CSA-W48.1.
- .9 Welding electrodes: to CSA-W48.1 and certified by Canadian Welding Bureau.
- .10 Galvanizing: hot dipped galvanizing with minimum zinc coating of 610 g/m² to CAN/CSA-G164.
- .11 Zinc-rich primer: to CAN/CGSB-1.181.
- .12 Bearing pads: smooth, steel.
- .13 Air entrainment admixtures: to ASTM C260-01.
- .14 Chemical admixtures: to ASTM C494.
- .15 Shims: steel.

2.2 MIXES

- .1 Concrete.
 - .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1, to give following properties: for all concrete.
 - .1 Cement: use Type GU Portland cement or Type GUb blended hydraulic cement Portland cement and Type F flax ash supplementary cementing materials.
 - .2 Minimum compressive strength at 28 days: 30 MPa.

- .3 Class of exposure: F2.
- .4 Nominal size of coarse aggregate: 20 mm.
- .5 Chemical admixtures: type air entrainment.
- .2 Grout.
 - .1 Shrinkage compensating grout: to Section 03 30 00 - Cast-in-Place Concrete.

2.3 MANUFACTURED UNITS

- .1 Manufacture units in accordance with CAN3-A23.4, and CSA-A251.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit which will not be exposed.
- .3 Provide hardware suitable for handling elements.
- .4 Design tendons and anchorages in accordance with CAN3-A23.3 CAN/CSA-S6.
- .5 Galvanize anchors steel embedments after fabrication and touch up with zinc-rich primer after welding.

2.4 FINISHES

- .1 Finish units to finish grade A to CAN3-A23.4, Section 24.

2.5 SOURCE QUALITY CONTROL

- .1 Provide Contract Administrator with certified copies of quality control tests related to this project as specified in CAN3-A23.4 and CSA-A251 CSA-G279.
- .2 Inspect prestressed concrete tendons in accordance with CSA-G279.
- .3 Provide records from in-house quality control programme based upon plant certification requirements to Contract Administrator for inspection and review.
- .4 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel supplied, showing physical and chemical analysis.
- .5 Precast plants should keep complete records of supply source of concrete material, steel reinforcement, prestressing steel and provide to Contract Administrator for review upon request.

Part 3 Execution

3.1 ERECTION

- .1 Do precast concrete work in accordance with CAN3-A23.4 and CAN3-A23.3.
- .2 Do welding in accordance with CSA-W59, for welding to steel structures and CSA-W186, for welding of reinforcement.

- .3 Non-cumulative erection tolerances in accordance with CAN3-A23-4, Section 10.
- .4 Set elevations and alignment between units to within allowable tolerances before connecting units.
- .5 Fasten precast units in place as indicated on reviewed shop drawings.
- .6 Do not weld or secure bearing plates at sliding joints.
- .7 Install precast concrete closures between stems of flanged units where indicated.
- .8 Clean field welds with wire brush and touch-up galvanized finish with zinc-rich primer.

3.2 CLEANING

- .1 Obtain approval of cleaning methods from Contract Administrator before cleaning soiled precast concrete surfaces.

END OF SECTION