



77-2008 ADDENDUM 2

FORT GARRY TWIN BRIDGES - WESTBOUND STRUCTURE REHABILITATION AND ASSOCIATED ROADWORKS

URGENT

**PLEASE FORWARD THIS DOCUMENT TO
WHOEVER IS IN POSSESSION OF THE BID
OPPORTUNITY**

ISSUED: March 6, 2008
BY: Rick Haldane-Wilson
TELEPHONE NO. (204) 956-0980

**THIS ADDENDUM SHALL BE INCORPORATED
INTO THE BID OPPORTUNITY AND SHALL
FORM A PART OF THE CONTRACT
DOCUMENTS**

Template Version: A20070419

Please note the following and attached changes, corrections, additions, deletions, information and/or instructions in connection with the Bid Opportunity, and be governed accordingly. Failure to acknowledge receipt of this Addendum in Paragraph 10 of Form A: Bid may render your Bid non-responsive.

PART A – BID SUBMISSION

Replace: 77-2008 Bid Submission with 77-2008 Addendum 2 - Bid Submission. The following is a summary of changes incorporated in the replacement Bid Submission:

Form B(R1): Revise Item A.10 Description of "Place MMFX Reinforcing Steel" to "Place MMFX 2 Reinforcing Steel".

Revise Item A.11 "Install Reinforcing Steel into Hardened Concrete", "Approx. Quantity" of 1,540 each to 1,850 each.

Replace Item A.13 Description of "Supply and Place Lean Mix Concrete" with "Flowable Cement-Stabilized Fill", "Spec. Ref." of E14 to CW 2030-R7 and CW 2160-R7, "Approx. Quantity" of 80 to 65.

Revise Item A.15 Description of "Supply and Install Anchor Units for Bridge Street Light Poles and BR1 Posts" to "Supply and Install Anchor Units for Bridge Street Lights and BR1 Posts".

Add Item B.15(iv) "Mountable Curb".

Add Item B.16(vii) "Mountable Curb (120mm ht, Dowelled)".

Various quantity changes to Roadwork – Part B and Detour Work – Part C.

PART D – SUPPLEMENTAL CONDITIONS

Revise: D14.3 (b) to read: Installation of **Demolition** Catch Platforms;

Revise: D14.3 (d) to read: **Structural Steel** Strengthening;

Add: D18.1(a)(xii) City of Winnipeg Police Services - Provide traffic control for the "Miles of Smiles Walk for St Amant" event taking place on May 4, 2008 between 12:00 and 14:00.

Revise: D22.1 (a) to read: Critical Stage – Part A Bridge Work and Part B Roadwork, completed such that the entire Westbound facility is safely open to traffic and the Westbound detour can be closed, as determined by the Contract Administrator – Ten Thousand Dollars (\$10,000);

- Revise: D26.3 (a)(ii) to read: Construction materials shall not be deposited **in the river** or stored on riverbanks or river shorelines unless written acceptance from the Contract Administrator is received in advance.
- Revise: D26.3 (b)(iv) to read: The Contractor shall ensure that any temporary fuel storage areas established for construction of the project are contained by an impermeable dyke and are located a minimum distance of **107 metres away from the edge of the water line for normal summer water levels** of the Red River. Dykes shall be designed, constructed, and maintained to retain not less than 100% of the capacity of the total number of containers or 110% of the largest container, whichever is greatest. The dykes shall be constructed of clay or similar impervious material. If this type of material is not available, the dyke shall be constructed of locally available material and lined with high-density polyethylene (HDPE). Furthermore, the fuel storage area(s) shall be secured by a barrier such as a high fence and gate to prevent vandalism.
- Revise: D26.3 (d)(ix) to read: Dangerous goods/hazardous waste storage areas shall be located at least **107 metres away from the edge of the water line for normal summer water levels** and be dyked.

PART E – SPECIFICATIONS

NOTE: Page numbering on some forms may be changed as a result. Page numbering and some clauses may be changed as a result.

- Revise: E1.3 to read: The following **Drawings** are applicable to the Work:

B173-08-041W REINFORCING SCHEDULE 2 (BLACK **BARS**)

B173-08-042W REINFORCING SCHEDULE 3 (BLACK **BARS**)
- Revise: E3 (a) to read: The Contractor shall supply **the Contract Administrator's** site office facilities meeting the following requirements:
- Revise: E4.4 (a) to read: No separate measurement or payment will be made for the Protection of Trees. Except as required in E4.3.1 (a)(iii) and E4.3.1 (a)(v) of this Specification, Elm trees shall not be pruned at any time between April 1 and July 31.
- Revise: E7.1 (a) to read: This Specification shall cover all operations relating to **the removal of the Westbound detour roads, the construction of the Eastbound detour roads, and all other activities associated with implementation and operation of the detour roads.**
- Revise: E7.3.3 (a) to read: Following Substantial Performance of Part A – **Bridge Work** and Part B – Roadwork (Critical Stage of August 29, 2008) and Bishop Grandin Boulevard Westbound traffic has been taken off the detour road, removal of Westbound detour roads may begin.
- Revise: E8.5.3 (b) to read: The pathway shall be kept free of all construction materials, debris, and equipment. **The Contractor shall provide side and overhead protection for a dedicated pedestrian pathway beneath the Bridge on each bank.**
- Revise: E9.2.6 (a) to read: The Contractor shall prepare and submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any Work on Site, a plan detailing the Contractor's hydrodemolition runoff control and disposal methods and procedures. Wastewater from the hydrodemolition process shall **meet the requirements of the City of Winnipeg By-Law No. 7070/97 Part 5, Control of Discharge to Sewers,** prior to entering the City's land drainage sewer system. Bridge deck drain openings shall be plugged during the hydrodemolition process. At no time can runoff of wastewater be permitted to enter the watercourse or the City's land drainage system unfiltered.
- Delete: E9.5.3 (b)

- Revise: E9.5.6 (a) to read: Stage I concrete removal shall be the removal of the concrete deck, if necessary, to a **nominal** depth of **40 mm** measured from the top of the existing concrete deck surface, **up to a maximum depth of the** mid height of the existing top **layer of the top** reinforcing mat **where deteriorated concrete exists**.
- Revise: E9.5.6 (b) to read: Following the removal of the asphalt wearing surface and waterproofing membrane, the Contractor shall conduct a **survey of the exposed concrete Bridge deck** as indicated on the Drawings. The Contract Administrator shall utilize this survey to develop a limit of excavation. It is estimated that a thickness varying between 25 and 40 mm is to be removed. The Contract Administrator will update the Drawings for the Contractor within five (5) Business Days.
- Revise: E9.5.6 (c) to read: Stage I concrete removal shall be undertaken by a combination of rotomilling and hydrodemolition.
- Add: E9.5.6 (d) Following the removal of Stage I concrete, the Contract Administrator shall conduct a delamination survey to determine if Stage II concrete removal is required.
- Revise: E9.5.7 (a) to read: **As directed by the Contract Administrator, the Contractor shall undertake Stage II concrete removals.** Stage II concrete removal shall be defined by the following types:
- (i) Type 1 – Removal of the concrete deck below **mid height of the** existing top **layer of the top** reinforcement mat to a depth of **25 mm below** the bottom layer of the **top reinforcement mat**; and
 - (ii) Type 2 – **Type 1 removal** to full depth concrete deck removal.
- Add: E9.5.7 (d) The top layer of reinforcing steel is being salvaged. It is expected that damage of the reinforcing steel will take place as a result of hydrodemolition. Therefore it must be ensured that the reinforcing steel is not damaged. **Minor** touch-ups of the coated reinforcing steel shall be required if damaged during concrete removal **and shall be undertaken as directed by the Contract Administrator.** Acceptable epoxy coating material is 3M Scotchkote or equivalent **as approved by the Contract Administrator in accordance with B6.** No additional payment shall be made for **minor** touch-ups. Any reinforcing steel damaged shall be replaced to the satisfaction of the Contract Administrator at no additional cost to the City.
- Revise: E9.5.9 to read: Screed Survey
- Revise: E9.5.9 (a) to read: The Contractor shall conduct a **screed** survey of the **Bridge deck after all structural removals** have been performed as indicated on the Drawings.
- Revise: E9.5.9 (b) to read: The Contract Administrator shall provide the final **screed** elevations for the new **deck slab concrete** and for the top of the **High Performance Concrete (HPC)** deck overlay.
- Revise: E9.5.9 (c) to read: The Contract Administrator shall update the Drawings for the Contractor within **five (5)** Business Days.
- Revise: E9.6.1 (c) to read: Structural Removals shall be paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, measured as specified herein, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and performing all operations herein described and all other items incidental to the Work. The area to be paid for shall be the total concrete removed **as directed and measured by the Contract Administrator.**
- Revise: E11.4.3 (a) to read: The City shall make available the use of an underbridge crane for inaccessible Work areas for the Contractor's use. The underbridge crane shall be made available **free of cost with operator** for a period of two weeks prior to the commencement of demolition **for the purpose of strengthening the existing steel box girders on spans 3 and 4.** **The bucket capacity of the underbridge crane is 600 lbs, with dimensions of 3' x 5'.** The Contractor shall provide to the City a minimum of **two weeks** notice for the use of

the underbridge crane. Should a lane closure be required for this Work, the Contractor shall not close any lanes on Bishop Grandin Boulevard during the hours of 06:30 to 09:00 and 15:30 to 18:00, except on Saturday and Sundays, and shall remove temporary traffic control devices from these lanes accordingly. One (1) lane on Bishop Grandin Boulevard may be closed outside these hours when working within four (4) metres of the edge of travelled lanes.

Revise: E11.6 (b) to read: Installation of Abutment Stiffeners shall be paid for at the Contract Unit Price per unit for "Supply and Install Abutment Stiffeners", measured and specified herein, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work.

Clarification of E13: MMFX Reinforcing Steel should read as **MMFX 2** Reinforcing Steel.

Revise: E13.3.4 (d) to read: For **MMFX 2** deck reinforcement, **MMFX 2 chairs** shall be drilled and grouted at the correct elevation into the existing concrete deck as a chairing mechanism **as shown on the Drawings**.

Revise: E13.3.4 (f) to read: Bar accessories shall include bar chairs, spacers, clips, wire ties, wire, hooks, or other similar devices and are to be acceptable to the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of black reinforcing steel and placing of **MMFX 2** reinforcing steel.

Revise: E13.6.2 (a) to read: Placing **MMFX 2** Reinforcing Steel shall be paid for at the Contract Unit Price per kilogram for "Place **MMFX 2** Reinforcing Steel", measured as specified herein, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work. The mass to be paid for shall be the total number of kilograms of **MMFX 2** reinforcing placed in accordance with this Specification, as accepted by the Contract Administrator, as computed from details on the reviewed Shop Drawings, excluding the mass of bar accessories. Installation of **MMFX 2 chairs as shown on Detail 3, Drawing 29**, into existing concrete shall be considered incidental to the Work and no payment shall be made for this Work.

Replace: E14 with the following:

E14 Structural Concrete

E14.1 Description

- (a) This Specification shall cover the preparation of Portland Cement Concrete for, and all concreting operations related to, the construction of Portland Cement Concrete Works as specified herein.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E14.2 Submittals

E14.2.1 Concrete Mix Design Requirements

- (a) **The Contractor shall submit a concrete mix design statement to the Contract Administrator for each of the concrete types specified herein that reflects the specified performance properties of the concrete. The mix design statement shall contain all the information as outlined on the concrete mix design statement as shown on the Manitoba Ready Mix Concrete Association website (www.mrmca.com). In addition, the mix design statement must indicate the expected method of placement (buggies, chute, or pump). If pumping methods are to be used, the method of placement must include a clear description of the pumping methods (line, vertical drop, length of hose, etc.).**
- (b) **The Supplier shall submit directly, in confidence, to the City of Winnipeg, the concrete mix designs for each of the concrete types specified herein. The purpose of this confidential submission will be**

for record keeping purposes only. The concrete mix design shall contain a description of the constituents and proportions, and at the minimum the following:

- (i) Cementitious content in kilograms per cubic metre or equivalent units, and type of cementitious materials;
 - (ii) Designated size, or sizes, of aggregates, and the gradation;
 - (iii) Aggregate source location(s);
 - (iv) Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis;
 - (v) Maximum allowable water content in kilograms per cubic metre or equivalent units and the water/cementitious ratio;
 - (vi) The limits for slump;
 - (vii) The limits for air content; and
 - (viii) Quantity of other admixtures.
- (c) **The concrete mix design statements must be received by the Contract Administrator a minimum of fourteen (14) days prior to placing of the concrete types. The concrete mix designs must be received by the City of Winnipeg a minimum of seven (7) days prior to placing of the concrete types.**
- (d) **The mix design statement shall also include the expected slump measurement for each concrete type. The tolerances for acceptance of slump measurements in the field, by the Contract Administrator, shall be in accordance to CSA A23.1-04 Clause 4.3.2.3.2.**
- (e) **Any change in the constituent materials of the concrete types shall require submission of a new concrete mix design statement, mix design, and concrete mix design test data. If, during the progress of the Work, the concrete supplied is found to be unsatisfactory for any reason, including poor workability, the Contract Administrator may require the Contractor to make the necessary adjustments.**

E14.2.2 Concrete Mix Design Test Data

- (a) The Contractor shall submit to the Contract Administrator for review and approval, **at least twenty-one (21) Business Days prior to placing concrete**, test data showing that the concrete supplied will meet the performance criteria stated in this Specification for each concrete type. At a minimum, the test data shall prove that the minimum compressive strength, flexural strength (**FRC** only), air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. All tests shall be based on the concrete samples taken from the point of discharge into the formwork. For example, at the concrete chute from the delivery truck if being placed by buggies or at the end of the pump should the Contractor wish to pump the concrete into place.
- (b) **Aggregates**
- (i) **The Contractor shall furnish, in writing to the Contract Administrator, the location of the sources where aggregate will be obtained in order that some may be inspected and tentatively accepted by the Contract Administrator. Changes in the source of aggregate supply during the course of the Contract shall not be permitted without notification in writing to and the expressed approval of the Contract Administrator.**
 - (ii) **The Contractor shall submit to the Contract Administrator for review and approval recent test information on sieve analysis of fine and coarse aggregates in accordance with CSA Standard Test Method A23.2A.**
 - (iii) **The Contractor shall submit to the Contract Administrator for review and approval recent test information on tests for organic impurities in fine aggregates for concrete, in accordance with CSA Standard Test Method A23.2-7A.**
 - (iv) **The Contractor shall submit to the Contract Administrator for review and approval recent test information on relative density and absorption of coarse aggregate, in accordance with CSA Standard Test Methods A23.2-12A.**
 - (v) **The Contractor shall submit to the Contract Administrator for review and approval recent test information on petrographic examination of aggregates for concrete, in accordance with CSA Standard Test Methods A23.2-15A. The purpose of the petrographic analysis is to ensure the aggregates provided are of the highest quality for use in the production of concrete and will**

produce a durable overlay. An acceptable aggregate will have an excellent rating as judged by an experienced petrographer, with a (weighted) petrographic number typically in the range of 100 to 120.

- (vi) **The Contractor shall submit to the Contract Administrator for review and approval recent test information on resistance to degradation of large-size coarse aggregate by abrasion and impact in the Los Angeles Machine, in accordance with CSA Standard Test Method A23.2-16A.**
- (vii) **The Contractor shall submit to the Contract Administrator for review and approval recent test information on potential alkali reactivity of cement aggregate combinations (mortar bar method), in accordance with CSA Standard Test Method A23.2-20A.**
- (c) **The Contractor shall submit to the Contract Administrator copies of all material quality control test results.**

E14.2.3 Notification of Ready Mix Supplier

- (a) The Contractor shall advise the Contract Administrator of the qualified Ready Mix Concrete Supplier that he is proposing to use at least twenty-one (21) Business Days prior to placing concrete. The Contract Administrator will verify the acceptability of the Supplier and the concrete mix design requirements. Acceptance of the Supplier and the concrete mix design(s) by the Contract Administrator does not relieve or reduce the responsibility of the Contractor or Supplier from the requirements of this Specification.

E14.2.4 Formwork and False Work

- (a) The Contractor shall design formwork and false work for the new **Bridge deck overhangs** to be released prior to the placement of the High Performance Concrete (HPC) deck overlay. **The formwork shall not extend beneath the underside of the girders.**
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty-one (21) Business Days prior to the scheduled commencement of any concrete placement, detailed design calculations and Shop Drawings for any temporary Works, including false work and formwork, that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.
- (c) False work must be designed to carry all loads associated with construction of overhangs including deflection due to dead loads, placement of concrete, hoarding, construction live loads, and any other loads that may occur. Shop Drawings shall show design loads, type, and number of equipment to be used for placing the concrete, method of construction, method of removal, type and grade of materials, and any further information that may be required by the Contract Administrator. The Contractor shall not proceed with Site Work until the Shop Drawings have been reviewed and approved.
- (d) For timber formwork and false work, the Shop Drawings shall specify the type and grade of lumber and show the size and spacing of all members. The Shop Drawings shall also show the type, size and spacing of all ties or other hardware, and the type, size and spacing of all bracing.

E14.2.5 Sequence of Concrete Deck Pour Construction

- (a) **Deck Slab Concrete (Stage I and Stage II Concrete)**
 - (i) **The Contractor shall pour the deck slab concrete in accordance to the pour sequence as outlined in Drawing SKT-S0714W "Deck Slab Control – Pour Sequence". Should the Contractor opt to submit an alternate construction pour sequence for the deck slab concrete, the Contractor shall submit to the Construction Administrator for review, at least twenty-one (21) Business Days prior to any concrete placement, the proposed alternate construction pour sequence.**
 - (ii) **The Contractor shall submit to the Contract Administrator for review, at least twenty-one (21) Business Days prior to any concrete placement, details of the construction joints.**
- (b) **HPC Deck Overlay**
 - (i) **The Contractor shall submit to the Contract Administrator for review, at least twenty-one (21) Business Days prior to any concrete placement, a detailed sequence of construction for the placement of the HPC deck overlay.**
 - (ii) **The Contractor shall submit to the Contract Administrator for review, at least twenty-one (21) Business Days prior to any concrete placement, details of the construction joints.**

E14.2.6 Moveable Deck Hoarding

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty-one (21) Business Days prior to the scheduled commencement of any Work on Site, Shop Drawings showing the fabricated details of the movable deck hoarding, design loads, method of construction, type and grade of materials, and any further information that may be required by the Contract Administrator.
- (b) The movable deck hoarding shall be designed by a Professional Engineer registered in the Province of Manitoba and constructed to the following requirements:
 - (i) Sufficient clearances shall be provided to enable the placing and finishing of the **deck slab concrete and HPC deck overlay** to proceed unhindered inside the hoarding;
 - (ii) The minimum length of the hoarding shall be 25 m or the length of the structure, whichever is shorter;
 - (iii) The hoarding shall have a clear, unsupported span of at least the clear deck width, plus room for **all of the screeding and finishing operations**;
 - (iv) The roof and sides of the hoarding shall be covered with waterproof and insulated material, with all joints overlapping and rendered waterproof and not subjected to heat loss. The material shall be strong enough to withstand the force of "driving" rain or snow, and at least two thirds of the roof and the entire sides shall be opaque in order to prevent the deck concrete from being exposed to direct sunlight;
 - (v) The sides of the hoarding at the junction of the hoarding with the deck forms shall be constructed to prevent the entrance of rain from the sides. Provisions shall be made for enclosing the ends of the hoarding on short notice in the event that closing of the ends proves necessary during the concrete placing operations; and
 - (vi) The hoarding shall be constructed on wheels or rollers for ready mobility. Another acceptable method is to have stationary sides, with the roof on wheels or rollers.

E14.2.7 Concrete Placement Schedule

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to scheduled commencement of any concrete placement, the proposed concrete placement schedule for all concrete placements.

E14.3 Materials

E14.3.1 General

- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.
- (b) All materials shall be handled in a careful and workman like manner, to the satisfaction of the Contract Administrator.

E14.3.2 Handling and Storage of Materials

- (a) All materials shall be handled and stored in a careful and workmanship like manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA-A23.1-04.

E14.3.3 Testing

- (a) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the City of Winnipeg for any materials taken by the Contract Administrator for testing purposes.
- (b) All materials shall conform to CSA Standard A23.1-04.
- (c) All testing of materials shall conform to CSA Standard A23.2-04.
- (d) All materials shall be accepted by the Contract Administrator at least twenty-one (21) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

E14.3.4 Concrete

- (a) Concrete materials susceptible to frost damage shall be protected from freezing.
- (b) Concrete shall have nominal compressive strengths (f'c) and meet the requirements for hardened concrete as specified in the following Table.

TABLE E14.1 REQUIREMENTS FOR HARDENED CONCRETE							
Type of Concrete	Location	Nominal Compressive Strength [MPa]	Class of Exposure	Air Content Category	Max Aggregate Size	Special Requirements	Post Residual Cracking Index
Type 1	Substructure, Slope Paving	35 @ 28 Days	C-1	1	20 mm	-	-
Type 2	Deck Slab Concrete , Barriers, Approach Slabs, and Roadway Expansion Slab	35 @ 28 Days	C-1	1	<u>20 mm</u>	Synthetic Fibres	0.3
Type 3	High Performance Concrete Deck Overlay	50 @ 56 Days	C-XL	1	<u>14 mm</u>	Crushed Granite Aggregate; Synthetic Fibres; <u>maximum Shrinkage Strain of 450 microstrains @ 56 Days; Set Retarders permitted</u>	0.3

- (c) The temperature of all types of concrete shall be between 15°C and 25°C at discharge. Temperature requirements for concrete containing silica fume shall be between 10°C and 18°C at discharge unless otherwise approved by the Contract Administrator.

E14.3.5 Working Base Concrete

- (a) **Working base concrete shall be placed in the locations as shown on the Drawings.**

E14.3.6 Aggregates

(a) General

- (i) All aggregates shall be handled to prevent segregation and inclusion of any foreign substances, and to obtain uniformity of materials. The two sizes of coarse and fine aggregates, and aggregates secured from different sources, shall be piled in separate stockpiles. The site of the stockpiles shall be cleaned of all foreign materials and shall be reasonably level and firm or on a built up platform. If the aggregates are placed directly on the ground, material shall not be removed from the stockpile within 150 mm of the ground level. This material shall remain undisturbed to avoid contaminating the aggregate being used with the ground material.
- (ii) The potential for deleterious alkali-aggregate reactivity shall be assessed in accordance with CSA A23.2-27A-04. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA A23.2-14A-04 or CSA A23.2-25A-04 is required.
- (iii) Petrographic analysis when performed shall be in accordance with MTO (Ministry of Transportation Ontario) Lab Test Method LS 609. The (weighted) petrographic number shall not exceed 130.

(b) Fine Aggregate

- (i) Fine aggregate shall meet the grading requirements of CSA A23.1-04, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75 um sieve. Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.
- (ii) Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12.

(c) Coarse Aggregate - Standard

- (i) The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CSA A23.1-04, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 2% shall pass a 75 um sieve. Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; shall have a minimum of two fractured faces; and shall have an absorption not exceeding 3%.
- (ii) The aggregate retained on the 5 mm sieve shall consist of clean, hard, tough, durable, angular particles with a rough surface texture, and shall be free from organic material, adherent coatings of clay, clay balls, an excess of thin particles or any other extraneous material.
- (iii) Course aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than 30%.
- (iv) Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12, for concrete exposed to freezing and thawing.

(d) Coarse Aggregate – Granite

- (i) Crushed granite aggregate shall be used for the types shown in Table E14.1, "Requirements for Hardened Concrete".
- (ii) Coarse aggregate shall be 100% crushed, washed granite, low in quartz, clean and free from alkali, organic, or other deleterious matter, shall have two fractured faces, and shall have an absorption not exceeding 3%.

E14.3.7 Admixtures

- (a) Air-entraining admixtures shall conform to the requirements of ASTM C260.
- (b) Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.
- (c) All admixtures shall be compatible with all other constituents. The addition of calcium chloride, accelerators and air-reducing agents, will not be permitted, unless otherwise approved by the Contract Administrator.

E14.3.8 Cementitious Materials

- (a) Cementitious materials shall conform to the requirements of CSA-A3001 and shall be free from lumps.
- (b) Should the Contractor choose to include a silica fume admixture in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of cement.
- (c) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class C-1 or F and the substitution shall not exceed 25% by mass of cement.
- (d) Cementitious materials shall be stored in a suitable weather-tight building that shall protect these materials from dampness and other destructive agents. Cementitious materials that have been stored for a length of time resulting in the hardening or the formation of lumps shall not be used in the Work.

E14.3.9 Water

- (a) Water to be used for mixing and curing concrete or grout and saturating the substrate shall conform to the requirements of CSA A23.1-04 and shall be free of oil, alkali, acidic, organic materials or deleterious substances. The Contractor shall not use water from shallow, stagnant or marshy sources.

E14.3.10 Synthetic Fibres

- (a) The synthetic fibres shall consist of 100% virgin polypropylene as supplied by Grace (Microfibre) or Master Builders (Fibre Mesh MD), or equal as accepted by the Contract Administrator in accordance with B6. The dosage shall be designed by the Contractor to meet the requirements for post-cracking residual strength **index (R_i)** and fibre dispersion in accordance to the Canadian Highway Bridge Design Code, CAN/CSA-S6-06, Section 16, Fibre-Reinforced Structures, Clause 16.6. The minimum dosage rate shall be 1.5 kg/m³ for the specified concrete types.
- (b) **Testing for post-cracking residual strength index of Fibre Reinforced Concrete (FRC) shall be tested as follows. One set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure using the same test set up in ASTM C 1399-04 without the steel plate. The average of the peak loads is the cracking load of the concrete (P_{cr}), and shall be provided to the Contract Administrator. A second set of five concrete beam specimens shall be tested to failure in accordance with ASTM C 1399-04. The average of the peak loads is the post cracking load of the concrete (P_{pcr}). The Contractor shall submit a summary of the results of all post-cracking residual strength index tests.**

E14.3.11 Formwork

- (a) Formwork materials shall conform to CSA Standard A23.1-04, and American Concrete Publication SP4, "Formwork for Concrete."
- (b) Form sheeting plywood to be covered with form liner or to be directly in contact with soil shall be exterior Douglas Fir, concrete form grade, conforming to CSA Standard O121-M1978, a minimum of 20 mm thick.
- (c) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CSA Standard O121-M1978. Approved Manufacturers are "Evans" and "C-Z."
- (d) Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.
- (e) No formwork accessories will be allowed to be left in place within 50 mm of the surface following form removal. Items to be left in place, must be made from a nonrusting material or galvanized steel; and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (f) Forms for exposed surfaces that do not require a form liner may be either new plywood or steel as authorized by the Contract Administrator.
- (g) Studding shall be spruce or pine and shall have such dimensions and spacing that they shall withstand without distortion all the forces to which the forms shall be subjected.
- (h) Walers shall be spruce or pine, with minimum dimensions of 100 mm x 150 mm. Studding shall be spruce or pine, with minimum dimensions of 50 x 150.
- (i) Stay-in-place formwork or false work is not acceptable and shall not be accepted unless shown on the Drawings.
- (j) All forms are incidental to these works and must be removed by the Contractor once adequate strength and curing of the concrete has been achieved.

E14.3.12 Form Coating

- (a) Form coating shall be "Sternson C.R.A." by Sternson, "SCP Strip Ease" by Specialty Construction Products, or equal as accepted by the Contract Administrator in accordance with B6.

E14.3.13 Permeable Formwork Liner

- (a) Formwork liner shall be Texel Drainform, Hydroform, or equal as accepted by the Contract Administrator in accordance with B6. This formwork liner shall be used on all exposed substructure and superstructure formed surfaces, except soffit surfaces, or where a normal form finish is specified.
- (b) Paper-lined forms shall be used on all soffit surfaces.

E14.3.14 Architectural Formwork Liner

- (a) The Contractor shall supply and install the architectural concrete finish formwork liner as shown on the Drawings in accordance with the Manufacturer's recommended procedures.

E14.3.15 Curing Compound

- (a) Curing compounds shall be liquid membrane-forming and conform to the requirements of ASTM Standard C309-98a. Rate of application shall be the rate required to meet the requirements of ASTM C309-98a for the texture of concrete the curing compound is being applied to.
- (b) Curing compound for approach slabs shall be resin-based and white-pigmented.

E14.3.16 Curing Blankets

- (a) Curing blankets for wet curing shall be 100 percent polyester, 3 mm thick, white in colour. An approved product is "Mirafi Geotextile P150". Alternately, a 10 oz burlap, 5 mil polyethylene, curing blanket white in colour shall be used; "Curelap" manufactured by Midwest Canvas, together with a second layer of burlap, or equal as accepted by the Contract Administrator in accordance with B6.

E14.3.17 Bonding Agents

- (a) Latex Bonding Agents
 - (i) Latex bonding agent shall be **Acryl-Stix, SikaCem 810**, or equal as accepted by the Contract Administrator in accordance with B6. Polyvinyl acetate-based latexes will not be permitted.
- (b) Bonding Grout
 - (i) The grout for bonding the HPC deck overlay concrete to the deck slab concrete shall be mixed in an agitating hopper slurry pump and shall consist of the following constituents, by weight:
 - 1 part water
 - 1 part latex bonding agent
 - 1½ parts Type GUSF Portland cement
 - (ii) The consistency of the bonding grout shall be such that it can be applied with a standard spray nozzle to the existing concrete surface in a thin, even coating that will not run or puddle in low spots.

E14.3.18 Epoxy Adhesive

- (a) Where epoxy adhesive for concrete to concrete and to steel is used, it shall be Sternson ST432 or ST433, Dural Duralbond, Capper Capbond E, Sikadur 32 Hi-bond, Concessive 1001 LPL, Meadows Rezi-Weld 1000, or equal as accepted by the Contract Administrator in accordance with B6.

E14.3.19 Epoxy Grout

- (a) Where epoxy grout is used, it shall be Sternson Talygrout 100, Sika Sikadur 42, CPD Epoxy Grout by Specialty Construction Products, Meadows Rezi-Weld EG-96, or equal as accepted by the Contract Administrator in accordance with B6.

E14.3.20 Non-Shrink Cementitious Grout

- (a) Where non-shrink cementitious grout is used, it shall be Sternson M-bed Standard, Specialty Construction Products CPD Non-Shrink Grout, Sika 212 Non-Shrink Grout, or equal as accepted by the Contract Administrator in accordance with B6. The minimum compressive strength of the grout at 28 days shall be 40 MPa.

E14.3.21 Patching Mortar

- (a) The patching mortar shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2 parts sand by damp loose volume. White Portland Cement shall be substituted for a part of the grey Portland Cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling or placing.

E14.3.22 Flexible Joint Sealant

- (a) Flexible joint sealant for all horizontal, vertical, and sloping joints shall be guaranteed non-staining, grey polyurethane, accepted by the Contract Administrator and applied in strict accordance with the details shown on the Drawings and the Manufacturer's instructions including appropriate primers if recommended. Accepted products are Vulkem 116 by Mameco, Sonolastic NP1 by Sonneborn, Sikaflex-1a by Sika, Bostik 915 by Bostik, or equal as accepted by the Contract Administrator in accordance with B6.

E14.3.23 Fibre Joint Filler

- (a) Fibre joint filler shall be rot-proof and of the preformed, nonextruding, resilient type made with a bituminous fibre such as Flexcell and shall conform to the requirements of ASTM Standard D1751-99 or equal as accepted by the Contract Administrator in accordance with B6.

E14.3.24 Precompressed Foam Joint Filler

- (a) Precompressed expanding filler shall be compressed to 20% of its expanded width and be a polyurethane foam, impregnated throughout with a latex modified asphalt. Approved products are "Emseal" by Emseal Corporation. Manufacturer's recommended primer and top coat are to be used.

E14.3.25 Low Density Styrofoam

- (a) Low density Styrofoam shall be the type accepted by the Contract Administrator.

E14.3.26 Backup Rod

- (a) Backup rod shall be preformed compressible polyethylene, urethane, neoprene, or vinyl foam backer rod, extruded into a closed cell form and oversized 30 to 50%.

E14.3.27 Dampproofing

- (a) Dampproofing materials shall be applied to all buried surfaces in contact with the soil to within 300 mm of Finished Ground Elevation, with the exception of those surfaces cast directly against the soil or in contact with prefabricated drainage composite. In addition, dampproofing shall be applied on the wingwall surfaces to be in contact with the lean mix concrete. Dampproofing materials shall be mineral colloid emulsified asphalt complying with Canadian General Standards Board Specification No. 37.16-M89. Acceptable product is Bakelite/Flintguard 710-11 Foundation Coating as manufactured by Bakor, Elsro Fibrated Foundation Coating, Insulmastic 7103 Fibered Waterproofing, or equal as accepted by the Contract Administrator in accordance with B6.
- (b) Dampproofing materials shall be applied to the sides of the abutment which are buried by landscape Works.
- (c) All damaged concrete, including tie holes to be filled with non-shrink grout prior to application of dampproofing.
- (d) Primer for dampproofing shall be asphalt primer, penetrating type conforming to CGSB 37-GP-9Ma. Acceptable products are Bakor Penetrating 910-01 Asphalt Primer as manufactured by Bakor Inc., Elsro Asphalt Primer No. 510, Insulmastic 7501 C/B Roof & Foundation Primer, or equal as accepted by the Contract Administrator in accordance with B6.

E14.3.28 Galvanized Dowels and Galvanized Expansion Sleeves

- (a) Dowels and expansion sleeves shall be fabricated in accordance with CSA Standard CAN/CSA-G30.18-M92.
- (b) The dowels shall be galvanized in accordance with CSA Standard G164-M92, to the retention of 600 g/m².

E14.3.29 Preformed Neoprene Compression Seal

- (a) Preformed neoprene compression seal shall be of the type specified in the Approved Products List.

E14.3.30 Miscellaneous Materials

- (a) Miscellaneous materials shall be of the type specified on the Drawings or as accepted by the Contract Administrator.

E14.3.31 Benchmark Plugs

- (a) Benchmark plugs shall be supplied by the City.

E14.4 Equipment

E14.4.1 Vibrators

- (a) The Contractor shall have sufficient numbers of internal concrete vibrators and experienced operators on site to properly consolidate all concrete in accordance with ACI 309. The type and size of vibrators shall be appropriate for the particular application, the size of the pour, and the amount of reinforcing and shall conform to standard construction procedures.

- (b) The Contractor shall use rubber coated vibrators for consolidating concrete containing epoxy-coated reinforcing steel, such as in locations that the existing deck reinforcing is exposed.
- (c) The Contractor shall have standby vibrators available at all times during the pour.

E14.4.2 Placing and Finishing Equipment for Bridge Deck Concrete

- (a) Placing Equipment
 - (i) Adjacent exposed deck reinforcing steel shall be adequately protected during concrete placement.
- (b) Screed for Deck Slab Concrete**
 - (i) **The Contractor may choose to use a mechanical or non-mechanical screed to strike the surface of the deck slab concrete;**
 - (ii) **Screed rails are required and shall be sufficient in number and length to ensure that the concrete cover is maintained and the finished elevation of the deck slab concrete meets the design elevations;**
 - (iii) **Screed guides shall be placed and fastened in position to ensure finishing of the concrete to the required profile. Supporting rails, upon which the finishing machine travels, shall be placed outside the area to be concreted. Provisions for anchorage of supporting rails shall provide for horizontal and vertical stability; positive anchorage may be required by the Contract Administrator. A hold-down device shot into concrete will not be permitted, unless the concrete is to be subsequently resurfaced;**
 - (iv) **Plans for anchoring support rails shall be submitted to the Contract Administrator for acceptance. The Contract Administrator's written acceptance must be received by the Contractor prior to the installation of any anchorage devices;**
 - (v) **The mechanical screed on guides or rails shall be supported so that they are completely clear of the finished surface;**
 - (vi) **Internal vibration of the concrete will be required with mechanical screeding. Care shall be taken not to overwork the concrete surface.**
 - (vii) **Care shall be taken to ensure that the screed bars are seated uniformly on the screed chairs and that the ends of the screed bars do not overhang the screed chairs by more than 75 mm;**
 - (viii) **Screed surface touching concrete shall not be made of aluminum (magnesium acceptable); and**
 - (ix) **The supply, setup, operation, and takedown of the screed for deck slab concrete shall be considered incidental to the placement of the deck slab concrete. No separate measurement or payment shall be made for this Work.**
- (c) Finishing Machine for HPC Deck Overlay**
 - (i) **Unless otherwise specified, an approved finishing machine complying with the following requirements shall be used;**
 - (ii) **A mechanical strike-off shall be required to provide a uniform thickness of concrete in front of the screed;**
 - (iii) **Design of the finishing machine, together with appurtenant equipment, shall be such that positive machine screeding to the plastic concrete will be obtained with 25mm of at least 150mm beyond the line where a sawcut is intended to form the edge of a subsequent placement section and shall overlap the sawn edge of a subsequent placement section and shall overlap the sawn edge of a previously-placed course at least 150mm;**
 - (iv) **Finishing machines that are approved for use for placing the HPC deck overlay are Bidwell Bridge Pavers and Gomaco Bridge Pavers;**
 - (v) **The finishing machine shall have a paving carriage with strike-off auger, rotating cylinders, and a finishing pan;**
 - (vi) **The finishing machine shall be capable of forward and reverse motion under positive control. Provision shall be made for raising the screeds to clear the screeded surface for travelling in reverse;**
 - (vii) **Supporting rails upon which the finishing machine travels will be required on all pours. The support of these rails shall be fully adjustable to obtain the correct profile;**

- (viii) **When placing concrete in a lane abutting a previously completed lane, the side of the finishing machine adjacent to the completed lane shall be equipped to travel on the completed lane;**
 - (ix) **Vehicles for transporting fresh concrete from the truck to the mechanical screed shall not travel on the reinforcement; and**
 - (x) **The supply, set up, operation, and takedown of the finishing machine shall be considered incidental to the placement of the HPC deck overlay and no separate measurement or payment shall be made for this Work.**
- (d) **Moveable Work Bridge for Bridge Deck Concrete**
- (i) **At least two moveable Work bridges will be required (one for finishing and one for curing operations), independent of the screeding and finishing machines for the bridge deck concrete;**
 - (ii) **These moveable Work bridges shall travel guided on rails supported clear of the finished Bridge deck;**
 - (iii) **The Contractor shall install a sturdy walkway with safety railing on each side of the Work area for the purpose of providing access to the Work bridge; and**
 - (iv) **The supply, set up, operation, and takedown of the moveable Work bridges shall be considered incidental to the placement of the Bridge Deck concrete. No separate measurement or payment shall be made for this Work.**
- (e) Moveable Deck Hoarding
- (i) The hoarding shall be constructed on wheels or rollers for ready mobility. Another acceptable method is to have stationary sides, with the roof on wheels or rollers;
 - (ii) The rail system for the movable deck hoarding shall be independent of the rail system used for the screeding machine and the Work Bridge;
 - (iii) The roof of the hoarding shall be checked for damage and water tested before each concrete pour, and all repairs shall be made, as required, before concrete placing will be allowed to begin;
 - (iv) The hoarding shall not be removed from overtop of a newly completed deck slab or HPC deck overlay without first obtaining permission from the Contract Administrator; and
 - (v) The supply, setup, operation, and takedown of the movable deck hoarding shall be considered incidental to the placement of the deck slab concrete and HPC deck overlay, and no separate measurement or payment shall be made for this Work.

E14.4.3 Placing and Finishing Equipment for Approach Slab Concrete

(a) Mechanical Screed

The mechanical screed shall be:

- (i) **Constructed to span the full width of the approach slabs being placed;**
 - (ii) Supported on screed rails positioned above the surface being screeded;
 - (iii) Sufficiently strong (truss type) to retain its shape under all working conditions, especially if any Work scaffolds are supported on the same screed rails;
 - (iv) Capable of producing the required flatness tolerance as specified in Clause E14.6.6 of this Specification; and
 - (v) The supply, setup, operation, and takedown of the movable mechanical screed shall be considered incidental to the placement of the approach **slabs**, and no separate measurement or payment shall be made for this Work.
- (b) Movable Work Bridge for Structural Approach Slab
- (i) The Contractor shall provide a movable bridge, spanning the approach slab at a right angle to the centreline of roadway in order to facilitate a broom finish, the application of curing compound, the inspection of the freshly-placed concrete, and any remedial Work required to be done to the screeded surface, including filling in any holes left by the screed bars. After the surface has been screeded, all further Work that may be required shall be done from the Work Bridge;
 - (ii) The Contractor shall install a sturdy walkway with safety railing on each side of the Work area, as required, for the purpose of providing safe access to the Work Bridge; and

- (iii) The supply, setup, operation, and takedown of the movable **Work bridge** shall be considered incidental to the placement of the approach **slabs**, and no separate measurement or payment shall be made for this Work.

E14.5 Construction Methods

E14.5.1 Scope of Work

- (a) It is intended that this Specification cover the construction of the following structural concrete Works, as indicated on the Drawings:
 - (i) Abutment Modifications;
 - (ii) Stage I Bridge Deck (**Deck Slab Concrete**);
 - (iii) Barriers;
 - (iv) Approach Slabs;
 - (v) Roadway Expansion Slabs;
 - (vi) Expansion Joint Concrete Nosings;
 - (vii) Slope Paving;
 - (viii) High Performance Concrete Deck Overlay; and
 - (ix) Stage II Bridge Deck (**Deck Slab Concrete**):
 - (i) Type 1
 - (ii) Type 2

E14.5.2 Description

- (a) Abutment modifications shall comprise of all Work involving modifications to the East and West abutment wingwalls and roof slabs. In addition, lean mix concrete between the existing and new wingwalls shall be associated with this Work.
- (b) Stage I Bridge deck concrete shall comprise the new concrete deck falling within the limits of excavation of Stage I concrete removals **and the top of the deck slab concrete**. Stage I concrete shall also comprise the construction of new **Bridge deck overhangs**.
- (c) Stage II Bridge deck concrete shall comprise the new concrete deck falling within the limits of excavation of Stage II concrete removals.
- (d) Barrier concrete shall comprise of the cast-in-place Bridge barriers and approach roadway barriers.
- (e) Approach slab concrete shall comprise all Work involving the approach slabs. In addition, lean mix concrete beneath the approach slabs shall be associated with this Work.
- (f) Expansion joint concrete nosings shall comprise of the concrete surrounding the expansion joints, specified in E16.6.4.
- (g) Slope paving concrete shall comprise of all Work involved with slope repair areas.
- (h) HPC deck overlay shall comprise of the concrete deck overlay above the **deck slab concrete**.

E14.5.3 Supplying Concrete

- (a) **All concrete shall be supplied from a plant certified by the Manitoba Ready Mix Concrete Association. The Contractor, upon request from the Contract Administrator, shall furnish proof of this certification.**
- (b) **All mixing of concrete must meet the provisions of CSA A23.1-04, Clause 5.2, Production of Concrete.**
- (c) Time of Hauling
 - (i) The maximum time allowed for all types of concrete to be delivered to the Site of the Work, including the time required to discharge, shall not exceed 120 minutes after batching. Batching of all types of concrete is considered to occur when any of the mix ingredients are introduced into the mixer, regardless of whether or not the mixer is revolving. For concrete that includes silica fume and fly ash, this requirement is reduced to 90 minutes.
 - (ii) Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of batching. In hot or cold weather, or under conditions contributing

to quick stiffening of the concrete, a time less than 120 and/or 90 minutes may be specified by the Contract Administrator. The Contractor will be informed of this requirement 24 hours prior to the scheduled placing of concrete.

- (iii) To avoid the reduction of delivery and discharge time in hot weather, the Contractor will be allowed to substitute crushed ice for a portion of the mixing water provided the specified water/cementitious ratio is maintained. All of the ice shall be melted completely before discharging any of the concrete at the delivery point.
 - (iv) **Unless otherwise noted in Table E14.1, "Requirements for Hardened Concrete", no retarders shall be used.**
 - (v) The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water. **If the slump of the concrete is less than that designated by the mix design statement, then water can be added on site provided the additional water meets the requirements of CSA A23.1-04 5.2.4.3.2. If additional water is to be added on site, it must be done under the guidance of the Suppliers' designated quality control person. The Supplier shall certify that the addition of water on site does not change the Mix Design for the concrete supplied. Any other water added to the concrete without such control will be grounds for rejection of the concrete by the Contract Administrator.**
 - (vi) A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the Owner upon request.
- (d) Delivery
- (i) The Contractor shall satisfy himself that the Concrete Supplier has sufficient plant capacity and satisfactory transporting equipment to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such that the development of cold joints will not occur. The methods of delivering and handling the concrete shall facilitate placing with a minimum of rehandling, and without damage to the structure or the concrete.
- (e) Concrete Placement Schedule
- (i) The Contractor shall provide to the Contract Administrator the proposed concrete placement schedule for all concrete placements. If, in the opinion of the Contract Administrator, the volume of the placement is deemed larger than can be placed with the facilities provided, the Contractor shall either:
 - (i) Limit the amount to be placed at any time (using adequate construction joints), or
 - (ii) Augment his facilities and Plant in order to complete the proposed placement, or
 - (iii) In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting.
 - (ii) The Contractor shall adhere strictly to the concrete placement schedule, if shown on the Drawings or otherwise specified, as approved by the Contract Administrator.

E14.5.4 False Work, Formwork, and Shoring

- (a) Design
- (i) All forms shall be of wood, metal or other materials as approved by the Contract Administrator.
 - (ii) The formwork and shoring for these Works shall be designed by a Professional Engineer registered in the Province of Manitoba. False work shall be designed according to the requirements of CSA S269.1, "False work for Construction Purposes." The Shop Drawings shall bear the Professional Engineer's seal. Shop Drawings submitted without the seal of a Professional Engineer will be rejected. The submission of such Shop Drawings to the Contract Administrator shall in no way relieve the Contractor of full responsibility for the safety and structural integrity of the formwork and shoring.
 - (iii) The formwork and shoring for these Works shall be designed, erected, braced, and maintained to safely support all vertical and lateral loads until such loads can be supported by the concrete all in accordance with CSA Standard CAN/CSA S269.3-M92. **There shall be no welding to the steel box girders for supporting formwork. All proposed fastening methods to the steel box girders must be submitted to the Contract Administrator for review and approval.**

Work. The Contract Administrator shall be the sole judge of their condition and his decision shall be final regarding the use of them again.

- (i) Where required by the Contract Administrator, the Contractor shall cast test panels not using less than two panels of representative samples of the forms he proposes for reuse and shall strip them after 48 hours for the Contract Administrator to judge the type of surface produced.
- (j) All form lumber, studding, etc., becomes the property of the Contractor when the Work is finished, and it shall be removed from the concrete and the site by the Contractor after the concrete is set, free of extra charge, and the entire site left in a neat and clean condition.

E14.5.5 Setting Deck Forms

- (a) The Contractor shall adjust forms, maintain uniform slab thickness, and adjust screed heights to plan elevations or to such other elevation as may be determined by the Contract Administrator in the field. The screed chairs shall be tack welded to the screed bases at the time that the screeds are adjusted to the required elevations.
- (b) Side forms shall be set to the grade and alignment indicated on the Drawings or as set by the Contract Administrator in the field. The screed chairs and screed rail supports shall be spaced to prevent deflections of the screed bars or screed rails during screeding operations.

E14.5.6 Setting Deck Joints

- (a) The Contractor shall adjust all deck joints to the required elevations and gaps as accepted by the Contract Administrator prior to placement of concrete adjacent thereto. The adjustment shall be done in accordance with the procedures for adjusting of the deck joints as recommended by the Manufacturer or as directed by the Contract Administrator.

E14.5.7 Permeable Formwork Liner

- (a) Permeable formwork liners shall be used on all exposed surfaces, except soffit surfaces, or where a normal form finish is specified.
- (b) The permeable formwork liner shall be used for only one (1) application.
- (c) The supply, setup, application, and removal of permeable formwork liner shall be considered incidental to the placement of structural concrete, and no separate measurement of payment shall be made for this Work.

E14.5.8 Architectural Formwork Liner

- (a) Architectural formwork liner shall be used on areas specified on the Drawings.
- (b) The architectural concrete finish formwork liner shall be replaced after each use unless specifically allowed to be reused by the Manufacturer.
- (c) The supply, setup, installation, and removal of architectural formwork liner shall be considered incidental to the placement of structural concrete, and no separate measurement or payment shall be made for this Work.

E14.5.9 Anchor Units for **Bridge Street Lights** and BR1 Posts

- (a) All anchor units and electrical embedded Work shall be as specified on the Drawings.
- (b) All anchor units and embedded electrical Work shall be held securely in place so as not to become displaced during concrete placement operations. Conduit placement operations shall be performed so as not to damage the conduit.
- (c) The Contractor shall coordinate the installation of all conduits, pull boxes, and junction boxes for the lighting electrical embedded Work described in the Specification E21, "Lighting and Miscellaneous PVC Conduit".
- (d) The Contractor shall coordinate the installation of aluminum traffic bridge posts and rails as described in the Specification E17, "Installation of Balanced Barrier and Aluminum Traffic Barrier".

E14.5.10 Preparation for Concreting Against Hardened Concrete

- (a) All hardened concrete against which new concrete is to be placed shall be prepared in the following manner:

- (i) Concrete is to be removed to sound concrete or to the limits as shown on the Drawings, whichever is greater. The resulting surface is to be rough with a minimum amplitude of 6 mm and maximum frequency of 15 mm.
- (ii) All existing surfaces and exposed reinforcing steel are to be sandblasted to reveal a clean substrate and kept clean until concrete placement. Sandblasting shall be followed by a high pressure water wash to remove all residues.
- (iii) Immediately prior to placing new concrete, cement slurry bonding grout shall be applied to the entire surface of the existing concrete.

E14.5.11 Placing Structural Concrete

(a) General

- (i) The Contract Administrator must be notified at least 24 hours prior to concrete placing so that an adequate inspection may be made of formwork, shoring, reinforcement, deck joints, mechanical screed setup, movable hoarding, and related Works. Placement without required prior notification will not be allowed.

(b) Placing Structural Concrete

- (i) Equipment for mixing or conveying concrete shall be thoroughly flushed with clean water before and after each pour. Water used for this purpose shall be discharged outside the forms. Pumping of concrete will be allowed for all substructure concrete. All equipment and processes are subject to acceptance by the Contract Administrator.
- (ii) Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation and a marked change in consistency.
- (iii) Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.
- (iv) Before depositing any concrete, all debris shall be removed from the space to be occupied by the concrete, and any mortar splashed upon the reinforcement or forms shall be removed.
- (v) Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.
- (vi) Placing of concrete, once started, shall be continuous. No concrete shall be placed on concrete which has sufficiently hardened to cause the formation of seams or "cold joints" within the section. If placing must be interrupted, construction joints shall be located where shown on the Drawings or as accepted by the Contract Administrator.
- (vii) Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.
- (viii) The maximum free drop of concrete into the forms shall not be greater than 1.5 m, otherwise rubber tubes or pouring ports spaced not more than 1.5 m vertically and 2.5 m horizontally shall be used. The Contractor shall obtain the Contract Administrator's acceptance, prior to pouring concrete, of all placing operations.
- (ix) All concrete, during and immediately after depositing, shall be consolidated by mechanical vibrators so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into the corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Mechanical vibrators shall have a minimum frequency of 7000 revolutions per minute immersed.
- (x) Vibrators shall be inserted systematically into the concrete at intervals such that the zones of influence of the vibrator overlap (generally 300 to 900 mm). Apply the vibrator at any point until the concrete is sufficiently compacted (5 to 15 seconds), but not long enough for segregation to occur. The vibrators shall be inserted vertically and withdrawn out of the concrete slowly. Spare vibrators in good working condition shall be kept on the job site during all placing operations.
- (xi) Concrete shall not be placed during rain or snow unless adequate protection is provided for formwork and concrete surfaces.
- (xii) Before any concrete is placed in the approach slabs, roadway approach slabs, expansion slab, or Bridge deck, the Contractor shall demonstrate to the satisfaction of the Contract Administrator before each pour that all necessary adjustments have been made to provide the required camber, crown, slab thickness, and concrete cover. This demonstration may be carried out by means of an attachment securely fastened to the finisher's strike-off machine and moving the machine and the

strike-off across the deck over the reinforcing steel with a minimum 3 mm clearance between the steel and attachment.

- (xiii) After verification that the surface meets acceptable limits and after final floating, the top surface shall be given Type 2 Finish – Unformed Surfaces.

E14.5.12 Finishing of Concrete Surfaces

(a) Type 1 Finish – Exposed Formed Surfaces

- (i) Formwork liner finish shall be applied to all exposed formed surfaces including all exposed concrete surfaces not included in Type 2, Type 3, Type 4 finishes.
- (ii) Exposed surfaces imply all surfaces exposed to view including surfaces to 300 mm below finish grade elevations.
- (iii) All surfaces to receive a formwork liner finish shall be formed using permeable formwork liner.
- (iv) The surfaces shall be patched as specified in this Specification. The surface shall be rubbed with a carborundum brick or other abrasive, to achieve a smooth-rubbed finish.
- (v) **Smooth-rubbed finish shall be produced on the newly hardened concrete surface no later than twenty-four (24) hours following form removal. Surfaces shall be thoroughly wetted and rubbed until uniform colour and texture are produced. No finishing mortar shall be used other than that produced from the concrete by the rubbing process.**

(b) Type 2 Finish – Unformed Surfaces

- (i) All unformed concrete surfaces except the approach slabs, **deck slab concrete**, and HPC deck overlay shall be finished as outlined hereinafter.
- (ii) Screeding of all unformed concrete surfaces shall be performed by the sawing movement of a straightedge along wood or metal strips or form edges that have been accurately set at required elevations.
- (iii) Screeding shall be done on all concrete surfaces as a first step in other finishing operations. Screeding shall be done immediately after the concrete has been vibrated.
- (iv) After screeding, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared. The surface shall then be consolidated with hand floats. Concrete surfaces after floating shall have a uniform, smooth, granular texture.

(c) Type 3 Finish – **Deck Slab Concrete and Approach Slabs**

- (i) The Contractor shall ensure that sufficient personnel are provided for the finishing of the slab surfaces. In the event that the depositing, vibrating, and screeding operations progress faster than the concrete finishing, the Contractor shall reduce the rate of concrete placement or cease the depositing of concrete until the exposed area of unfinished concrete has been satisfactorily finished. The Contract Administrator's judgement in this matter shall be final and binding on the Contractor. All loads of concrete that exceed the **120** minute discharge time limit during the day, while the finishing operations catch up, shall be rejected.

(d) Type 4 Finish - Surfaces Below Finished Grade

- (i) All surfaces below 300 mm below finished grade except underside of footings shall be patched in accordance with E14.3.20, E14.3.21, and E14.5.16 of this Specification.
- (ii) All surfaces below 300 mm below finish grade shall receive dampproofing in accordance with E14.5.24 of this Specification.

(e) **Working Base Concrete Finish**

- (i) **During placing, concrete working base shall be vibrated.**
- (ii) **The supply, set up, operation, and finishing of working base concrete shall be considered incidental to the placement of working base concrete, and no separate measurement or payment shall be made for this Work.**

E14.5.13 General Curing

Refer to E14.5.18 for cold weather curing requirements and E14.5.19 of this Specification for hot weather curing requirements.

- (a) The use of curing compound shall not be allowed on concrete areas that are to receive additional concrete or dampproofing.
- (b) Freshly finished concrete shall have either a curing compound applied or covered and kept moist by means of wet polyester blankets immediately following finishing operations and shall be maintained at above 10°C for at least seven (7) consecutive days thereafter. Construction joints shall only be covered and kept saturated by means of wet polyester blankets for the curing period.
- (c) Curing compounds shall be applied at the rate required by ASTM P198 for the accepted product. The compound must be applied uniformly and by roller. Spraying of the compound will not be permitted.
- (d) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, running water, vibration, and mechanical shock. Concrete shall be protected from freezing until at least 24 hours after the end of the curing period.
 - (i) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3°C in one hour or 20°C in 24 hours.
- (e) Care shall be exercised to ensure that the polyester curing blanket is well drained and that it is placed as soon as the surface will support it without deformation. The Contractor shall ensure that water from the polyester curing blankets does not run into areas where concrete placement and finishing operations are underway. If this occurs, concrete placement shall stop until the problem is corrected satisfactory to the Contract Administrator.
- (f) Formed surfaces shall receive, immediately after stripping and patching, the same curing as finished surfaces, with the exception of the Bridge deck soffit surfaces.

E14.5.14 Curing of Approach Slab

- (a) After the finishing is completed, the surface shall be promptly covered with a minimum of a single layer of clean, predampened polyester blanket.
- (b) Care shall be exercised to ensure that the polyester blanket is well drained and that it is placed as soon as the surface will support it without deformation. The Contractor shall ensure that water from the polyester blankets does not run into areas where concrete placement and finishing operations are underway. If this occurs, concrete placement shall stop until the problem is corrected satisfactory to the Contract Administrator.
- (c) Water used for wetting the blankets for the first 72 hours shall be a minimum temperature of 40°C when applied to the blankets. Potable water only shall be used.
- (d) Failure to apply wet polyester blankets within 30 minutes after the concrete has been deposited or before the finished surface comes out from under the blankets, shall be cause for rejecting the Work so affected. Concrete in the rejected area shall be removed and replaced at no additional cost to the City.
- (e) As soon as the concrete can be walked on without damaging the surface, the polyester blankets shall be covered with a layer of 4 mil thick white polyethylene film. Black insulated tarps will not be allowed.
- (f) For the approach slab, the surfaces shall receive a wet polyester blanket cure for at least 72 hours. Warm water, as specified, shall be applied, as necessary, to keep the polyester blankets wet for that period. If the wet cure is removed before seven days, curing compound is to be applied.
- (g) Following 72 hours, regular water temperatures may be used to continue the curing with polyester blankets in place.

E14.5.15 Form Removal

- (a) The Contract Administrator must be notified at least 24 hours prior to form removal and give acceptance prior to the Contractor beginning form removal operations.
- (b) All forms shall remain in place and the concrete shall not be loaded for a minimum of seven (7) days after initial concrete placement, unless otherwise accepted by the Contract Administrator or noted otherwise on the Drawings.

- (c) Notwithstanding the above, the minimum strength of concrete in place for safe removal of vertical forms for abutments shall be 25 MPa, with the added provision that the member shall be of sufficient strength to safely carry its own weight, together with super-imposed construction loads. Bridge deck soffit forms shall remain in place to support construction live loads during the placement of traffic barriers. Bridge deck soffit forms shall be removed prior to placement of the HPC deck overlay. Stripping of these forms shall not be permitted until a concrete strength of **28** MPa has been achieved.
- (d) Field-cured test specimens representative of the cast-in-place concrete being stripped shall be tested as specified in this Specification to verify the concrete strength.

E14.5.16 Patching of Formed Surfaces

- (a) Immediately after forms have been removed, but before any repairing or surface finishing is started, the concrete surface shall be inspected by the Contract Administrator. Any repair or surface finishing started before this inspection may be rejected and required to be removed.
- (b) All formed concrete surfaces shall have bolts, ties, struts, and all other timber or metal parts not specifically required for construction purposes cut back 75 mm from the surface before patching.
- (c) Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter, voids left by strutting, and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched and then applying patching mortar. A slurry grout consisting of water and cement shall be well brushed onto the area to be patched. When the slurry grout begins to lose the water sheen, the patching mortar shall be applied. It shall be struck off slightly higher than the surface and left for one hour before final finishing permitting initial shrinkage of the patching mortar. It shall be touched up until it is satisfactory to the Contract Administrator. The patch shall be cured as specified in this Specification. The final colour shall match the surrounding concrete.
- (d) All objectionable fins, projections, offsets, streaks, or other surface imperfections shall be removed by means acceptable to the Contract Administrator. Cement washes of any kind shall not be used.
- (e) Concrete shall be cast against forms which will produce plane surfaces with no bulges, indentations, or protuberances other than those shown on the Drawings.
- (f) The arrangement of panel joints shall be kept to a minimum. Panels containing worn edges, patches, or other defects which will impair the texture of concrete surfaces shall not be used.

E14.5.17 High Performance Concrete Deck Overlay

- (a) General
 - (i) **The HPC deck overlay shall be constructed in accordance with the requirements of this Specification; and**
 - (ii) Any patching to the Bridge deck concrete shall reach a minimum compressive strength of 35 MPa, as determined by field-cured test cylinders, before the HPC deck overlay is placed.
- (b) Surface Preparation
 - (i) The concrete Bridge deck surface, over which the HPC deck overlay placing is to be applied, shall be thoroughly cleaned to remove all laitance, dirt, or other deleterious material. The cleaning shall be accomplished by shot-blasting and/or other means deemed necessary as accepted by the Contract Administrator. The cleaning shall remove laitance and oil-contaminated areas and expose the upper portion of the fine aggregate and the top surface of the coarse aggregate. The cleaning operations shall be completed and acceptable to the Contract Administrator.
 - (ii) The time interval between the surface preparation and the placing of the deck overlay concrete shall be kept to a minimum, and utmost care shall be taken to keep the prepared surfaces clean during the interval.
 - (iii) Immediately before proceeding with each placement, the prepared surface shall be inspected for dirt and other deleterious materials that may have been deposited after the completion of cleaning. All such dirt and deleterious material shall be cleaned off in a manner and by procedures satisfactory to the Contract Administrator.
- (c) Mixing
 - (i) A water-reducing admixture for improving Workability will be required. The admixture must be accepted by the Contract Administrator and shall be used in strict accordance with the Manufacturer's instructions.

(d) Dry Run of **Finishing** Machine

- (i) The Contractor is responsible for properly setting the screed **supporting** rails to ensure compliance with the specified longitudinal and transverse deck grades, without creating potential ponding areas or “bird baths.”
- (ii) Sufficient screed **supporting** guide rails to provide the required coverage for the entire pour, as approved by the Contract Administrator, shall be set out and adjusted for height the day prior to the pour. The Contract Administrator will then check the deck grades, as follows:
 - That the screed **supporting** rail system upon which the finishing machine will travel has been placed outside the area to be concreted. Arrangements for positive anchorage of supporting rails shall provide for horizontal and vertical stability. Hold-down devices shot into the concrete will not be permitted.
 - That the finishing machine and **screed** rails have been adjusted so that the height of the screed above the existing concrete at each point meets the Contract Administrator’s requirements. To confirm the Contractor’s adjustment of the machine and guide rails, the finishing machine shall be “dry run,” and screed clearance measurements taken at each support point, by the Contractor. Resetting of the machine and/or **screed** rails shall be done by the Contractor as required by the Contract Administrator.

(e) Placing High Performance Concrete Deck Overlay

- (i) No longitudinal or transverse joints will be allowed unless detailed on the Drawings or authorized in writing by the Contract Administrator. Where transverse and longitudinal joints are allowed, the HPC deck overlay previously placed shall be sawn to a straight edge and vertical edge before the adjacent concrete overlay is placed.
- (ii) After the surface has been cleaned and immediately before placing concrete, a thin coating of bonding grout shall be scrubbed into the dry, prepared surface or latex bonding agent shall be sprayed onto the prepared surface in accordance with Manufacturer’s recommendations. Care shall be exercised to ensure that all parts receive a thorough, even coating and that no excess of grout is permitted to collect in pockets. The rate of progress in applying grout shall be limited so that the grout does not become dry before it is covered with new concrete.
- (iii) The Contractor shall take every precaution necessary to secure a smooth-riding Bridge deck, within the tolerances indicated in E14.6.6 in this Specification.
- (iv) Concrete shall be placed so as to avoid segregation of constituent materials. The concrete finishing machine shall provide sufficient vibration to properly compact the mix. Excess vibration which may cause segregation shall be avoided. If over 75 mm in thickness, or if reinforcing steel is in the lift, the concrete shall be internally vibrated in advance of machine finishing.
- (v) The temperature of the concrete shall not be less than 10°C, nor more than 18°C, at the time of placing, and shall be maintained below this maximum temperature by the inclusion of ice in the mix in place of a portion of the mix water, as approved by the Contract Administrator, taking care to maintain the design water/cementitious ratio.
- (vi) The overall combination of labour and equipment for proportioning, mixing, placing, and finishing new concrete shall be of such minimum capability as to meet the following requirements, as shown on Table E14.2, “Minimum Requirement for Placing High Performance Concrete Deck Overlay”, except when noted otherwise on the Drawings.

TABLE E14.2 MINIMUM REQUIREMENT FOR PLACING HIGH PERFORMANCE CONCRETE DECK OVERLAY	
TOTAL CONCRETE AREA PER BRIDGE (Square Metre)	MINIMUM REQUIREMENTS (Cubic Metres/Hour)
0 - 275	1.0
276 - 410	1.5
411 - 550	2.0
Over 550	2.5

- (vii) The **finishing** machine shall be so designed that, when concrete is mixed and placed at the specified minimum rate, under normal operating conditions, the elapsed time between depositing the concrete and final screeding shall not exceed 10 minutes. Similarly, the placing equipment and operations shall be such that in no case shall the elapsed time between batching of ready-mix concrete and final screeding exceed 90 minutes.
 - (viii) Placement of the concrete shall be a continuous operation throughout the pour. In the event of equipment breakdown, such that concrete placement is stopped or delayed for a period of 60 minutes or more, further placement shall be discontinued and may resume only after a period of not less than 12 hours. This restriction does not prohibit continuation of placement provided that a gap is left in the lane or pour strip. The gap shall be sufficient in length for the finishing machine to clear the previously placed concrete. The fill-in section shall be placed after a period of not less than 12 hours. The edge of any discontinued overlay shall be saw cut vertically to a depth of 50 mm and then shall be chipped out and thoroughly cleaned before placing further overlay concrete.
 - (ix) Screed guides shall be placed and fastened in position to ensure finishing of concrete to the required profile. Supporting rails upon which the finishing machine travels shall be placed outside the area to be concreted. Provisions for anchorage of supporting rails shall provide for horizontal and vertical stability; positive anchorage may be required by the Contract Administrator. A hold-down device shot into the lower lift deck concrete will not be permitted. Plans for anchoring support rails shall be submitted to the Contract Administrator for acceptance. The Contract Administrator's acceptance must be received by the Contractor prior to the installation of any anchorage devices.
 - (x) The finished Bridge deck grades shown on the Drawings are preliminary only and are subject to revision during construction by the Contract Administrator.
 - (xi) The deck overlay shall have a minimum thickness of 50 mm. Actual HPC deck overlay thickness may be greater. This would be to accommodate field adjustments for camber and deflection.
 - (xii) The vibratory screed of the finishing equipment shall be moved slowly and at a uniform rate, such that screeding shall be completed in no more than two passes. The screed vibrators shall not be allowed to run except when screeding is actually in progress. The screeded surface shall not be walked on or otherwise damaged.
 - (xiii) The concrete surface produced behind the **finishing** machine shall be magnesium floated the minimum amount necessary to ensure that the surface is free from open texturing, plucked aggregate or projecting polypropylene fibres and local projections or depressions, to meet the surface tolerance specified. The Contractor shall ensure that the concrete surface is not overworked, resulting in excessive loss of air entrainment.
 - (xiv) During the concrete finishing operations, the Contractor shall utilize a 3.05 m (10 ft.) straightedge with a 75 mm (3 inch) semicircular shape, as supplied by Bidwell Inc., and as accepted by the Contract Administrator. It shall be used both for flattening the plastic concrete surface and for checking and verifying the surface flatness before commencing curing of the surface. The entire surface shall be checked and any areas not within the surface flatness tolerances specified under the Quality Control section of this Specification shall be corrected using the straight edge. Care shall be taken to preserve the crown and cross section of the roadway.
 - (xv) Upon completion of the straight-edge checking and final floating the joint with any previous pour (or any transverse joints) shall be sealed by the application of the bonding grout.
- (f) Curing Concrete
- (i) Immediately following finishing of the concrete, apply fog misting until the concrete has enough strength to support the placement of the predampened blankets. The misting device shall not be used to apply water to the concrete's surface for finishing purposes. The misting device shall not be directed towards the concrete surface. Only a fine coating or sheen should be applied with the misting device. There should be no standing water.
 - (ii) After the joint painting is completed, the surface shall be promptly covered with a single layer of clean, lightly pre-dampened, polyester curing blanket.
 - (iii) Care shall be exercised to ensure that the polyester curing blanket is well drained and that it is placed as soon as the surface will support it without deformation. The Contractor shall ensure that water from the polyester curing blankets does not run into areas where concrete placement and finishing operations are underway. If this occurs, concrete placement shall stop until the problem is corrected to the satisfaction of the Contract Administrator.

- (iv) The predampened polyester curing blankets shall be a temperature of 20°C, ± 5°C, when applied to the deck.
- (v) Failure to apply wet polyester curing blankets within 30 minutes after the deck concrete has been deposited shall be cause for rejecting the Works so affected. However, if the concrete is re-vibrated because of failure to meet density requirements within initial vibration, this time will be extended by 15 minutes. Concrete in the rejected area shall be removed and replaced at no additional cost to the City.
- (vi) It is intended that the surface receive a wet polyester blanket cure for at least seven (7) days. Water shall be applied as necessary to keep the concrete and polyester curing blankets saturated. The Contractor must ensure the concrete and polyester curing blankets are kept saturated with water for the entire seven (7) days.
- (vii) As soon as the deck concrete can be walked on without damaging the surface, as approved by the Contract Administrator, the polyester curing blankets shall be covered with a layer of minimum 4-mil polyethylene film and a layer of insulated tarps (during cold weather) in order to maintain the concrete temperature of 10°C.
- (viii) If, in the opinion of the Contract Administrator, curing has not been maintained sufficiently, the curing period will be extended as directed with no additional payment made.

(g) Surface Texturing **of HPC Overlay**

- (i) Grooves shall be cut into the concrete deck surface following the verification that the surface meets acceptable limits and after curing. Grooves are to be parallel (within 2 mm) and cut perpendicular to traffic flow. Grooves shall be cut into the concrete deck surface following the curing period. Grooving fresh concrete with no rack in place of cutting cured concrete will not be permitted. Grooves are to be parallel (within 2 mm) and cut perpendicular to traffic flow.
- (ii) Saw cuts shall be 2.5 mm wide, 6 ± 2 mm deep, and spaced 25 mm on centre.
- (iii) The area 600 mm from traffic barriers and curbs is not to be grooved and the end of the grooves shall be in a straight line parallel with the traffic barrier or curb face.
- (iv) Saw cuts shall extend no closer than 100 mm to expansion joints and deck drains.
- (v) The Contractor shall supply all water. All run-off from grooving operations and suspended solids shall be collected at either end of the Bridge off the Bridge approaches or deck, in collection tanks, passed through several settling and filtration processes before it is discharged into the sewer system. The final effluent shall meet the requirements of **the City of Winnipeg By-Law No. 7070/97 Part 5, Control of Discharge into Sewers**, for water quality.
- (vi) All Work associated with surface texturing shall be considered incidental and no additional measurement or payment shall be made for this Work.

(h) Limitation of Operations

- (i) Provisions shall be made to protect the concrete by only casting overlay concrete under good weather conditions. This means that the air temperatures shall be between 5°C and 25°C and the surface moisture evaporation rate is less than 0.75 kg/square metre per hour as determined by CSA A23.1-04, Appendix D, "Guidelines for Curing and Protection". Also, it shall not be raining and no rain forecast for the duration of each pour. The Contract Administrator's decision in this matter will be final.

E14.5.18 Cold Weather Concreting

- (a) The requirements of CSA Standard A23.1-04 shall be applied to all concreting operations during cold weather, i.e., if the mean daily temperature falls below 5°C during placing or curing.

E14.5.19 Hot Weather Concreting

(a) General

- (i) The requirements of this section shall be applied during hot weather, i.e., air temperatures above **27°C** during placing.
- (ii) Concrete shall be placed at as low a temperature as possible, preferably below 15°C but not above 27°C. Aggregate stockpiles may be cooled by water sprays and sun shades.

- (iii) The Contractor shall use cold water and/or ice in the mix to keep the temperature of the fresh concrete down, if required. Ice may be substituted for a portion of the mixing water; provided it has melted by the time mixing is completed.
 - (iv) Form and conveying equipment shall be kept as cool as possible before concreting by shading them from the sun, painting their surfaces white and/or the use of water sprays.
 - (v) Sun shades and wind breaks shall be used as required during placing and finishing.
 - (vi) Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".
 - (vii) The Contract Administrator's acceptance is necessary before the Contractor may use admixtures such as retardants to delay setting, or water reducing agents to maintain Workability and strength, and these must then appear in the Mix Design Statement submitted to the Contract Administrator.
 - (viii) Curing shall follow immediately after the finishing operation.
- (b) Hot-Weather Curing
- (i) When the air temperature is at or above 25°C, curing shall be accomplished by fog misting and by using saturated absorptive fabric, in order to achieve cooling by evaporation. Fog misting is mandatory for deck concrete at all temperatures.
 - (ii) Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.
- (c) Job Preparation
- (i) When the air temperature is at or above 25°C, or when there is probability of its rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by mist fogging and evaporation.
- (d) Concrete Temperature
- (i) The temperature of the concrete as placed shall be as low as practicable and in no case greater than the following temperatures, as shown in Table E14.3, "Acceptable Concrete Temperature", for the indicated size of the concrete section.

TABLE E14.3: ACCEPTABLE CONCRETE TEMPERATURES		
THICKNESS OF SECTION, M	TEMPERATURES °C	
	MINIMUM	MAXIMUM
Less than:		
1	10	27
1.2	5	25

E14.5.20 Cleanup

- (a) The Contractor shall cleanup equipment and construction debris on at least a daily basis to the satisfaction of the Contract Administrator.

E14.5.21 Protection From Drying

- (a) Placement of deck concrete and the HPC deck overlay shall not be permitted when the surface moisture evaporation exceeds 0.75 kg/m²/h. Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator.
- (b) The nomograph, Figure D1, Appendix D of CSA Standard A23.1-04 shall be used to estimate surface moisture evaporation rates.

E14.5.22 Construction Joints

- (a) Construction joints shall be located only where shown on the Drawings or as otherwise accepted in writing by the Contract Administrator. Construction joints shall be at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints.

- (b) The face of joints shall be cleaned of all laitance and dirt, after which an epoxy adhesive bonding agent shall be applied. Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.
- (c) Prior to applying the bonding agent, the joints shall be thoroughly cleaned to make them free of all laitance, loose aggregates, form release agents, curing compound, and other surface treatments, roughened to provide a minimum amplitude of 6 mm, and primed with material as recommended by the bonding agent Manufacturer. No primer or sealant shall be installed until the joint preparation has been accepted by the Contract Administrator. Accepted means of roughening include the removal of laitance and mortar paste by water jet and soft brush when concrete is in hardened state.

E14.5.23 Finishing of Concrete Barrier Joints

- (a) The installation of the fibre joint filler, the backup rod, and the flexible joint sealant shall be as shown on the Drawings.
- (b) Fibre joint fillers and flexible joint sealant shall be installed as per the Manufacturer's recommendations.
- (c) The flexible joint sealant at the barrier joints shall be tooled to provide a clean, uniform finish.
- (d) The supply and installation of flexible joint sealant and fibre joint fillers shall be considered incidental to the Work, and no additional measurement or payment shall be made for this Work.

E14.5.24 Application of Dampproofing

- (a) Surfaces shall be patched as specified under E14.5.16 of this Specification prior to application of dampproofing.
- (b) Brush or spray primer on all surfaces, brushing into all corners and allow drying. Apply two (2) coats of dampproofing allowing the first coat to dry before applying the second coat. Minimum application rate per coat shall be 0.6 L/m².

E14.5.25 Benchmarks

- (a) The Contractor shall install a benchmark plug(s) supplied by the Contract Administrator at the locations on each structural item directed by the Contract Administrator.

E14.5.26 Structure Identification Date

- (a) The Contractor shall indent into the exposed concrete a structure identification date at the location on each end of the structure as shown on the Drawings in accordance with the detail shown on the Drawings or as otherwise directed by the Contract Administrator.

E14.5.27 Installation of Dowels and Galvanized Expansion Sleeves in Barriers

- (a) Dowels and galvanized expansion sleeves shall be installed across construction joints exactly parallel to the direction of movement and each other.
- (b) The galvanized sleeves shall be installed in the side of the joint which is cast first.
- (c) The sleeves and dowels shall be positioned as shown on the Drawings and shall be held in place by positive and satisfactory means, such as a template, so that their correct position will be maintained after the concrete has been placed, vibrated, and finished. If sleeves and/or dowels are displaced during concrete placing operations, concrete placement shall cease and shall not resume until the displaced dowels and/or sleeves have been reset to the correct alignment.

E14.6 Quality Control

E14.6.1 Inspection

- (a) All Workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works which are not in accordance with the requirements of this Specification.

E14.6.2 Access

- (a) The Contract Administrator shall be afforded full access for the inspection and control testing of concrete and constituent materials, both at the site of Work and at any plant used for the production of concrete, to determine whether the concrete is being supplied in accordance with this Specification.

E14.6.3 Materials

- (a) All materials supplied under this Specification shall be subject to testing and acceptance by the Contract Administrator in accordance with this Specification.

E14.6.4 Concrete Quality

- (a) **The Contract Administrator reserves the right reject concrete in the field that does not meet the Specifications.**
- (b) **Quality control tests will be used to determine the acceptability of the concrete supplied by the Contractor.**
- (c) The Contractor shall provide, without charge, the samples of concrete and the constituent materials required for quality control tests and provide such assistance and use of tools and construction equipment as is required.
- (d) **The Contractor will be required to undertake quality control tests, of all concrete supplied. All test results are to be copied to the Contract Administrator immediately after the tests have been performed.**
- (e) The frequency and number of concrete quality control tests shall be in accordance with the requirements of CSA Standard A23.1-04. An outline of the quality tests is as follows:
- (f) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C-04, "Slump of Concrete". If the measured slump falls outside the limits in E14.2.1 of this Specification, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.
- (g) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C-04, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E14.2.1 of this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.
- (h) The air-void system shall be proven satisfactory by data from tests performed in accordance with the test method of ASTM C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C-04, shall be determined prior to the start of construction on cylinders of concrete made with the same materials, mix proportions, and mixing procedures as intended for the project. If deemed necessary by the Contract Administrator to further check the air-void system during construction, testing of cylinders may be from concrete as delivered to the job Site and will be carried out by the Contract Administrator. The concrete will be considered to have a satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.
- (i) **Rapid chloride permeability testing shall be performed in accordance with ASTM C 1202.**
- (j) **Testing for post-cracking residual strength index shall be in accordance with E14.3.10.**
- (k) **Testing for shrinkage strain shall take place for deck slab concrete and the HPC deck overlay in accordance with ASTM C 157.**
- (l) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C-04, "Sampling Plastic Concrete".
- (m) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C-04, "Making and Curing Concrete Compression and Flexure Test Specimens".
- (n) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor, except for the HPC deck overlay where the fifty-six (56) day compressive strength tests shall be the basis for acceptance. For each twenty-eight (28) or fifty-six (56) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with

CSA Standard Test Method A23.2-9C-04, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which will be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.

- (o) Compressive strength tests on specimens cured under the same conditions as the concrete Works shall be made to check the strength of the in-place concrete so as to determine if the concrete has reached the minimum allowable working compressive strength as specified in Table E14.1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field-cured strength test, the **strength of field-cured test specimens** shall be determined in accordance with CSA Standard Test Method A23.2-9C-04, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.
- (p) **Notwithstanding CSA A23.2-04, cores taken from HPC deck overlay must achieve at a minimum 85% of the specified concrete design strength.**

E14.6.5 Corrective Action

- (a) If the results of the tests indicate that the concrete is not of the specified quality, the Contract Administrator shall have the right to implement additional testing, as required, to further evaluate the concrete, at the Contractor's expense. The Contractor shall, at his own expense, correct such Work or replace such materials found to be defective under this Specification in an acceptable manner to the satisfaction of the Contract Administrator.

E14.6.6 Surface Flatness Requirements

- (a) The surface of the HPC deck overlay and the approach slab shall be finished to a flatness tolerance as specified herein. The surface flatness of the finished concrete shall be determined by measuring the elevation difference between equidistant points spaced 305 mm apart, along straight or curved lines running parallel or perpendicular (radial) to the direction of travel on the Bridge deck. An acceptable surface flatness, as measured along any such line on the finished surface, shall have the absolute difference between any two consecutive readings (a reading being the difference in elevation between two consecutive points) not exceeding 5 mm.
- (b) At each location(s) where the absolute difference of 5 mm is exceeded, further detailed contour survey(s) shall be conducted by and at the discretion of the Contract Administrator to determine the extent of the area requiring corrective action, all at the Contractor's expense. Corrective measures shall involve immediate removal of the surface in the areas not meeting the specified surface flatness tolerance and/or acceptable rideability, in the judgement of the Contract Administrator, and replacement of same to a minimum depth of 50 mm, with the perimeter of the area saw-cut to a depth of 25 mm (the cut face to be sloped to key-in the replacement concrete), as directed by the Contract Administrator. If more than 20 percent of the surface is rejected by the Contract Administrator based on the flatness tolerance and/or any other defect, the Contractor shall immediately remove and replace the entire area of the applicable pour.
- (c) This criterion will not apply across the crown or at any deck drains, which must be constructed to meet design grades as shown on the Drawings or as directed by the Contract Administrator.
- (d) The Contract Administrator shall take readings and determine the acceptability for the surface flatness within thirty-six (36) hours following the completion of each pour. The Contractor shall remove and replace the curing blankets, as required by the Contract Administrator, to undertake the necessary flatness testing and shall restore same immediately upon completion of the testing in each area to the satisfaction of the Contract Administrator.

E14.7 Measurement and Payment

E14.7.1 Structural Concrete

- (a) The Supply and Placement of Structural Concrete shall not be measured. This Work shall be paid for at the Contract Lump Sum Price for the "Items of Work" listed here below, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work.

(b) Items of Work:

Supply and Place Structural Concrete

- (i) Abutment Modifications;
- (ii) Stage I Bridge Deck;
- (iii) Barriers;
- (iv) Approach Slabs;
- (v) Roadway Expansion Slab;
- (vi) Expansion Joint Concrete Nosings;
- (vii) Slope Paving; and
- (viii) High Performance Concrete Deck Overlay.

- (c) Supplying and installing of all the listed materials, concrete design requirements, equipment, construction methods, and quality controls associated with this Specification and Drawings shall be considered incidental to "Supply and Place Structural Concrete", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

E14.7.2 Additional Stage II Deck Concrete

- (a) Where additional Stage II deck concrete removals took place, additional Stage II Deck Concrete shall be paid for at the Contract Unit Price per square metre for the "Items of Work", listed here below measured as specified herein, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work.

(b) Items of Work:

Supply and Place Structural Concrete

- (i) Stage II Bridge Deck
 - (a) Type 1
 - (b) Type 2

E14.7.3 Dampproofing

- (a) Dampproofing shall be paid for at the Contract Unit Price per square metre for "Supply and Install Dampproofing", measured as specified herein, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and performing all operations herein described and all other items incidental to the Work. The area to be paid for shall be the dampproofed surface area as shown on the Drawings and herein specified.

E14.7.4 Bridge Street Lights and BR1 Anchor Units

- (a) The Supply and Installation of Bridge Street Lights and BR1 Anchor Units shall not be measured. This item of Work shall be paid for at the Contract Lump Sum Price for "Supply and Install Anchor Units for Bridge Street Lights and BR1 Posts", performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and performing all operations herein described and all other items incidental to the Work.

E14.7.5 Galvanized Dowels and Galvanized Expansion Sleeves

- (a) **The Supply and Installation of Galvanized Dowels and Galvanized Expansion Sleeves shall be paid for at the Contract Unit Price per unit for "Supply and Install Galvanized Dowels and Expansion Sleeves", measured as specified herein,** performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and performing all operations herein described and all other items incidental to the Work.

Revise: E15.6.1 (a) to read: **Mortar/Concrete placement shall be paid for at the Contract Unit Price per square metre for "Repair Miscellaneous Areas of Abutment Concrete",** measured as specified herein, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and performing all operations herein described and all other items incidental to the Work.

- Revise: E16.6.5 (a) to read: The seal at each expansion joint shall be installed as one continuous piece after completion of all Bridge and approach roadway concreting and asphaltting operations, to the satisfaction of the Contract Administrator, and shall not be installed prior to casting of the expansion joints into the concrete.
- Revise: E16.10 (a) to read: The Supply and Installation of Expansion Joints shall be paid for at the Contract Unit Price **per unit for "Supply and Install Expansion Joints", measured as specified herein**, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid for in full for supplying all materials and performing all operations herein described and all other items incidental to the Work.
- Add: E17.2.6 Aluminum Post Shaft
- Add: E17.2.6 (a) The aluminum post shaft shall be made from a single channel-shape extrusion welded to a plate shape. The post base and shaft shall then be welded together.
- Add: E17.2.6 (b) Welding shall conform to the requirements of CSA standards S224-1969, Welded Aluminum Design and Workmanship and W47.2-1987, Aluminum Welding Qualification Code. Aluminum filler alloy shall be one of the following: ER4043, ER5356, ER5554, ER55556, and ER5654.
- Replace: E17.3.3 (a) to read: The aluminum traffic rails shall be salvaged from the existing Bridge in accordance with E9 "**Structural Removals**", and reinstalled on the new widened Bridge.
- Add: E17.6 Submittals
- Add: E17.6 (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any Work on Site, the Shop Drawings prior to fabrication of aluminum traffic barrier components.
- Revise: E19.2 (a) to read: Rubberized asphalt waterproofing shall be American Hydrotech's Monolithic Membrane **6125, BAKOR 790-11 Hot Applied Rubberized Asphalt Waterproofing/Roofing Membrane, or equal as accepted by the Contract Administrator in accordance with B6.**
- Revise: E19.2.1 (a) to read: The elastomeric sheet membrane shall be Elaso-Petrotech No. 240 or **as accepted by the Contract Administrator in accordance with B6, compatible with the hot-poured rubberized asphalt waterproofing.**
- Revise: E19.2.3 (a) to read: Surface conditioner, to be applied to the concrete surfaces of the **west abutment roof slab**, shall conform to the requirements of the Manufacturer of the rubberized asphalt waterproofing.
- Revise: E19.3.1 (a) to read: The hot-poured rubberized asphalt waterproofing shall be applied on the west **abutment roof slab**, as shown on the Drawings.
- Revise: E19.3.2 (a) to read: The **concrete** surfaces onto which the hot-poured rubberized asphalt waterproofing to be applied shall be thoroughly cleaned by means of gritblasting. All rough spots, ridges, and edges in the concrete surface resulting from protrusions of concrete aggregate or cement paste shall be removed by light chipping or grinding or other approved methods. A final cleaning of the concrete surfaces shall be done using high velocity compressed air. The concrete surfaces shall be dry, clean, and free from frost, dust, dirt, and all foreign matter.
- Revise: E19.3.2 (b) to read: After the roof slab has been cleaned, it shall be covered with surface conditioner. The quantity used shall be 160 mL/m², or as recommended by the Manufacturer. The surface conditioner shall be allowed to dry before the application of the **rubberized asphalt waterproofing.**
- Revise: E21.1 (d) to read: Roadway luminaires located on the Bridge deck shall be supplied, erected, wired, and connected by Manitoba Hydro. The Contractor shall provide and install luminaire bases and conduit system associated with these luminaires, including conduits complete with

pull cords and the necessary pull boxes, junction boxes, expansion fittings, and all required accessories. The Contractor shall **schedule and** coordinate all such Work with Manitoba Hydro.

Delete: E21.6 (a)

Revise: E21.6 (c) to read: Items of Work:

Electrical

- i) Conduit System Complete with Pull Strings for Roadway Lighting;
- ii) Conduit and Wiring for Underbridge Lighting;
- iii) Modifications for Power Distribution to Accommodate New Lighting Circuit;
- iv) Photocell Control for New Lighting Circuit; and
- v) Lighting Fixtures.

Revise: E22.2 (c) to read: The Branch II Aqueduct and Fort Garry-St. Vital Feedermain are constructed of Prestressed Concrete Cylinder Pipe conforming to AWWA Standard C301. The Branch II Aqueduct east of the Red River was manufactured and constructed in 1959. The Branch II Aqueduct and Fort Garry-St. Vital Feedermain west of the Red River were generally manufactured and installed in 1988. **The Feedermain east of the Red River was manufactured and installed in 1960 from the west limit of River road to the east limits of construction, and in 1977 from the west limit of river Road to the Red River.**

Add: E22.2 (e) Loading limitations and calculated loads associated with typical construction equipment are attached to this Specification as Appendix B. The loading calculations shall be interpreted with caution, however, as many factors can cause applied loads to increase considerably, such as unbalanced loading, variations in wheel base or track width, payload, impact factors due to excessive speed or vibration, etc.

Revise: E22.4 (a) to read: **For construction of permanent roadways, Drawing SKT-C0009 and Table 1 Cover Summary (Appendix B) identify several Feedermain crossings/locations affected by construction. For construction of Eastbound detour roadways, Drawings C0009 and C0010 detail 3 locations with 5 Feedermain/Aqueduct crossings affected by construction.** Pipe locations are noted on the Drawings based on the original record drawings.

Revise: E22.4 (b) to read: The Contractor shall **verify pipeline location and obvert elevation by soft excavation methods (hydrovac or hand digging) at the Feedermain Valve Chamber east of River Road on the North side of Bishop Grandin Boulevard and at pipe locations 4b, 5, 9a, 9b, 20, and 23.**

Revise: E22.4 (c)(iv) to read: Subbase and Base Course Construction

- **Where roadways cross the Feedermain/aqueduct place a 5.0 m length of Reinforcement/Separation Geotextile Fabric the width of the pavement subgrade** in accordance with the City of Winnipeg Specification CW 3130-R1.
- Subbase or base course materials shall not be dumped directly on pipelines but shall be carefully bladed in-place.
- Subbase compaction shall be either carried out by static methods without vibration or with smaller approved equipment such as hand held plate packers or smaller roller equipment.

Add: E22.6 Compliance With the Specification

- Add: E22.6 (a) The Contractor shall ensure that all work crew members understand and observe the requirements of this Specification. Prior to commencement of on-Site work, the Contractor shall jointly conduct an orientation meeting with the Contractor Administrator with all superintendents, foremen and heavy equipment operators to make all workers on site are fully cognizant of the limitations of altered loading on the Feedermain, the ramifications of inadvertent damage to the pipelines, the constraints associated with Work in close proximity to the Feedermain and the specific details of the Construction Method Statement in instances where a Construction Method Statement is in effect.
- Add: E22.6 (b) Employees of the Contractor or any Subcontractor that fail to comply with the conditions for working in close proximity to the Feedermain shall be promptly removed from the Site.
- Revise: E26 to read: **Remove and** Salvage Corrugated Steel Pipe
- Revise: E26.2 (a) to read: **Remove and** Salvage Corrugated Steel Pipe shall be paid for at the Contract Unit Price per metre for "**Remove and** Salvage Corrugated Steel Pipe", measured as specified herein, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work. The units to be paid for will be the total metres of Corrugated Steel Pipe **removed and** salvaged in accordance with this Specification, accepted, and measured by the Contract Administrator.

DRAWINGS

The following is a summary of major changes incorporated in the Issued for Tender Drawings:

- Replace: 77-2008 _Drawing_B173-08-002W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-002W-R1
- Replace: 77-2008 _Drawing_B173-08-003W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-003W-R1
- Replace: 77-2008 _Drawing_B173-08-006W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-006W-R1
- Replace: 77-2008 _Drawing_B173-08-007W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-007W-R1
- Replace: 77-2008 _Drawing_B173-08-009W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-009W-R1
- Replace: 77-2008 _Drawing_B173-08-011W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-011W-R1
- Replace: 77-2008 _Drawing_B173-08-013W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-013W-R1
- Replace: 77-2008 _Drawing_B173-08-015W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-015W-R1
- Replace: 77-2008 _Drawing_B173-08-016W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-016W-R1
- Replace: 77-2008 _Drawing_B173-08-017W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-017W-R1
- Replace: 77-2008 _Drawing_B173-08-019W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-019W-R1
- Replace: 77-2008 _Drawing_B173-08-025W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-025W-R1
- Replace: 77-2008 _Drawing_B173-08-026W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-026W-R1
- Replace: 77-2008 _Drawing_B173-08-027W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-027W-R1
- Replace: 77-2008 _Drawing_B173-08-028W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-028W-R1
- Replace: 77-2008 _Drawing_B173-08-029W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-029W-R1
- Replace: 77-2008 _Drawing_B173-08-031W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-031W-R1

Replace: 77-2008 _Drawing_B173-08-032W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-032W-R1

Replace: 77-2008 _Drawing_B173-08-034W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-034W-R1

Replace: 77-2008 _Drawing_B173-08-035W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-035W-R1

Replace: 77-2008 _Drawing_B173-08-037W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-037W-R1

Replace: 77-2008 _Drawing_B173-08-039W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-039W-R1

Replace: 77-2008 _Drawing_B173-08-043W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-043W-R1

Replace: 77-2008 _Drawing_B173-08-052W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-052W-R1

Replace: 77-2008 _Drawing_B173-08-053W-R0 with 77-2008 _Addendum_2 –Drawing_B173-08-053W-R1

Add: 77-2008 _Addendum_2 -Drawing_0600070700-SKT-S0714-R0

Add: 77-2008 _Addendum_2 –Drawing_0600070700-SKT-C0009-R0

APPENDIX

Add: 77-2008 _Addendum_2 Appendix A: Condition Survey of Fort Garry Bridge Decks by National Testing Laboratories Ltd.

Add: 77-2008 _Addendum_2 Appendix B: Branch II Aqueduct and Fort Garry-St. Vital Feedermain Loading Limitations and Calculated Loads Associated with Typical Construction Equipment for Construction Crossings Identified on the Project