

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .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(R2013), 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 CAN/CSA-S269.3-M92(R2013), Concrete Formwork, National Standard of Canada

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork.
- .3 Indicate method and schedule of construction, procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .5 Indicate sequence of erection and removal of formwork as directed by Departmental Representative.
- .6 Each shop drawing submitted to bear the stamp and signature of a qualified Professional Engineer registered or licensed to practice in the Province of Nova Scotia.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.
 - .2 Place materials defined as hazardous or toxic in designated containers.
 - .3 Divert wood materials from landfill to a recycling, reuse or composting facility as approved by Departmental Representative.
 - .4 Divert plastic materials from landfill to a recycling, reuse or composting facility as approved by Departmental Representative.

- .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by Departmental Representative.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Formwork materials:
 - .1 Use plywood and wood formwork materials to CSA-0121, CSA-086, and CSA-0153.
 - .2 For exposed to view flat surfaces, use medium dense overlay plywood, 19 mm thick.
- .2 Form ties:
 - .1 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
- .3 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, preventing concrete from sticking to forms.
- .4 Form stripping agent: colourless mineral oil, subject to Departmental Representative's approval.

PART 3 EXECUTION

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Contractor solely responsible for design and construction of formwork and safety of structure before and after forms are removed.
- .3 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .4 Formwork and all supporting or bracing members shall be designed such that they will not deflect noticeably under the weight or pressure of the concrete and other loadings incidental to construction. The maximum deflection of facing materials in concrete surfaces exposed to view shall be 1/360 of the span between supporting members.
- .5 When necessary to maintain specified tolerances, the formwork shall be cambered to compensate for anticipated deflections.
- .6 Align form joints and make watertight. Keep form joints to minimum.
- .7 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .8 Form chases, slots, recesses as indicated.
- .9 Build in inserts, anchors, and other embedments as required.

- .10 Before concrete is placed, all forms are to be inspected by Contractor's superintendent to ensure that they are properly placed, sufficiently rigid and tight enough to prevent leakage of water from concrete.
- .11 Prior to placing concrete, suitable means for checking alignment and elevations of forms during concrete placement operation shall be devised. Checks shall be made frequently during placement. Corrective wedging or shoring carried out both horizontally and vertically as required, until all concrete is in place.
- .12 Properly clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete. Provide temporary openings for clean-out purposes at bottom of all deep units.

3.2 TOLERANCES

- .1 Variations from plumb: in the lines and surfaces of wall: 6 mm per 3 m but not more than 20 mm.
- .2 Variations from the level or from the grades indicated on the drawings: in 3 mm - 6 mm, but not to exceed 10 mm.
- .3 Variation in the thickness of slabs and walls: minus 6 mm, plus 12 mm.
- .4 Footings: variations in dimensions in plan: minus 12 mm, plus 50 mm.
- .5 Misplacement or eccentricity: plus or minus 30 mm.
- .6 In addition to the above, all concrete wall and footing tolerances to be within requirements of CSP arch manufacturer.

3.3 FORMWORK REMOVAL

- .1 Unless otherwise approved, leave formwork in place for following minimum periods of time after placing concrete:
 - .1 3 day for footings.
 - .2 7 days for walls.
- .2 Remove formwork when concrete has reached 80% of its design strength or minimum period noted above, whichever comes later,
- .3 Forms shall be removed progressively and with care so that corner of concrete members are not damaged.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 10 00 - Concrete Forming and Accessories.
- .3 Section 03 30 00 - Cast-in-Place Concrete.

1.2 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 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A1064/A1064M-15, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A23.3-14, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18-09(R2014), Billet-Steel Bars for Concrete Reinforcement.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

- .1 Submit shop drawings, including placing of reinforcement, in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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 with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .3 Each shop drawing submitted to bear stamp and signature of a qualified Professional Engineer registered or licensed to practice in the Province of Nova Scotia.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 47 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Place materials defined as hazardous or toxic in designated containers.
- .2 Handle and store reinforcing steel in such a manner to keep it free of dirt, mud, ice and water.
- .3 Off-load reinforcing steel from the truck directly onto purpose-made storage racks and cover with tarps.
- .4 Clean reinforcing steel of excess rust and previously deposited concrete prior to placing concrete.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 All bars shall be free from loose rust or scale, oil, structural defects, and shall be unpainted and uncoated. Bars shall be bent cold and accurately shaped as required.
- .4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M-15.
- .5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

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.
 - .1 ACI 315R unless indicated otherwise.
- .2 Hooks are to be standard unless noted otherwise. All splices shall be Class "B" tension lap splices. No more than 50% of the reinforcing shall be spliced at any given location.
- .3 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .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 Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum four (4) weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative 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 Departmental Representative.
- .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 Install, support and space reinforcement in alignment to position and clearances indicated and secure to supports.
- .3 All reinforcing shall be accurately placed and secured against displacement by ties or clips and shall be supported by concrete or metal supports, spacers, etc.
- .4 Placing accessories shall be provided in such spacing as to adequately support the reinforcing in its designated position.
- .5 The Contractor shall inform the Departmental Representative 48 hours before the concrete is to be poured. Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .6 Remove and replace reinforcement which is visibly damaged or cracked.
- .7 Do not cut reinforcement, either before or after concrete it's placed, to permit incorporation of other work.
- .8 Do not relocate reinforcement without approval.
- .9 Clean reinforcement before placing concrete.

3.3 CONCRETE PROTECTION FOR REINFORCEMENT

- .1 Unless otherwise indicated on plans, reinforcing steel shall be detailed so that distance from face of steel to nearest face of concrete is not less than one diameter, nor in any case less than the following:
 - .1 70 ± 20 mm for footings exposed surfaces and walls.

- .2 100 ± 25 mm for concrete surfaces cast against and permanently
exposed to earth (bottom bars in footing.)

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 10 00 - Concrete Forming and Accessories.
- .3 Section 03 20 00 - Concrete Reinforcing.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .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 C330/C330M-14, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - .4 ASTM C494/C494M-15, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06(R2011), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-13, Cementitious Materials for Use in Concrete.

1.3 DESIGN REQUIREMENTS

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

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit proposed quality control procedures for Departmental Representative's review.
- .3 Minimum two (2) weeks prior to starting concrete work, submit proposed quality control procedures for Departmental Representative's approval for following items:
 - .1 Cold and hot weather concreting.
 - .2 Temporary bracing.
 - .3 Chairs and spacers for support of reinforcing.
 - .4 Curing of concrete.

- .5 Finishes.
- .6 Formwork removal.

1.5 CONSTRUCTION QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out in accordance with CSA-A23.1.
- .2 Testing laboratory will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .3 Non-destructive methods for testing concrete shall be in accordance with CSA-A23.2.
- .4 Inspection or testing by Departmental Representative, or Testing Agency designated by Departmental Representative, will not augment or replace the Contractor's quality control nor relieve him of his contractual responsibilities.

1.6 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 At least 2 weeks prior to beginning Work, inform Departmental Representative of proposed source of aggregates and provide access for sampling.

1.7 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Site Meetings: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart, convene pre-installation meeting one week prior to beginning of concrete work.
- .3 Ensure key personnel, site supervisor, Departmental Representative, speciality contractor - finishing, forming concrete producer, and representative from testing laboratories attend.
 - .1 Verify project requirements.
- .4 Provide certification that plant, equipment and materials to be used in concrete comply with requirements of CSA-A23.1.
- .5 Provide mix designs in compliance with CSA-A23.1 to provide concrete quality, yield and strength as specified under paragraph 2.2 - MIXES. Mix designs to be prepared by and stamped by an engineer licensed to practice in Nova Scotia.
- .6 Provide certification that the concrete supplier is certified by the Atlantic Provinces Ready Mixed Concrete Association program or equivalent. This certification is to remain in good standing for the duration of the project and until the warranty period expires.

1.8 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 120 minutes after batching.

- .1 Modifications to maximum time limit must be agreed to Engineer laboratory representative and concrete producer as described in CSA A23.1/A23.2.
- .2 Deviations to be submitted for review by Departmental Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Divert unused concrete materials from landfill to local quarry facility approved by Departmental Representative.
 - .3 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Departmental Representative.
 - .5 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.
 - .6 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 GU, or Type GUb.
- .2 Supplementary cementing materials: to CAN/CSA-A3001.
- .3 Water: to CSA-A23.1.
- .4 Aggregates:
 - .1 To CAN/CSA-A23.1/A23.2 and ASTM C330/C330M. Coarse aggregates to be normal density.
 - .2 Maximum aggregate size shall not exceed 19 mm.
- .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260/C260M. Air entrainment shall be used in all concrete.
 - .2 Chemical admixture: to ASTM C494/C494M and ASTM C1017/C1017M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 MIXES

- .1 Provide the concrete mix designs for all concrete used in the work.

- .2 Ensure that the mixture proportions are properly batched, mixed, placed, and cured, such that the concrete conforms to the specification.
- .3 Proportion normal density concrete in accordance with A23.1, Alternative 1, to give the following quality for concrete as indicated:
 - .1 For general structural concrete:
 - .1 Minimum compressive strength at 28 days: 35 MPa.
 - .2 Class of exposure: C-1.
 - .3 Maximum water/cement ratio: 0.40.
 - .4 Nominal maximum size of coarse aggregate: 19 mm.
 - .5 Slump at time and point of discharge: 80 mm ± 20 mm.
 - .6 Air content: 4 to 7% for walls.
 - .2 For mud slab:
 - .1 Minimum compressive strength at 28 days: 15 MPa.
 - .2 Class of exposure: N.
 - .3 Nominal size of coarse aggregate: 19 mm.
 - .4 Slump at time of discharge: 80 mm.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Obtain Departmental Representative'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.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature, and test samples taken.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

- .11 Do not place load upon new concrete until authorized by Departmental Representative.
- .12 Reinforcing steel, embedded parts, and inserts to be secured in position prior to placing concrete.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Hot-weather and cold-weather concreting shall be carried out, protected, and cured in accordance with CSA-A23.1.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Cure all concrete for a minimum of 7 days after placing.
- .5 Finishing and curing:
 - .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .2 Formed surfaces:
 - .1 Concrete wall surfaces to be left exposed in finished work - smooth form finish.
- .6 Should the strength of concrete already poured, as shown by job cured test cylinders, fall below the required strength at 28 days, or at 7 days test fail to reach a minimum of 70% of 28 days strength, the Departmental Representative shall have the right to require changes in mixing proportions for the remainder of the work so as to attain these strengths. The Departmental Representative shall also have the right to require additional curing of these portions of the work represented by test specimens not meeting the herein quoted strength criteria.
- .7 Should such additional curing not produce the required strength, the Departmental Representative shall have the right to require strengthening or replacement of the portions of work in question at no additional cost to the Owner.
- .8 The Departmental Representative reserves the right to reduce the amount of payment for all concrete which failed to meet the requirements of the drawings and this specification, where the defect is such as to permit leaving the concrete in question in place.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2 and as otherwise indicated on the drawings.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in paragraph 1.4 - SUBMITTALS.
 - .1 Concrete strength tests.
 - .2 Slump tests.
 - .3 Air content test.

- .2 Inspection and testing of concrete and concrete materials will be carried out in accordance with CSA-A23.1/A23.2 by testing laboratory designated by Departmental Representative.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
 - .2 Submit test results to Departmental Representative as soon as test is complete.
- .3 Ensure test results are distributed for discussion at pre-pour meeting between testing laboratory and Departmental Representative.
- .4 Costs of tests will not be measured separately for payment but shall be included in the overall cost of the project.
- .5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .7 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

END OF SECTION

1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 185/A 185M-05a, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .2 ASTM A 775/A 775M-04a, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .3 ASTM C 260-01, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .4 ASTM D 412-98a(2002)e1, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
 - .5 ASTM D 2240-05, Standard Test Method for Rubber Property - Durometer Hardness.
 - .6 ASTM C 1433-10, Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers.
 - .7 ASTM C 877-10, External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-99, Ready Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A23.3-(R2010), Design of Concrete Structures.
 - .3 CSA-A23.4-09, Precast Concrete - Materials and Construction.
 - .4 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-08, Cementitious Materials for Use in Concrete.
 - .5 CAN/CSA-G30.18-09, Carbon-Steel Bars for Concrete Reinforcement.
 - .6 CAN/CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .7 CAN/CSA-S6-06, Canadian Highway Bridge Design Code.
 - .8 CSA-W47.1-09, Certification of Companies for Fusion Welding for Steel.
 - .9 CAN/CSA W48-06(R2011), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .10 CSA-W59-03 (R2008), Welded Steel Construction (Metal Arc Welding) (Metric version).
 - .11 CSA-W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 The Master Painters Institute (MPI) - Architectural Painting Specification Manual (ASM) - February 2004
 - .1 MPI # 18, Organic Zinc Rich Primer.
 - .2 MPI # 23, Oil Alkyd Primer.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .6 American Association of State Highway and Transportation Officials (AASHTO)

- .1 LRFO Bridge Design Specifications.

1.2 DESIGN REQUIREMENTS

- .1 Design precast elements to CSA-A23.3 and CSA-A23.4 to carry handling stresses.
- .2 Design precast concrete panel retaining walls to carry highway loads in accordance with Canadian Highway Bridge Design Code, CAN/CSA-S6.
- .3 Design connections/attachments of arch culvert and associated precast concrete panel retaining walls to load/forces specified by Canadian Highway Bridge Design Code, CAN/CSA-S6.
- .4 Provide detailed design drawings for typical precast elements and connections as described in PART 1 - SUBMITTALS.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets.
- .3 Submit shop drawings in accordance with CSA-A23.3 and CSA-A23.4 and include following items:
 - .1 Details of prestressed and non-prestressed members, reinforcement and their connections.
 - .2 Camber.
 - .3 Gaskets.
 - .4 Finishing schedules.
 - .5 Methods of handling, erection and sealing.
 - .6 Openings, sleeves, inserts and related reinforcement.
- .4 Shop Drawings: submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

1.4 QUALITY ASSURANCE

- .1 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Departmental Representative verifying compliance that concrete provided meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.5 QUALIFICATIONS

- .1 Fabricate and erect precast concrete elements by manufacturing plant certified in appropriate categories according to CSA-A23.4
- .2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting tender and to specifically verify as part of tender that plant is currently certified in appropriate categories, (Structural).
- .3 Only precast elements fabricated in such certified plants to be acceptable to Departmental Representative and plant certification to be maintained for duration of fabrication, erection until warranty expires.
- .4 Welding companies certified to CSA-W47.1.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle and store precast/prestressed units according to manufacturer's instructions.
- .2 Protect unit corners from contacting earth to prevent from staining.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.1 MANUFACTURED UNITS

- .1 Manufacture units in accordance with CSA-A23.4.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit not be exposed.
- .3 Provide hardware suitable for handling elements.
- .4 Shop prime anchors and steel inserts after fabrication and touch up primer on anchors after welding. Do not apply primer to embedded portion of anchor or inserts.
- .5 Precast concrete panel retaining walls: geometry as indicated.
 - .1 Only proprietary engineered concrete retaining wall systems are acceptable.
 - .2 Provide Departmental Representative with one set of complete working drawings, and one copy of detailed design calculations, for review at least 4 weeks prior to beginning construction. Drawings shall indicate dimensions of units, wall elevations, sections and grade profile. Drawings and design calculations to bear signature and stamp of qualified professional engineer registered or licensed in province of Nova Scotia in Canada.
 - .3 Verify existing site conditions and ground elevations before preparing working drawings.
 - .4 Use only one type of proprietary engineered retaining wall system for Project. Do not substitute for any component normally supplied by supplier of proprietary engineered retaining wall system.
 - .5 Wall unit texture and pattern shall be continuous at all exposed wall areas.

2.2 FINISHES

- .1 Finish units to standard grade to CSA-A23.4.

2.3 SOURCE QUALITY CONTROL

- .1 Provide Departmental Representative with certified copies of quality control tests related to this project as specified in CSA-A23.4 and CSA-G279.
- .2 Provide records from in-house quality control program based upon plant certification requirements to Departmental Representative for inspection and review.
- .3 Provide Departmental Representative with certified copy of mill test report of reinforcing steel supplied, showing physical and chemical analysis.

- .4 Precast plants should keep complete records of supply source of concrete material, steel reinforcement, prestressing steel and provide to Departmental Representative for review upon request.

3 EXECUTION

3.1 ERECTION

- .1 Erect, fasten and join precast elements in accordance with manufacturer's instruction, and as indicated on reviewed shop drawings.
- .2 Do precast concrete work in accordance with CSA-A23.4 CSA-A23.3 and CAN/CSA-S6.
- .3 Do welding in accordance with CSA-W59, for welding to steel structures and CSA-W186, for welding of reinforcement.
- .4 Non-cumulative erection tolerances in accordance with CSA-A23-4.
- .5 Set elevations and alignment between units to within allowable tolerances before connecting units.

3.2 VERIFICATION

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in Part 2 - Products, by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

3.3 CLEANING

- .1 Use cleaning methods as reviewed by Departmental Representative before cleaning soiled precast concrete surfaces.

END OF SECTION