Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 10 00 Concrete Forming and Accessories

.2 Section 03 20 00 Concrete Reinforcing

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C 171-07, Standard Specification for Sheet Materials for Curing Concrete.

.2 ASTM C 260-06, Standard Specification for Air-Entraining Admixtures for Concrete.

.3 ASTM C 309-07, Standard Specification for Liquid Membrane- Forming Compounds for Curing Concrete.

.4 ASTM C 330-05, Standard Specification for Lightweight Aggregates for Structural Concrete.

.5 ASTM C457-08, Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.

.6 ASTM C 494/C 494M-08, Standard Specification for Chemical Admixtures for Concrete.

.7 ASTM C496/C496M-04e1, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

.8 ASTM C666/C666M-03, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

.9 ASTM C 684-99(2003), Standard Test Method for Making, Accelerated Curing, and Testing Concrete Compression Test Specimens.

.10 ASTM C 1017/C 1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.11 ASTM C1202-07, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.12 ASTM D 412-06a, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.13 ASTM D 624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.14 ASTM D4285-83(2006, Standard Test Method for Indicating Oil or Water in Compressed Air.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-A23.1-04/A23.2-04, 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 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.

.3 All references listed in CAN/CSA-A23.1-04 shall be applicable to this section as required.

1.3 DEFINITIONS

.1 Cold weather: means those conditions when the air temperature is at or below 5 degrees C. It is also considered to exist when the air temperature is at or likely to fall below 5 degrees C within 96 hours after concrete placement. Temperature refers to shade temperature.

.2 Hot weather: means those conditions when the air temperature is at or above 28 degrees C. It is also considered to exist when the air temperature is at or is likely to rise above 28 degrees C within 24 hours after concrete placement. Temperature refers to shade temperature.

1.4 INCLUSIONS

.1 Costs associated with the work described in this section that is not subject to a particular item of the Unit Price Table must be included either in the general lump sum portion of the contract or in the cost of the associated work paid under an article of the Unit Price Table.

.2 Payment of the cast-in-place concrete of roadway components will be included in the fixed priced item « Approach Road Works ». No measurement shall be made.

.3 Payment for the unit price item « Bearing Seat Repairs at Piers 2 & 3” shall be measured for each bearing seat and shall be composite items for all costs to complete the work in accordance to the contract documents, including:

.1 Access including all access equipment and/or access works;

.2 Field measurements;

.3 Preparation and submission of all documents associated to the work;

.4 Surface preparation of the concrete;

.5 Supply, installation and curing of the repair mortar;

.6 All costs related to the work execution (e.g. supervision, security, shelter, lighting, heating, overtime, etc.) depending of the allowed working hours (day, night and/or weekends);

.7 Surface preparation and coating of existing structural steel according to the requirements of Section 09 97 19;

.8 Handling, transportation, and delivery costs including of road signs and/or flagmen required upon delivery of equipment, materials and equipment;

.9 Inspection and testing fees;

.10 Management and administration fees related to the prescribed work;

.11 Any other labor, equipment or materials required to complete the work required as described herein, and reflected in the contract documents.

.4 All costs, including the cost of access, inspection, and testing, associated with the correction or repairs of rejectable defects are the responsibility of the Contractor.

.5 Progress payments will only be made after:

.1 Completion of work in conformance with the contract documents.

.2 Completion of required Quality Control Inspections by the Contractor associated to the work being paid;

.3 Submission and acceptance of all documentation required in this section associated to the work; and,

.4 Completion of required Quality Assurance Inspection by the Department Representative associated to the work.

1.5 DESIGN REQUIREMENTS

.1 Performance in accordance with CAN/CSA-A23.1-04, and as described in this specification.

1.6 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 At least 4 weeks prior to commencing concrete work, the Contractor shall submit the following:

.1 Certification of concrete plant

.2 Mix design(s) for concrete, including technical data on admixtures, mix proportions, and aggregate sources

.3 Certification that mix proportions and materials are adjusted to prevent alkali aggregate reactivity problems

.4 Certification that low alkali cement has an equivalent alkali content no greater than 0.6%

.3 Submission of the mix design shall include results of testing for:

.1 28 day compressive strength

.2 air void parameters of the hardened concrete

.3 aggregate test results

.4 admixture test results

.5 All supporting data shall be less than 12 months old at the time of submission of the mix design.

.4 When superplasticizer is used, the supporting documentation shall be based on the mix design with superplasticizer.

.5 Certificate(s) of Conformance for dowels (see 3.3 - Construction).

.6 Calibration of the air meter used for testing plastic concrete (only if requested by the Departmental Representative).

.7 Results of all destructive testing shall be submitted to the Departmental Representative within 24 hours of testing.

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.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CAN/CSA-A23.1-04.

.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 facility.

.3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Departmental Representative.

.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: Type 10, to CAN/CSA-A3001.

.2 Supplementary cementing materials: with maximum 10% fly ash replacement, by mass of total cementitious materials to CAN/CSA- A3001.

.3 Water: to CAN/CSA-A23.1-04.

.4 Aggregates: to CAN/CSA-A23.1-04. Coarse aggregates to be normal density.

.5 Admixtures:

.1 Air entraining admixture: to ASTM C 260-08.

.2 Chemical admixture: to ASTM C 494/C 494M-08 and ASTM C 1017/C 1017M-07.

.6 Curing compound: to CAN/CSA-A23.1-04 and ASTM C 309-07.

.7 Non-shrink cementitious grout: per Section 01 61 00 – Common Product Requirements.

.8 Asphalt impregnated fibre board: 20 mm thick, installed at the end of each approach slab complete with 20 x 40 mm deep saw-cut filled with hot poured rubberized joint sealing compound.

2.2 MIXES

.1 Performance Criteria for concrete in all locations:

.1 Provide concrete mix, in accordance with CAN/CSA-A23.1-04, to meet following requirements:

.1 Durability and class of exposure: C-1.

.2 Minimum compressive strength at 28 days: 30 MPa.

.3 Maximum water/cement ratio: 0.40.

.4 Maximum nominal size of coarse aggregate: 19 mm.

.5 Slump at time and point of discharge: 70 ± 20 mm.

.6 Air Content: 5.5 to 8.5%.

.7 Spacing Factor: 170 micrometres maximum average per lot with no individual test result exceeding 260 micrometres (ASTM C 457-08).

.8 Chemical admixtures: Admixtures in accordance with ASTM C 494/C 494M-08.

2.3 EQUIPMENT

.1 Equipment made of aluminum material shall not come in contact with the plastic concrete.

.2 Placing Equipment

.1 Consolidating Equipment: Per CAN/CSA A23.1-04. Internal vibrators used to consolidate concrete components containing galvanized steel reinforcement shall have a resilient covering that will not damage the galvanized reinforcement during use. External form vibrators shall not be permitted.

.2 Mixer for Bonding Agents: The mixer for the bonding agent shall be a stationary mixer, power driven, and capable of uniformly mixing the materials.

.3 Hand Finishing Equipment: Floats shall be made of magnesium or wood. Magnesium bull floats shall be commercially made.

.4 Straight Edges: Two straight edges commercially made of metal, one 3m and one 0.5m long shall be used.

.5 Mixing Plant shall be capable of producing printed tickets in accordance with CAN/CSA A23.1-04.

.6 Concrete shall be produced at a batching plant. The use of mobile mixers is not permitted.

Part 3 Execution

3.1 PREPARATION

.1 Provide the Departmental Representative with 24 hours' notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

3.2 PLACEMENT

.1 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 of Work.

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

.3 Protect previous Work from staining.

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

3.3 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1-04.

.2 Grout using procedures in accordance with manufacturer's recommendations.

.3 Prewetting:

.1 Existing concrete shall be saturated surface dry (SSD) before placement of new concrete.

.2 All standing water shall be removed prior to concrete placement.

.4 Finishing:

.1 Finish concrete in accordance with CAN/CSA-A23.1-04. All exposed surfaces shall have a minimum of smooth-form finish, except as noted elsewhere in the specifications.

.5 Surface Finish – Formed Surface:

.1 Concrete surfaces shall not be treated with cement slurry or paste.

.2 Within 3 days following the removal of forms, all holes left in surfaces by the removal of formwork and falsework and air holes which have a dimension greater than 15 mm shall be filled with cementitious non-shrink grout.

.3 The holes shall be surface saturated dry at the time of filling, and the grout shall be tamped into place.

.4 Honey-combing or cavities shall be repaired as follows:

.1 Concrete shall be removed in conformance with Section 02 41 16.01 – Structure Demolition.

.2 Where the resultant cavity has an average depth greater than 100 mm and an area greater than 0.1 m2 it shall be formed and patched with concrete equivalent to that used in the structure. The faces of the cavity shall be abrasive blast cleaned. The patch shall be placed within 24 h after the blast cleaning. Before placing the concrete, the faces of the cavity shall be surface saturated dry.

.3 All other cavities shall be prepared as for the larger cavities and then shall be filled with cementitious non-shrink grout. The surface of the repair shall be floated to a surface texture to match the adjacent concrete.

.4 Repairs shall be cured with burlap and water and protected as required for cold weather concreting.

.6 Protection and Curing:

.1 Curing compounds shall not be permitted on any part of the bridge concrete structures.

.2 Protection and curing in accordance with CAN/CSA-A23.1-04.

.3 Burlap shall be presoaked by immersing it in water for a period for 24 hours prior to placing.

.4 Continuously wet burlap for seven (7) days.

.5 Provide for hot-weather and cold-weather protection as required in CAN/CSA-A23.1-04.

3.4 SURFACE TOLERANCE

.1 Concrete tolerance in accordance with CAN/CSA-A23.1-04.

3.5 QUALITY CONTROL

.1 Be responsible for all quality control testing of concrete.

.2 Site tests:

.1 Testing for slump, air content, compressive strength and temperature will be done in conformance with CAN/CSA A23.1-04 and CAN/CSA A23.2-04.

.2 Frequency of Testing shall be as follows:

.1 Air, Slump, and Temperature test: One test for each load of concrete until satisfactory control is established daily and rate of placement > 35 m3 per hour; then 1 test for each 3 loads of concrete. Satisfactory control is considered to have been established when tests on five consecutive loads or batches of concrete are within specification requirements.

.2 28 Day Compressive test Cylinders (Requirements in sets/day): Based on Quantity in m3 for Each Class of Concrete per Placement.

< 10 m3	1 set/day
10-25 m3	2 sets/day
25-50 m3	3 sets/day
50-100 m3	4 sets/day
100-500 m3	5 sets/day

.3 7 Day Compressive Test: one (1) cylinder for each set of 28 Day Compressive Test cast.

.4 Be responsible for casting any additional cylinders required for interim testing other than that specified above.

.3 Accelerated curing of concrete cylinders shall not be permitted.

.4 Certification of Personnel: Field sampling and testing of concrete shall be undertaken by personnel holding either one of the following certifications –

.1 ACI Concrete Field Testing Technician, grade 1

.2 CSA Certified Concrete Testing Technician, Concrete Testing and Sampling Certificate (CSA A283-06 Category 0).

.5 Personnel undertaking the testing shall have a valid, original card issued by the certifying agency in their possession at all times.

.6 Samples for determining acceptance of concrete for air and slump shall be grab samples

taken according to CAN/CSA A23.2-1C after approximately 10% of the load has been discharged. The discharge shall be stopped until the testing for air and slump has been completed and the results are found to be satisfactory. If the test results do not meet the contract requirements, and the on-site adjustments to the mix as specified in CAN/CSA A23.1-04 cannot produce acceptable concrete, the remainder of the load shall be rejected.

.7 Concrete compressive strength shall be considered acceptable when it meets the following:

.1 The average of compressive strength test results for each set shall be equal to or greater than the specified strength.

.2 Any Individual strength test shall be no more than 5% below the specified strength.

.8 If compressive strength tests indicate the concrete is less than 95% of the specified strength, the concrete shall be removed and replaced at no additional cost to the Departmental Representative.

3.6 QUALITY ASSURANCE

.1 The Departmental Representative may take additional tests at his discretion for Quality Assurance testing. All costs associated with Quality Assurance testing shall be borne by the Departmental Representative.

.2 Additional testing by the Departmental Representative shall not relieve the Contractor of his contractual responsibility nor replace the Contractor’s Quality Control.

END OF SECTION