

## PART 1 - GENERAL

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| <u>1.1 RELATED WORK</u>                  | .1 | Section 02 41 13 - Selective Site Demolition.   |
|  | .2 | Section 02 41 13.14 - Asphalt Pavement Removal.   |
| <u>1.2 REFERENCES</u>                    | .1 | CAN/CSA-A23.1-M90 - Concrete Materials and Methods of Concrete Construction.  |
| <u>1.3 ENVIRONMENTAL CONDITIONS</u>      | .1 | Provide adequate nuisance dust protection masks and ear protection to operator.   |
|  | .2 | Wet cutting only will be permitted unless directed otherwise by Departmental Representative.  |
| <u>1.4 PROTECTION</u>                    | .1 | Protect surrounding surfaces from damage due to work of this section. Make good such damage to satisfaction of Departmental Representative and at no additional cost.                                   |
| <u>1.5 CONCRETE CUTTING</u>              | .1 | Contractor to cut concrete as required.   |
| <u>1.6 CONTRACTOR'S RESPONSIBILITIES</u> | .1 | Furnish labour and facilities to:<br>.1 Provide access to work requiring cutting.<br>.2 Make good work disturbed by Cutting.<br>.3 Provide storage on site for cutting specialists equipment and tools. |

## PART 2 - PRODUCTS

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| <u>2.1 MATERIALS</u> | .1 | Concrete cutting saw to CAN/CSA-C22.2 No 71.1-M89 - Portable Electric Tools. |
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PART 3 - EXECUTION

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| <u>3.1 PREPARATION</u>          | .1 | Define exactly, all lines to be cut or cored and mark with indelible lines. All quantities and thicknesses to be determined with Departmental Representative and provided to Departmental Representative in writing. |
|                                 | .2 | Advise Departmental Representative prior to commencing cutting.  |
|                                 | .3 | Departmental Representative to approve areas, quantities, and thicknesses identified prior to any cutting  |
| <u>3.2 CUTTING,<br/>GENERAL</u> | .1 | Sawcut to depth required using a purpose made blade in a specialized concrete saw. Depth to be a minimum of 15 mm to avoid the necessity of feather edging.  |
|                                 | .2 | Sawed surfaces to be smooth, plane and parallel unless otherwise specified.  |
|                                 | .3 | Remove all debris and clean surfaces of loose material.  |
|                                 | .4 | Remove all concrete dust and debris resulting from work specified and dispose of off DND property at NSDEL approved dumpsite.  |

## PART 1 - GENERAL

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| <u>1.1 RELATED SECTIONS</u> | .1 | Section 01 74 21 - Construction/ Demolition Management and Disposal. |
|                             | .2 | Section 03 20 00 - Concrete Reinforcing.                             |
|                             | .3 | Section 03 30 00 - Cast-in-Place Concrete.                           |
|                             | .4 | Section 03 35 00 - Concrete Finishing.                               |
|                             | .5 | Section 33 42 13.01 - Concrete Open Span Culvert.                    |

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| <u>1.2 REFERENCES</u> | .1 | Canadian Standards Association (CSA)  |
|                       | .1 | CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction. |
|                       | .2 | CSA-086S1-05, Engineering Design in Wood (Limit States Design).                 |
|                       | .3 | CSA S269.1-1975(R2003), Falsework for Construction Purposes.                    |
|                       | .4 | CAN/CSA-S269.3-M92(R2008) Concrete Formwork.                                    |
|                       | .5 | CSA 0121-08, Douglas Fir Plywood.   |
|                       | .2 | Council of Forest Industries of British Columbia (COFI)                         |
|                       | .1 | COFI Exterior Plywood for Concrete Formwork.                                    |

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| <u>1.3 SHOP DRAWINGS</u> | .1 | Submit shop drawings for formwork and falsework for suspended slab formwork and supports in accordance with Section 01 33 00 - Submittal Procedures.  |
|                          | .2 | Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangements 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. |
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| <u>1.3 SHOP DRAWINGS<br/>(Cont'd)</u> | .3 | Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.                                 |
|                                       | .4 | Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.   |
|                                       | .5 | Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in the Province of Nova Scotia. |

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| <u>1.4 RESPONSIBILITY</u> | .1 | Contractor to design for method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings. |
|                           | .2 | Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms upon request from Departmental Representative.  |

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| <u>1.5 WASTE<br/>MANAGEMENT AND<br/>DISPOSAL</u> | .1 | Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.  |
|  | .2 | Place materials defined as hazardous or toxic waste in designated containers.  |
|  | .3 | Ensure emptied containers are sealed and stored safely for disposal away from children.  |
|  | .4 | Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.<br>.1 Use of sealers, form release and stripping agents within the inboard side of the weather barrier, including must comply with VOC limits as set by SCAQMD Rule 1113. |
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| <u>1.6 DELIVERY,<br/>STORAGE AND<br/>HANDLING</u> | .1 | Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.             |
|   | .2 | Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign matter. Handle and erect the fabricated formwork so as to prevent damage. |

## PART 2 - PRODUCTS

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| <u>2.1 MATERIALS</u> | .1 | Formwork materials:<br>.1 Use wood and wood product formwork materials to CSA-A23.1/A23.2 and CSA 0121.<br>.2 Plywood and wood formwork materials to CSA-0121, CAN3-086.1, CAN3-086.1S1, CSA 0153.  |
|                      | .2 | Falsework materials: to CSA S269.1.   |
|                      | .3 | Form ties:<br>.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. Holes are to be filled with non-shrink grout.<br>.2 Adjustable in lengths to permit tightening and alignment of forms. |
|                      | .4 | Form release agent: non-toxic, biodegradable, low VOC, chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.  |
|                      | .5 | Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm <sup>2</sup> /sat 40°C, flashpoint minimum 150°C, open cup.   |
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### PART 3 - EXECUTION

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| <u>3.1 FABRICATION AND<br/>ERECTION</u> | <ul style="list-style-type: none"> <li>.1 Verify lines and levels before proceeding with formwork/falsework and ensure dimensions agree with drawings. Review all drawings and check dimensions prior to construction for proper fit and report any discrepancies before proceeding with the work.</li> <li>.2 Obtain Departmental Representative's approval for use of earth forms.</li> <li>.3 Obtain Departmental Representative's approval before framing openings not indicated on drawings.</li> <li>.4 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.</li> <li>.5 Assemble formwork so that concrete is not damaged during its removal.</li> <li>.6 Fabricate and erect falsework in accordance with CSA S269.1 and COFI exterior plywood for concrete formwork.</li> <li>.7 Provide form finishes as per CAN/CSA A23.1-09 and ACI 301 as follows: <ul style="list-style-type: none"> <li>.1 Top of footings: rough form finish to CSA A23.1.</li> <li>.2 Repair all deficient areas prior to proceeding with other finishes.</li> </ul> </li> <li>.8 Do not place shores and mud sills on frozen ground.</li> <li>.9 Provide site drainage to prevent washout of soil supporting mud sills and shores.</li> <li>.10 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.</li> <li>.11 Align form joints and make watertight. Keep form joints to minimum.</li> </ul> |
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3.1 FABRICATION AND  
ERECTION  
(Cont'd)

- .12 Locate horizontal form joints for walls and pilasters below top of finished grade. Minimize vertical form joints for walls above top of finished grade.
- .13 Form slots, openings, drips, recesses, expansion and control joints as indicated.
- .14 Prior to placing concrete, the elevations of forms shall be checked to verify drainage slopes.
- .15 Provide 48 hours notice to Departmental Representative for inspection prior to concrete placement.
- .16 Clean formwork as erection proceeds, to remove foreign matter. Remove cuttings, shavings and debris from within forms. Flush completely with water to remove remaining foreign matters. Ensure that water and debris drain to exterior through clean-out ports.
- .17 During cold weather, remove ice and snow from within forms, do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure.
- .18 Patch all form tie holes and finish surface to remove all evidence of tie holes and/or patching.
- .19 Construction Joints:
  - .1 Form construction joints where required and as approved.
  - .2 Build waterstops into forms, supported against displacement by pouring of concrete.
  - .3 Use preformed waterstop corners and intersections where they are available to suit conditions.
  - .4 Join waterstops to preformed corners and intersections, and between lengths with butted and welded connections in accordance with manufacturer's recommendations.
- .20 Clean formwork in accordance with CSA A23.1/A23.2 before placing concrete.

3.1 FABRICATION AND ERECTION  
(Cont'd)

- .21 Apply form release agent to all formed surfaces prior to casting concrete.

3.2 REMOVAL AND  
RESHORING

- .1 Notify Departmental Representative prior to form removal.
- .2 Form removal times are dependent on proper curing as specified herein.
- .3 Remove formwork progressively and in accordance with the reference code requirements, and so that no shock loads or imbalanced loads are imposed on the structure.
- .4 Leave formwork in place for following minimum periods of time after placing concrete.  
.1 3 days for footings and retaining walls.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.
- .6 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.
- .7 Provide all 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.



PART 1 - GENERAL

1.1 PRICE AND  
PAYMENT PROCEDURES .1 Not Used

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 CSA International  
.1 CSA-A23.1-09/A23.2-09, Concrete  
Materials and Methods of Concrete  
Construction/Test Methods and Standard  
Practices for Concrete.  
.2 CSA-A23.3-04 (R2010), Design of  
Concrete Structures.  
.3 CSA-G30.18-09, Carbon Steel Bars for  
Concrete Reinforcement.  
.4 CSA W186-M1990(R2007), Welding of  
Reinforcing Bars in Reinforced Concrete  
Construction.  
.3 Reinforcing Steel Institute of Canada (RSIC)  
.1 RSIC-2004, Reinforcing Steel Manual of  
Standard Practice.

1.3 ACTION AND  
INFORMATIONAL  
SUBMITTALS .1 Submit 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 Shop Drawings:  
.1 Submit drawings stamped and signed by  
professional engineer registered or licensed  
in Nova Scotia.  
.1 Indicate placing of reinforcement  
and:  
.1 Bar bending details.  
.2 Lists.  
.3 Quantities of reinforcement.

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| 1.3 ACTION AND<br>INFORMATIONAL<br>SUBMITTALS<br>(Cont'd) | .3 (Cont'd)<br>.1 (Cont'd)<br>.4 Sizes, spacings, locations of<br>reinforcement and mechanical<br>splices if approved by<br>Departmental Representative, with<br>identifying code marks to permit<br>correct placement without<br>reference to structural drawings.<br>.5 Indicate sizes, spacings and<br>locations of chairs, spacers and<br>hangers.<br>.2 Detail lap lengths and bar development<br>lengths to CSA-A23.3, unless otherwise<br>indicated.<br>.1 Provide type B tension lap splices<br>where indicated unless otherwise<br>indicated.                                       |
| 1.4 QUALITY<br>ASSURANCE                                  | .1 Submit in accordance with Section 01 45 00<br>- Quality Control and as described in PART<br>2 - SOURCE QUALITY CONTROL.<br>.1 Mill Test Report: upon request, provide<br>Departmental Representative with certified<br>copy of mill test report of reinforcing<br>steel, minimum 4 weeks prior to beginning<br>reinforcing work.<br>.2 Upon request submit in writing to<br>Departmental Representative proposed source<br>of reinforcement material to be supplied.  |
| 1.5 DELIVERY,<br>STORAGE AND<br>HANDLING                  | .1 Deliver, store and handle materials in<br>accordance with Section 01 61 00 - Common<br>Product Requirements and with manufacturer's<br>written instructions.<br>.2 Delivery and Acceptance Requirements:<br>deliver materials to site in original<br>factory packaging, labelled with<br>manufacturer's name and address.<br>.3 Storage and Handling Requirements:<br>.1 Store materials off ground indoors in<br>dry location and in accordance with<br>manufacturer's recommendations in clean,<br>dry, well-ventilated area.<br>.2 Replace defective or damaged materials<br>with new. |
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## 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 CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to ASTM A 82/A 82M.
- .4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .5 Mechanical splices: subject to approval of Departmental Representative.
- .6 Smooth plain round bars: to CSA-G40.20/G40.21.

### 2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 ANSI/ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada. Shop fabricate and bend all reinforcing steel.
    - .1 ACI 315R unless indicated otherwise.
  - .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
  - .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
  - .4 Have welding performed by workers qualified under CSA W47.1.
    - .1 Welding of reinforcing steel to have prior approval of Departmental Representative.
  - .5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
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2.2 FABRICATION  
(Cont'd)

- .6 Match dowels from footings to vertical reinforcing in wall above.

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 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

2.4 CLEANING

- .1 Clean reinforcing to CSA/A23.2. All reinforcing bars are to be free of scale, rust, and contamination at time of placing in forms.

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 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.

3.2 PLACING  
REINFORCEMENT  
(Cont'd)

- .3 After reinforcing is placed and prior to closing of forms, obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

3.3 STORAGE

- .1 Store reinforcing steel to prevent deterioration, contamination, or disfigurement.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Abbreviations and Acronyms:
  - .1 Cement: hydraulic cement or blended hydraulic cement (GUb - where b denotes blended).
    - .1 Type GU or GUb - General use cement.
- .2 Reference Standards:
  - .1 ASTM International
    - .1 ASTM C 260-06, Standard Specification for Air-Entraining Admixtures for Concrete.
    - .2 ASTM C 309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
    - .3 ASTM C 494/C 494M-08a, Standard Specification for Chemical Admixtures for Concrete.
    - .4 ASTM C 1017/C 1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
    - .5 ASTM A615/A615M-12, Standard Specification for Deformed and Plain Carbon-steel Bars for Concrete Reinforcement.
  - .2 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 A283-06, Qualification Code for Concrete Testing Laboratories.
    - .3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .4 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.2 ADMINISTRATIVE  
REQUIREMENTS

- .1 Pre-installation Meetings: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart, convene pre-installation meeting one week prior to beginning concrete works.

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| 1.2 ADMINISTRATIVE<br>REQUIREMENTS<br>(Cont'd) | .1 | (Cont'd)<br>.1 Ensure key personnel, site supervisor,<br>Departmental Representative speciality<br>contractor - forming concrete producer,<br>testing laboratories attend.<br>.1 Verify project requirements.   |
| 1.3 ACTION AND<br>INFORMATIONAL<br>SUBMITTALS  | .1 | Provide submittals in accordance with<br>Section 01 33 00 - Submittal Procedures.   |
|  | .2 | Provide testing inspection results and<br>reports for review by Departmental<br>Representative and do not proceed without<br>written approval when deviations from mix<br>design or parameters are found.   |
|  | .3 | Concrete pours: provide accurate records of<br>poured concrete items indicating date and<br>location of pour, quality, air temperature<br>and test samples taken as described in PART<br>3 - FIELD QUALITY CONTROL.   |
|  | .4 | Concrete hauling time: provide for review by<br>Departmental Representative deviations<br>exceeding maximum allowable time of 120<br>minutes for concrete to be delivered to site<br>of Work and discharged after batching.   |
|  | .5 | Provide two copies of WHMIS MSDS in<br>accordance with Section 01 35 29.06 - Health<br>and Safety Requirements 01 35 43 -<br>Environmental Procedures.  |
| 1.4 QUALITY<br>ASSURANCE                       | .1 | Quality Assurance: in accordance with<br>Section 01 45 00 - Quality Control.  |
|  | .2 | Provide Departmental Representative, minimum<br>4 weeks prior to starting concrete work,<br>with valid and recognized certificate from<br>plant delivering concrete.<br>.1 Provide test data and certification by<br>qualified independent inspection and testing<br>laboratory that materials and mix designs<br>used in concrete mixture will meet specified<br>requirements. |
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| 1.4 QUALITY ASSURANCE<br>(Cont'd)  | .3 | Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:<br>.1 Falsework erection.<br>.2 Hot weather concrete.<br>.3 Cold weather concrete.<br>.4 Curing.<br>.5 Finishes.<br>.6 Formwork removal.<br>.7 Joints.<br>.8 Backfilling.  |
|                                    | .4 | Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.   |
| 1.5 DELIVERY, STORAGE AND HANDLING | .1 | Delivery and Acceptance Requirements:<br>.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.<br>.1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative, laboratory representative, and concrete producer as described in CSA A23.1/A23.2.<br>.2 Deviations to be submitted for review by Departmental Representative.<br>.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2. |

## PART 2 - PRODUCTS

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| 2.1 CONCRETE DESIGN CRITERIA | .1 | Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS. |
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- 2.2 CONCRETE  
PERFORMANCE CRITERIA
- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.
- 2.3 CONCRETE  
MATERIALS
- .1 Cement: to CSA A3001, Type GU to CSA A23.1/A23.2 and CAN/CSA A5.
- .2 Hydraulic cement: Type GUb to CSA A3001.
- .3 Water: to CSA A23.1.
- .4 Aggregates: to CSA A23.1/A23.2. Coarse aggregates to be normal density.
- .5 Admixtures:
- .1 Air entraining admixture: to CSA A23.1/A23.2 and CAN3-A266.1.
- .2 Chemical admixture: to CSA A23.1/A23.2 and CAN3-A266.4. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .3 Obtain authorization from Departmental Representative for use of super plasticizing admixture, water reducer, and/or other admixtures as approved by Departmental Representative to achieve designed concrete properties.
- .6 Concrete shall be normal and shall have a unit weight of 2350 kg/m3.
- .7 Curing compound: to CSA A23.1/A23.2 white and ASTM C 309.
- .8 Waterstops: Sodium Bentonite based (75%)
- .1 Volclay Waterstop Rx or equal as approved by Departmental Representative.
- .2 Install waterstops to provide continuous waterseal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when using waterstops. Use equipment to manufacturers requirements to field splice waterstops.
- .9 Premoulded joint fillers:
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| 2.3 CONCRETE MATERIALS<br>(Cont'd) | .9 (Cont'd) | .1 Bituminous impregnated fiber board: to ASTM D 1751.  |
|                                    |             | .2 Sponge rubber: to ASTM D 1752, Type I, flexible firm grade.  |
|                                    |             | .3 Self-expanding Standard cork: to ASTM D 1752, Type II III.   |
|                                    | .10         | Weep hole tubes: plastic.   |
| 2.4 CONCRETE MIXES                 | .1          | Performance Method for specifying concrete: to meet Departmental Representative performance criteria and to CSA A23.1/A23.2.                |
|                                    | .2          | Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan. |
|                                    | .1          | Provide concrete mix to meet following plastic state requirements:  |
|                                    | .1          | Uniformity: to CSA A23.1  |
|                                    | .2          | Workability: free of loss of mortar, segregation.   |
|                                    | .3          | Finishability: amount of bleeding.  |
|                                    | .4          | Set time: 2 hours maximum.  |
|                                    | .2          | Provide concrete mix to meet following hard state requirements:   |
|                                    | .1          | Durability and class of exposure: C-1.  |
|                                    | .2          | Compressive strength at 28 age: 35 Mpa minimum.   |
|                                    | .3          | Intended application: footings and retaining wall.  |
|                                    | .4          | Aggregate size 20 mm maximum.   |
|                                    | .3          | Provide lean concrete mix to meet following requirements:   |
|                                    | .1          | Compressive strength at 28 days: 10 MPa minimum.  |
|                                    | .3          | Provide quality management plan to ensure verification of concrete quality to specified performance.  |
|                                    | .4          | Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.  |
| 2.5 ROCK ANCHORS                   | .1          | Anchor and accessories:   |
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- 2.5 ROCK ANCHORS      .1    (Cont'd)
- .1    25 mm nominal diameter hot rolled  
   threaded bar (25M/#8), Fy = 517 MPa, Fu =  
   690 MPa, conforming to CSA G30.18-09, ASTM  
   A615.
- .2    Couplers and nuts must meet ultimate  
   strength capacity of bar.
- .2    Resin:
- .1    Polyester resin grout, with 30 minute  
   minimum cure time.

### PART 3 - EXECUTION

- 3.1 PREPARATION      .1    Obtain Departmental Representative's written  
   approval before placing concrete.
- .1    Provide 24 hours minimum 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 will be 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    Maintain accurate records of poured concrete  
   items to indicate date, location of pour,  
   quality, air temperature and test samples  
   taken.
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- 3.1 PREPARATION  
(Cont'd)
- .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 shrinkage compensating grout epoxy grout to anchor and hold dowels in positions as indicated.
- .10 Do not place load upon new concrete until authorized by Departmental Representative. Backfilling of retaining walls is prohibited until authorized by Departmental Representative.
- 3.2 INSTALLATION/  
APPLICATION
- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
- .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through walls except where indicated or approved by Departmental Representative.
- .2 Where approved by Departmental Representative, 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 Departmental Representative.
- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
- .5 Confirm locations and sizes of sleeves and openings shown on drawings.
- .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 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.
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3.2 INSTALLATION/  
APPLICATION  
(Cont'd)

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- .4 Finishing and curing:
  - .1 Finish concrete to CSA A23.1/A23.2.
    - .1 Schedule:.
    - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
    - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: brushed on exposed pad footings. Provide written declaration that compounds used are compatible.
- .5 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 Departmental Representative.
- .6 Rock Anchors:
  - .1 To drill holes and install anchors, acceptable methods include track drills, tire mounted drills, jacklegs or storrrpers.
  - .2 Minimum 32 mm diameter hole.
  - .3 Hole must be cleaned with air or water prior to installing resin cartridge.
  - .4 Tension only to be applied on anchor after resin has set.
  - .5 Resin cartridge to provide partial encapsulation of anchor based on manufacturer's recommendations.
  - .6 Anchors to be grouted into solid rock and must withstand an allowable tensile load of 189 KN and a shear load of 134 KN (FS=2). 25% of total number of rock anchors to be tested to ensure specified capacities.
  - .7 Location of rock anchors to be coordinated so as not to coincide with precast concrete engineered retaining wall supports.

<u>3.3 SURFACE TOLERANCE</u>	.1	Concrete tolerance to CSA A23.1 Straightedge Method.
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<u>3.4 FIELD QUALITY CONTROL</u>	.1	Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS. .1 Concrete pours. .2 Slump. .3 Air content. .4 Compressive strength at 3 and 7 28 and 56 days. .5 Air and concrete temperature. .6 Weather.
	.2	Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2. .1 Ensure testing laboratory is certified to CSA A283.
	.3	Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
	.4	Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
	.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	For compressive strength testing, a minimum of 3 cylinders and 2 field cured cylinders are required for: .1 Each day's pour .2 Each type of grade of concrete .3 Each change of supplier .4 Each 40 cubic metre or fraction thereof for footings and foundation walls.

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| 3.4 FIELD QUALITY<br>CONTROL<br>(Cont'd) | .6 | (Cont'd)<br>.5 Additional test specimens shall be taken whenever requested by the Departmental Representative to verify the concrete quality.  |
|  | .7 | Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.  |
|  | .8 | Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.  |
| 3.5 CLEANING                             | .1 | Clean in accordance with Section 01 74 11 - Cleaning.  |
|  | .2 | Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.<br>.1 Divert unused concrete materials from landfill to local quarry facility after receipt of written approval from Departmental Representative.<br>.2 Provide appropriate area on job site where concrete trucks and be safely washed.<br>.3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.<br>.4 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.<br>.5 Prevent admixtures and additive materials from entering drinking water supplies or streams.<br>.6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.<br>.7 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations. |
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- 3.6 CURING
- .1 Ensure that freshly placed concrete is protected from freezing, dehydration, mechanical shock and contact with injurious substances.
  - .2 Do not use curing compounds that would have a detrimental effect on bonding, adhesion, curing, appearance, or similar qualities of materials applied to concrete surfaces. Use only moisture curing.
  - .3 Protect the concrete from premature drying and extremes of temperature.
  - .4 Cure, protect and finish concrete to CAN/CSA A23.1-09, CSA S269.1 and S269.3. Curing type in accordance with specified exposure classification unless more stringent requirements are noted otherwise. Special curing and finishing requirements are as follows:
    - .1 Exterior concrete pads: curing "TYPE 2". Seven (7) days total at >10°C and for the time necessary to attain 70% of the specified concrete strength.
  - .5 Foot traffic shall be kept off curing concrete for 1 day.
  - .6 Vehicles shall be kept off concrete for 7 days.
- 3.7 DEFECTIVE WORK
- .1 Repairs and classification of unacceptable concrete to be in accordance with CSA-A23.1/A23.2.
  - .2 Remove defective concrete and embedded debris and repair as directed by Departmental Representative.
  - .3 Excessive honeycomb or embedded debris in any concrete shall deem it defective. Remove and replace defective concrete.
  - .4 Remove to bare concrete curing compounds detrimental to application of specified finishes.
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- 3.7 DEFECTIVE WORK    .5    Concrete to be supplied at the minimum  
    (Cont'd)
- .6    Repair all shrinkage cracks in the completed  
                                 concrete work employing a suitable epoxy  
                                 injection technique acceptable to  
                                 Departmental Representative to completely  
                                 seal all such cracks.

PART 1 - GENERAL

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| <u>1.1 REFERENCES</u>                          | .1 | Canadian General Standards Board (CGSB)<br>.1 CAN/CGSB-25.20-95, Surface Sealer for Floors.   |
|  | .2 | CSA International<br>.1 CAN/CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.   |
|  | .3 | South Coast Air Quality Management District (SCAQMD), California State<br>.1 SCAQMD Rule 1168-A2005(June 2006), Adhesives and Sealants Applications.  |
| <u>1.2 ACTION AND INFORMATIONAL SUBMITTALS</u> | .1 | Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.   |
|  | .2 | Product Data:<br>.1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.<br>.1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. |
| <u>1.3 DELIVERY, STORAGE AND HANDLING</u>      | .1 | Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.   |
|  | .2 | Delivery and Acceptance Requirements:<br>.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.  |
|  | .3 | Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.   |
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## PART 2 - PRODUCTS

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| <u>2.1 PERFORMANCE REQUIREMENTS</u> | .1 | Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.  |
|                                     | .2 | Submit written declaration that components used are compatible and will not adversely affect finished products and their installation adhesives.                          |
| <u>2.2 SEALING COMPOUNDS</u>        | .1 | Surface sealer: to CAN/CGSB-25.20, Type 1 - solvent-based Type 2 - water based, clear colour.   |
|                                     | .2 | Sealants: maximum VOC limit 250 g/L to SCAQMD Rule 1168.  |
|                                     | .3 | Surface sealer: acrylic carnuba wax, colour.  |
|                                     | .4 | Surface sealers are not manufactured or formulated with aromatic solvents formaldehyde halogenated solvents mercury lead cadmium hexavalent chromium and their compounds. |
| <u>2.3 CURING COMPOUNDS</u>         | .1 | Select low VOC, water-based, organic-solvent free curing compounds.   |
| <u>2.4 MIXES</u>                    | .1 | Mixing ratios in accordance with manufacturer's written instructions.   |

## PART 3 - EXECUTION

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| <u>3.1 EXAMINATION</u> | .1 | Verify that slab surfaces are ready to receive work and elevations are as indicated on shop drawings recommended by manufacturer's written instructions. |
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- 3.2 PREPARATION OF EXISTING SLAB
- .1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.
  - .2 Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.

- 3.3 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
    - .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.

- 3.4 PROTECTION
- .1 Protect finished installation in accordance with manufacturer's instructions.

## PART 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.
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1.1 REFERENCES  
(Cont'd)

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- .3 (Cont'd)
- .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

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- .1 Design precast elements to CSA-A23.3 and CSA-A23.4 to carry handling stresses.
  - .2 Design precast open span culverts and associated wingwalls to carry highway loads in accordance with Canadian Highway Bridge Design Code, CAN/CSA-S6.
  - .3 Design connections/attachments of precast open span culverts and associated wingwalls 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.
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### 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 Finishing schedules.
  - .4 Methods of handling, erection and sealing.
  - .5 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).
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<u>1.5 QUALIFICATIONS</u> (Cont'd)	.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.
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.4	Welding companies certified to CSA-W47.1.
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<u>1.6 DELIVERY, STORAGE AND HANDLING</u>	.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.

## PART 2 - PRODUCTS

<u>2.1 MANUFACTURED UNITS</u>	.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 culverts: size as indicated.
	.6	Precast wingwalls: geometry as indicated. .1 Only proprietary engineered concrete retaining wall systems are acceptable.

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|---------------------------------------|----|---|
| 2.1 MANUFACTURED<br>UNITS<br>(Cont'd) | .6 | (Cont'd)<br>.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.<br>.3 Verify existing site conditions and ground elevations before preparing working drawings.<br>.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.<br>.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<br>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 programme 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.  |
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### PART 3 - EXECUTION

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|-------------------------|----|--|
| <u>3.1 ERECTION</u>     | .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.   |
| <u>3.2 VERIFICATION</u> | .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. |
| <u>3.3 CLEANING</u>     | .1 | Use cleaning methods as reviewed by Departmental Representative before cleaning soiled precast concrete surfaces.  |