



**THE CITY OF WINNIPEG**

# **BID OPPORTUNITY**

**BID OPPORTUNITY NO. 1021-2011**

**STURGEON ROAD BRIDGE REPLACEMENT**

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## **PART B - BIDDING PROCEDURES**

### **B1. CONTRACT TITLE**

B1.1 Sturgeon Road Bridge Replacement

### **B2. SUBMISSION DEADLINE**

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, January 25, 2012.

B2.2 Bids determined by the Manager of Materials to have been received later than the Submission Deadline will not be accepted and will be returned upon request.

B2.3 The Contract Administrator or the Manager of Materials may extend the Submission Deadline by issuing an addendum at any time prior to the time and date specified in B2.1.

### **B3. SITE INVESTIGATION**

B3.1 Further to C3.1, the Bidder may view the Site without making an appointment.

B3.2 The drawings for the existing bridge and Sturgeon Road are provided in Appendix C of this Specification.

B3.3 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

### **B4. ENQUIRIES**

B4.1 All enquiries shall be directed to the Contract Administrator identified in D4.1.

B4.2 If the Bidder finds errors, discrepancies or omissions in the Bid Opportunity, or is unsure of the meaning or intent of any provision therein, the Bidder shall notify the Contract Administrator of the error, discrepancy or omission, or request a clarification as to the meaning or intent of the provision at least five (5) Business Days prior to the Submission Deadline.

B4.3 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator to all Bidders by issuing an addendum.

B4.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator only to the Bidder who made the enquiry.

B4.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B4 unless that response or interpretation is provided by the Contract Administrator in writing.

### **B5. ADDENDA**

B5.1 The Contract Administrator may, at any time prior to the Submission deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.

B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B5.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/bidopp.asp>

B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

B5.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

## **B6. SUBSTITUTES**

B6.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:

- (a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;
- (b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;
- (c) identify any anticipated cost or time savings that may be associated with the substitute;
- (d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;
- (e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.

B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an "approved equal" or as an "approved alternative", or may refuse to grant approval of the substitute.

B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.

B6.7 If the Contract Administrator approves a substitute as an "approved equal", any Bidder may use the approved equal in place of the specified item.

B6.8 If the Contract Administrator approves a substitute as an "approved alternative", any Bidder bidding that approved alternative may base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B15.

B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B6.10 Notwithstanding B6.2 to B6.9, in accordance with B7.6, deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B15.1(a).

## **B7. BID COMPONENTS**

B7.1 The Bid shall consist of the following components:

- (a) Form A: Bid;
- (b) Form B: Prices, hard copy;
- (c) Bid Security;
  - (i) Form G1: Bid Bond and Agreement to Bond, or  
Form G2: Irrevocable Standby Letter of Credit and Undertaking, or  
a certified cheque or draft;

B7.2 Further to B7.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B6.

B7.3 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Bid.

B7.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B7.4.1 Samples or other components of the Bid which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder's Bid.

B7.4.2 A hard copy of Form B: Prices must be submitted with the Bid. If there is any discrepancy between the Adobe PDF version of Form B: Prices and the Microsoft Excel version of Form B: Prices, the PDF version shall take precedence.

B7.5 Bidders are advised not to include any information/literature except as requested in accordance with B7.1.

B7.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, will be evaluated in accordance with B15.1(a).

B7.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.8 Bids shall be submitted to:

The City of Winnipeg  
Corporate Finance Department  
Materials Management Division  
185 King Street, Main Floor  
Winnipeg MB R3B 1J1

**B8. BID**

- B8.1 The Bidder shall complete Form A: Bid, making all required entries.
- B8.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:
- (a) if the Bidder is a sole proprietor carrying on business in his own name, his name shall be inserted;
  - (b) if the Bidder is a partnership, the full name of the partnership shall be inserted;
  - (c) if the Bidder is a corporation, the full name of the corporation shall be inserted;
  - (d) if the Bidder is carrying on business under a name other than his own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.
- B8.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B8.2.
- B8.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.
- B8.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:
- (a) if the Bidder is a sole proprietor carrying on business in his own name, it shall be signed by the Bidder;
  - (b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;
  - (c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, shall be affixed;
  - (d) if the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.
- B8.4.1 The name and official capacity of all individuals signing Form A: Bid should be printed below such signatures.
- B8.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid and the Contract, when awarded, shall be both joint and several.

**B9. PRICES**

- B9.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.
- B9.1.1 For the convenience of Bidders, and pursuant to B7.4.2 and B15.4.3, an electronic spreadsheet Form B: Prices in Microsoft Excel (.xls) format is available along with the Adobe PDF documents for this Bid Opportunity on the Bid Opportunities page at the Materials Management Division website at <http://www.winnipeg.ca/matmgt>
- B9.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.
- B9.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.
- B9.4 Payments to Non-Resident Contractors are subject to Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).



- B9.5 Form B: Prices is organized into Sections of the Work. Bidders shall provide a total price for each Section and, on the summary sheet, a Total Bid Price consisting of the sum of prices for all Sections of the Work.

## **B10. QUALIFICATION**

- B10.1 The Bidder shall:

- (a) undertake to be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba; and
- (b) be financially capable of carrying out the terms of the Contract; and
- (c) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract.

- B10.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

- (a) be responsible and not be suspended, debarred or in default of any obligations to the City. A list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/debar.stm>

- B10.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

- (a) have successfully carried out work similar in nature, scope and value to the Work; and
- (b) be fully capable of performing the Work required to be in strict accordance with the terms and provisions of the Contract; and
- (c) have a written workplace safety and health program if required pursuant to The Workplace Safety and Health Act (Manitoba);

- B10.4 Further to B10.3(c), the Bidder shall, within five (5) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder/Subcontractor has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

- (a) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association or by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or
- (b) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt>)

- B10.5 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

- B10.6 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

## **B11. BID SECURITY**

**B11.1** The Bidder shall provide bid security in the form of:

- (a) a bid bond, in the amount of at least ten percent (10%) of the Total Bid Price, and agreement to bond of a company registered to conduct the business of a surety in Manitoba, in the form included in the Bid Submission (Form G1: Bid Bond and Agreement to Bond); or
- (b) an irrevocable standby letter of credit, in the amount of at least ten percent (10%) of the Total Bid Price, and undertaking issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form included in the Bid Submission (Form G2: Irrevocable Standby Letter of Credit and Undertaking); or
- (c) a certified cheque or draft payable to "The City of Winnipeg", in the amount of at least fifty percent (50%) of the Total Bid Price, drawn on a bank or other financial institution registered to conduct business in Manitoba.

**B11.1.1** If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

**B11.1.2** All signatures on bid securities shall be original.

**B11.1.3** The Bidder shall sign the Bid Bond.

**B11.1.4** The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.

**B11.2** The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

**B11.2.1** Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B11.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

**B11.2.2** The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

**B11.3** The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

## **B12. OPENING OF BIDS AND RELEASE OF INFORMATION**

**B12.1** Bids will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Division, or in such other office as may be designated by the Manager of Materials.

**B12.1.1** Bidders or their representatives may attend.

**B12.1.2** Bids determined by the Manager of Materials, or his designate, to not include the bid security specified in B11 will not be read out.

**B12.2** Following the submission deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt>

B12.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt>

B12.4 The Bidder is advised that any information contained in any Bid may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

### **B13. IRREVOCABLE BID**

B13.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.

B13.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

### **B14. WITHDRAWAL OF BIDS**

B14.1 A Bidder may withdraw his Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B14.1.1 Notwithstanding C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B14.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

B14.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:

- (a) retain the Bid until after the Submission Deadline has elapsed;
- (b) open the Bid to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and
- (c) if the notice has been given by any one of the persons specified in B14.1.3(b), declare the Bid withdrawn.

B14.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B13.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

### **B15. EVALUATION OF BIDS**

B15.1 Award of the Contract shall be based on the following bid evaluation criteria:

- (a) compliance by the Bidder with the requirements of the Bid Opportunity, or acceptable deviation therefrom (pass/fail);
- (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B10 (pass/fail);
- (c) Total Bid Price;
- (d) economic analysis of any approved alternative pursuant to B6.

- B15.2 Further to B15.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.
- B15.3 Further to B15.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid or in other information required to be submitted, that he is responsible and qualified.
- B15.4 Further to B15.1(c), the Total Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.
- B15.4.1 If there is any discrepancy between the Total Bid Price written in figures, the Total Bid Price written in words and the sum of the quantities multiplied by the unit prices for each item, the sum of the quantities multiplied by the unit prices for each item shall take precedence.
- B15.4.2 Further to B15.1(a), in the event that a unit price is not provided on Form B: Prices, the City will determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.
- B15.4.3 The electronic Form B: Prices and the formulas imbedded in that spreadsheet are only provided for the convenience of Bidders. The City makes no representations or warranties as to the correctness of the imbedded formulas. It is the Bidder's responsibility to ensure the extensions of the unit prices and the sum of Total Bid Price performed as a function of the formulas within the electronic Form B: Prices are correct.

## **B16. AWARD OF CONTRACT**

- B16.1 The City will give notice of the award of the Contract or will give notice that no award will be made.
- B16.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.
- B16.2.1 Without limiting the generality of B16.2, the City will have no obligation to award a Contract where:
- (a) the prices exceed the available City funds for the Work;
  - (b) the prices are materially in excess of the prices received for similar work in the past;
  - (c) the prices are materially in excess of the City's cost to perform the Work, or a significant portion thereof, with its own forces;
  - (d) only one Bid is received; or
  - (e) in the judgment of the Award Authority, the interests of the City would best be served by not awarding a Contract.
- B16.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid, in accordance with B15.
- B16.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.

## PART C - GENERAL CONDITIONS

### C0. GENERAL CONDITIONS

- C0.1 The *General Conditions for Construction* (Revision 2006 12 15) are applicable to the Work of the Contract.
- C0.1.1 The *General Conditions for Construction* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at [http://www.winnipeg.ca/matmgt/gen\\_cond.stm](http://www.winnipeg.ca/matmgt/gen_cond.stm)
- C0.2 A reference in the Bid Opportunity to a section, clause or subclause with the prefix “**C**” designates a section, clause or subclause in the *General Conditions for Construction*.

## **PART D - SUPPLEMENTAL CONDITIONS**

### **GENERAL**

#### **D1. GENERAL CONDITIONS**

D1.1 In addition to the General Conditions for Construction, these Supplemental Conditions are applicable to the Work of the Contract.

#### **D2. SCOPE OF WORK**

D2.1 The Work to be done under the Contract shall consist of

- (a) Construction of the northbound bridge and two (2) new northbound lanes of concrete pavement from Portage Avenue to Hallonquist Drive.
- (b) Construction of the southbound bridge and two (2) new southbound lanes of concrete pavement from Portage Avenue to Hallonquist Drive.
- (c) Landscaping of Sturgeon Road.

D2.2 The major components of the Work are as follows:

- (a) Bridge Work: Phase 1 – Northbound Bridge (2012)
  - (i) Detour traffic from Northbound Structure;
  - (ii) Remove existing northbound bridge;
  - (iii) Construction of new northbound bridge;
  - (iv) Construction of new retaining walls;
  - (v) Construct rock socket caissons;
  - (vi) Supply and drive steel piles;
  - (vii) Construct concrete pier cap;
  - (viii) Construct concrete abutment bearing seat;
  - (ix) Construct concrete abutment wingwall;
  - (x) Construct concrete abutment backwall;
  - (xi) Construct and place precast, pre-stressed concrete box girders;
  - (xii) Laterally post tension girders;
  - (xiii) Grout girder shear keys;
  - (xiv) Construct concrete deck;
  - (xv) Construct concrete sidewalk;
  - (xvi) Construct concrete traffic barriers;
  - (xvii) Supply and place aluminum balanced barriers;
  - (xviii) Construct concrete reinforced road slab;
  - (xix) Construct concrete approach slab;
  - (xx) Supply and place aluminum pedestrian railing;
  - (xxi) Construct high performance concrete overlay;
  - (xxii) Install active transportation path lighting;
  - (xxiii) Construct modular block walls;
  - (xxiv) Backfill abutments;
  - (xxv) Supply and construct chain link fence.

- (b) Construction of two (2) new northbound lanes of concrete pavement from Portage Avenue to Hallonquist Drive (2012)
  - (i) Locate existing water main by soft digging methods
  - (ii) Clearing and grubbing;
  - (iii) Stripping and stockpile of topsoil;
  - (iv) Removal of existing pavement;
  - (v) Excavation;
  - (vi) Install temporary shoring wall as required;
  - (vii) Placing suitable site material;
  - (viii) Installation of subdrains;
  - (ix) Compaction of existing sub-grade and place suitable site material;
  - (x) Installation of catch basins and connection pipe;
  - (xi) Placement of separation/reinforcement fabric;
  - (xii) Placement of sub-base and base course materials;
  - (xiii) Construction of 230 mm concrete pavement (plain-dowelled) utilizing slip-form paving equipment;
  - (xiv) Construction of 230 mm concrete pavement (plain-dowelled) hand placement;
  - (xv) Adjustment of existing manholes and catch basins;
  - (xvi) Construction of 180 mm (integral) barrier curb utilizing slip-form paving equipment;
  - (xvii) Construct concrete sidewalk;
  - (xviii) Ditch grading and sloping;
  - (xix) Traffic diversions.
- (c) Bridge Work: Phase 2 – Southbound Bridge (2012)
  - (i) Detour traffic from Southbound Structure;
  - (ii) Remove existing northbound bridge;
  - (iii) Construction of new northbound bridge;
  - (iv) Construction of new retaining walls;
  - (v) Construct rock socket caissons;
  - (vi) Supply and drive steel piles;
  - (vii) Construct concrete pier cap;
  - (viii) Construct concrete abutment bearing seat;
  - (ix) Construct concrete abutment wingwall;
  - (x) Construct concrete abutment backwall;
  - (xi) Construct and place precast, pre-stressed concrete box girders;
  - (xii) Laterally post tension girders;
  - (xiii) Grout girder shear keys;
  - (xiv) Construct concrete deck;
  - (xv) Construct concrete sidewalk;
  - (xvi) Construct concrete traffic barriers;
  - (xvii) Supply and place aluminum balanced barriers;
  - (xviii) Construct concrete reinforced road slab;
  - (xix) Construct concrete approach slab;
  - (xx) Supply and place aluminum pedestrian railing;
  - (xxi) Construct high performance concrete overlay;
  - (xxii) Install active transportation path lighting;
  - (xxiii) Construct modular block walls;

- (xxiv) Backfill abutments;
- (xxv) Supply and construct chain link fence
- (d) Construction of two (2) new southbound lanes of concrete pavement from Portage Avenue to Hallonquist Drive (2016)
  - (i) Clearing and grubbing;
  - (ii) Stripping and stockpile of topsoil;
  - (iii) Removal of existing pavement;
  - (iv) Excavation;
  - (v) Install temporary shoring wall as required;
  - (vi) Placing suitable site material;
  - (vii) Installation of subdrains;
  - (viii) Compaction of existing sub-grade and place suitable site material;
  - (ix) Installation of catch basins and connection pipe;
  - (x) Placement of separation/reinforcement fabric;
  - (xi) Placement of sub-base and base course materials;
  - (xii) Construction of 230 mm concrete pavement (plain-dowelled) utilizing slip-form paving equipment;
  - (xiii) Construction of 230 mm concrete pavement (plain-dowelled) hand placement;
  - (xiv) Adjustment of existing manholes and catch basins;
  - (xv) Construction of 180 mm (integral) barrier curb utilizing slip-form paving equipment;
  - (xvi) Construct concrete sidewalk;
  - (xvii) Ditch grading and sloping;
  - (xviii) Traffic diversions.
- (e) Landscaping of Sturgeon Road
  - (i) Construct active transportation paths
  - (ii) Touch-up grading;
  - (iii) Placement of top soil;
  - (iv) Placement of seed and sod;
  - (v) Planting of trees and plants;
  - (vi) Maintenance of landscaping.

### D3. DEFINITIONS

#### D3.1 When used in this Bid Opportunity:

- (a) **"ACI"** means the American Concrete Institute that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work.
- (b) **"ASTM"** means the American Society for Testing and Materials that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work.
- (c) **"CSA"** means the Canadian Standards Association that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work.
- (d) **"HPC Overlay"** means a High Performance Concrete Overlay to be cast on top of the new Bridge structural deck concrete. Refer to E20 "High Performance Concrete (HPC) Overlay" for further details.
- (e) **"ICRI"** means the International Concrete Repair Institute that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work.



- (f) **“Indicator Strips”** means a ground surface that is in colour-contrast to an adjacent accessible route. For this project this means clay brick pavers/paving stones in formed blockouts within the sidewalk. These delineate the edges of the accessible sidewalk and are typically located at the back of road curb, and the sidewalk edge at the property line. For this project, the terms indicator strips, paving bands, paving stones, or clay brick pavers can be used interchangeably.
- (g) **“MTO”** means the Ministry of Transportation Ontario that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work.
- (h) **“OPSS”** means the Ontario Provincial Standard Specification that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work.
- (i) **“RSIC”** means the Reinforcing Steel Institute of Canada that complies with the latest edition of standards including amendments and supplements in effect on the date of issue of this Bid Opportunity shall apply to the Work.

#### **D4. CONTRACT ADMINISTRATOR**

- D4.1 The Contract Administrator is Stantec Consulting Ltd, represented by:  
Kevin Amy, M.Sc., P. Eng.  
Project Manager  
100-1355 Taylor Ave., Winnipeg, MB R3M 3Y9  
Telephone No. (204) 488-5743  
Facsimile No. (204) 284-4795
- D4.2 At the pre-construction meeting, Kevin Amy, will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

#### **D5. CONTRACTOR'S SUPERVISOR**

- D5.1 At the pre-construction meeting, the Contractor shall identify his designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.
- D5.2 At least two (2) business days prior to the commencement of any Work on the site, the Contractor shall provide the Contract Administrator with a phone number where the supervisor identified in D5.1 or an alternate can be contacted twenty-four (24) hours a day to respond to an emergency.

#### **D6. NOTICES**

- D6.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.
- D6.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.3, D6.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D4.1.
- D6.3 Notwithstanding C21., all notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following facsimile number:  
The City of Winnipeg  
Chief Financial Officer  
Facsimile No.: (204) 949-1174

- D6.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

The City of Winnipeg  
Legal Services Department  
Attn: Director of Legal Services  
185 King Street, 3rd Floor  
Winnipeg MB R3B 1J1  
Facsimile No.: (204) 947-9155

## **D7. FURNISHING OF DOCUMENTS**

- D7.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

## **SUBMISSIONS**

### **D8. AUTHORITY TO CARRY ON BUSINESS**

- D8.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

### **D9. SAFE WORK PLAN**

- D9.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.
- D9.2 The Safe Work Plan shall be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/safety/default.stm>

### **D10. INSURANCE**

- D10.1 The Contractor shall provide and maintain the following insurance coverage:
- (a) Wrap-up liability insurance in an amount not less than ten million dollars (\$10,000,000.00) inclusive per occurrence, ten million (\$10,000,000.00) general aggregate, insuring against bodily injury, personal injury and property damage including loss of use therefore. The insured parties under the policy shall include The Contractor, The City of Winnipeg and all others having an insurable interest in the Project. This policy shall be endorsed to extend to both construction sites and shall cover typical aspects of a project of this nature for which insurance may be purchased but will at a minimum carry:
    - (i) Products and completed operations liability, the completed operations liability coverage shall include 24 months completed operations after Total Performance.
    - (ii) Owner's and contractor's protective liability
    - (iii) Contractual liability
    - (iv) Cross liability or Severability clause
    - (v) Contingent employer's liability

- (b) Course of construction insurance in the form of an “all risks” builder’s risk policy in the amount of one hundred percent (100%) of the total Contract Price, written in the name of The Contractor, The City of Winnipeg and all others having an insurable interest in the Project. This policy shall be maintained at all times during the performance of the Work and until the date of Total Performance. One policy will extend to cover both constructions
- (c) Automobile liability insurance for owned and non-owned automobiles used for in connection with the Work in the amount of at least five million dollars (\$5,000,000.00) at all times during the performance of the Work; The Contractor shall require and ensure that each of its Subcontractors on the project also maintains automobile liability in the amount of at least five million dollars (\$5,000,000.00) and until the date of Total Performance,
- (d) General liability insurance, in the amount of at least five million dollars (\$5,000,000.00) covering bodily injury, property damage, personal and advertising injury, products and completed operations, The City of Winnipeg as an additional insured, broadform completed operations, contractual liability, cross liability clause, loading or unloading, underground property damage, unlicensed motor vehicle liability, and non-owned automobile liability. Such general liability insurance to remain in force at all times during the performance of the Work and throughout the warranty period.

D10.2 Deductibles shall be borne by The Contractor.

D10.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) business days prior to the commencement of any Work on the Site.

D10.4 All policies shall be taken out with insurers licensed to and carrying on business in the Province of Manitoba.

D10.5 The Contractor shall not cancel, or cause any such policy or policies to lapse without a minimum of thirty (30) days prior notice to The City.

D10.6 The Contractor shall provide written notice to The City of Winnipeg of any material changes to their policies within thirty (30) days of the change taking effect.

## **D11. PERFORMANCE SECURITY**

D11.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

- (a) a performance bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H1: Performance Bond), in the amount of fifty percent (50%) of the Contract Price; or
- (b) an irrevocable standby letter of credit issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form attached to these Supplemental Conditions (Form H2: Irrevocable Standby Letter of Credit), in the amount of fifty percent (50%) of the Contract Price; or
- (c) a certified cheque or draft payable to “The City of Winnipeg”, drawn on a bank or other financial institution registered to conduct business in Manitoba, in the amount of fifty percent (50%) of the Contract Price.

D11.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

- D11.2 If the bid security provided in his Bid was not a certified cheque or draft pursuant to B11.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site and in no event later than the date specified in the C4.1 for the return of the executed Contract.

**D12. SUBCONTRACTOR LIST**

- D12.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at or prior to a pre-construction meeting, or at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the C4.1 for the return of the executed Contract.

**D13. EQUIPMENT LIST**

- D13.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment List) at or prior to a pre-construction meeting, or at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the C4.1 for the return of the executed Contract.

**D14. DETAILED WORK SCHEDULE**

- D14.1 The Contractor shall provide the Contract Administrator with a detailed work schedule at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the General Conditions for the return of the executed Contract.
- D14.2 The detailed work schedule shall consist of the following:
- (a) a critical path method (C.P.M.) schedule for the Work;
  - (b) a Gantt chart for the Work based on the C.P.M. schedule; and
  - (c) a daily manpower schedule for the Work
- all acceptable to the Contract Administrator.

**SCHEDULE OF WORK**

**D15. COMMENCEMENT**

- D15.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.
- D15.2 The Contractor shall not commence any Work on the Site until:
- (a) the Contract Administrator has confirmed receipt and approval of:
    - (i) evidence of authority to carry on business specified in D8;
    - (ii) evidence of the workers compensation coverage specified in C6.15;
    - (iii) the twenty-four (24) hour emergency response phone number specified in D5.2.
    - (iv) the Safe Work Plan specified in D9;
    - (v) evidence of the insurance specified in D10;
    - (vi) the performance security specified in D11;
    - (vii) the subcontractor list specified in D12;
    - (viii) the equipment list specified in D13;
    - (ix) the detailed work schedule specified in D14.

- (b) the Contractor has attended a pre-construction meeting with the Contract Administrator, or the Contract Administrator has waived the requirement for a pre-construction meeting.

D15.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

D15.4 The City intends to award this Contract by March 16, 2012.

D15.4.1 If the actual date of award is later than the intended date, the dates specified for Critical Stages, Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

#### **D16. RESTRICTED WORK HOURS**

D16.1 Further to clause 3.10 the latest version of the City of Winnipeg Standard Construction Specification CW 1130, the Contractor shall require written permission forty-eight (48) hours in advance from the Contract Administrator for any work to be performed between 2000 hours and 0700 hours, or on Sunday, Statutory Holidays and or Civic Holidays.

D16.2 In accordance with the Manual of Temporary Traffic Control, Sections 2.03, 2.04, 2.05 and 2.06, should the Traffic Management Branch of the Public Works Department require that work on Regional Streets be carried out at night or on Sundays or on public holidays, where permitted by the City of Winnipeg Police Department, or that work be restricted or suspended during peak traffic hours, no additional compensation will be considered to meet these requirements.

D16.3 Night Work And Noise Limitations

- (a) Night work may have to be undertaken by the Contractor, as required by his Schedule of Work and by his actual work progress, to ensure timely completion of all Works of this Contract, all at his own cost.
- (b) Further to the General Conditions, the Contractor shall show that he has the approval of all applicable authorities in regard to said night work and to the anticipated/actual construction noise levels. In particular, such Work shall conform with the Noise Control By-Law No. 2480/79. Also, the Contractor, at his own cost, incidental to these Works, shall supply sufficient lighting to enable all night work to be done in a safe and efficient manner, satisfactory to the Contract Administrator.
- (c) The Contractor is advised that possible noise level problems may limit his Work activities on Sundays and at night. The Contractor must request and receive approval from the Contract Administrator at least 48 hours in advance of any Contract Work to be undertaken on Sundays or at night. It will be the Contractor's responsibility to schedule work activities to minimize potential problems and/or to employ noise-reduction measures to lower the noise to an acceptable level. Time extension will not be granted on the basis of the Contractor being ordered to limit his activities at night.

#### **D17. CONTRACTOR LIGHTING DURING CONSTRUCTION**

D17.1 The Contractor shall not apply direct lighting to any nearby residential buildings for the construction of the Work.

#### **D18. WORK BY OTHERS**

D18.1 Work by others on or near the Site will include but not necessarily be limited to:

- (a) Manitoba Hydro – Relocation of existing 25 KV line. The contractor is expected to cooperate with Manitoba Hydro to facilitate construction;

- (b) Manitoba Hydro – Removal of existing and installation of new street lighting along Sturgeon Road within the construction limits. Relocation of existing ornamental light standards at Grace Hospital property. The contractor is expected to cooperate with Manitoba Hydro to facilitate construction;
- (c) MTS – Relocation of existing MTS line. The contractor is expected to cooperate with MTS to facilitate construction;
- (d) City of Winnipeg Traffic Signals – Installation of traffic signals at intersection of Portage Avenue and Sturgeon Road. The contractor is expected to cooperate with City of Winnipeg Traffic Signals to facilitate construction;
- (e) City of Winnipeg Traffic Services – Replacement of signs and painting of traffic lines. The contractor is expected to cooperate with City of Winnipeg Traffic Services to facilitate construction.

## **D19. SEQUENCE OF WORK**

D19.1 Further to C6.1, the sequence of work shall be as follows:

- D19.1.1 The Work shall be divided into two (2) phases . Each Phase shall be subdivided into stages.
- D19.1.2 Phase 1 shall be completed in 2012,
  - (a) The northbound bridge is to be completed in Phase 1.
  - (b) Construction of two (2) new northbound lanes of concrete pavement from Portage Avenue to Hallonquist Drive are to be completed in Phase 1.
- D19.1.3 Phase 2 shall be completed in 2013,
  - (a) The southbound bridge is to be completed in Phase 2.
  - (b) Construction of two (2) new southbound lanes of concrete pavement from Portage Avenue to Hallonquist Drive are to be completed in Phase 2.
  - (c) Landscaping of Sturgeon Road is to be completed in Phase 2.
- D19.1.4 Immediately following the completion of each Phase of the Work, the Contractor shall clean up the Site and remove all plant, surplus material, waste and debris, other than that left by the City or other contractors.

## **D20. SUBSTANTIAL PERFORMANCE**

- D20.1 The Contractor shall achieve Substantial Performance by July 27, 2013.
- D20.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.
- D20.3 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a certificate of Substantial Performance is the date on which Substantial Performance has been achieved.

## **D21. TOTAL PERFORMANCE**

- D21.1 The Contractor shall achieve Total Performance by August 27, 2013.

D21.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.

D21.3 The date on which the Work has been certified by the Contract Administrator as being totally performed to the requirements of the Contract through the issue of a certificate of Total Performance is the date on which Total Performance has been achieved.

## **D22. LIQUIDATED DAMAGES**

D22.1 If the Contractor fails to achieve Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for same, the Contractor shall pay the City the following amounts per Calendar Day for each and every Calendar Day following the days fixed herein for same during which such failure continues:

- (a) Substantial Performance – Three Thousand dollars (\$3,000.00);
- (b) Total Performance – Five Hundred dollars (\$500.00).

D22.2 The amounts specified for liquidated damages in D22.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve critical stages, Substantial Performance or Total Performance by the days fixed herein for same.

D22.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

## **D23. SCHEDULED MAINTENANCE**

D23.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

- (a) Seeding as specified in the latest version of the City of Winnipeg Standard Construction Specification as specified in CW 3520;
- (b) Reflective crack maintenance during two year maintenance. Warranty as specified in the latest version of the City of Winnipeg Standard Construction Specification as specified in CW 3250;

D23.2 Determination of Substantial Performance and Total Performance shall be exclusive of scheduled maintenance identified herein. All scheduled maintenance shall be completed prior to the expiration of the warranty period. Where the scheduled maintenance cannot be completed during the warranty period, the warranty period shall be extended for such period of time as it takes the Contractor to complete the scheduled maintenance.

## **CONTROL OF WORK**

### **D24. JOB MEETINGS**

D24.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

D24.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

**D25. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)**

D25.1 Further to C6.24, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

**D26. AUTHORIZED WORK ON PRIVATE PROPERTY**

D26.1 The Contractor shall confine his Works to the right-of-way or easements as much as possible. Where Work is required to be done on or accessed through private property, the Contractor shall obtain written permission from the property owner and provide a copy to the Contract Administrator.

**D27. LAYOUT OF WORK**

**D27.1 Bridge Work**

D27.1.1 The Contract Administrator shall provide the basic centrelines and a benchmark for construction of Bridge Work.

D27.1.2 The Contractor shall be responsible for the true and proper laying out of the Work and for the correctness of the location, levels, dimensions, and alignment of all aspects of the Work. He shall provide all required instruments and competent personnel for performing all layouts.

D27.1.3 The Contract Administrator shall be notified at least one (1) Business Day prior to any Work being commenced in order to have the option to check and review all elevations and layouts at his discretion.

D27.1.4 Should any error appear or arise in location, levels, dimensions, and/or alignments during the course of the Work, the Contractor shall promptly rectify such errors to the satisfaction of the Contract Administrator, at his own expense.

D27.1.5 The Contractor shall carefully protect and preserve all benchmarks, stakes, and other items of the basic data supplied by the Contract Administrator. Any such benchmarks or stakes removed or destroyed by the Contractor, without the consent of the Contract Administrator, shall be replaced by the Contract Administrator at the expense of the Contractor.

**D27.2 Roadwork**

D27.2.1 Further to the City of Winnipeg Specifications GC 6.28(h), the Contract Administrator shall mark, to the extent determined to be necessary, the location, alignment and elevation of the Work by means of stakes or marks, and the Contractor shall make the completed Works conform to the lines and marks thus indicated.

D27.2.2 Stakes and marks required shall be provided no later than one (1) Business Day following the day on which the Contractor request such stakes, and/or marks, except where the Contractor's request is made immediately following asphalt paving operations. Then the Contract Administrator may require a maximum of two (2) Business Days to provide stakes and marks as a result of required adjustments to final design grades.

D27.2.3 The Contractor shall notify the Contract Administrator immediately of the disturbance of any such stakes or marks. The cost of correcting any errors arising out of neglect of the Contractor to so notify the Contract Administrator shall be borne entirely by the Contractor, as well as the cost of replacing any disturbed stakes or marks.

D27.2.4 Before commencing Work, the Contractor shall satisfy themselves as to the meaning and correctness of all stakes and marks and no claims shall be entertained by the City on account of any alleged inaccuracies. If any error is suspected in the Drawings, Specifications or the directions of the Contract Administrator, Work shall be discontinued



until the errors are rectified, but no claims shall be made on account of any delay occasioned thereby.

- D27.2.5 The Contractor shall determine and provide all dimensions and elevations measured from the stakes or marks.

## **D28. COOPERATION WITH OTHERS**

- D28.1 The Contractor's attention is directed to the fact that other Contractors, the personnel of Utilities and the staff of the City may be working on the structure, approach roadways, adjacent roadways or rights-of-way. The activities of these agencies may coincide with the Contractor's execution of the Work, and it will be the Contractor's responsibility to cooperate to the fullest extent with the other personnel working in the area, and such cooperation is an obligation of the Contractor under the terms of the Contract.

## **MEASUREMENT AND PAYMENT**

### **D29. PAYMENT**

- D29.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

## **WARRANTY**

### **D30. WARRANTY**

- D30.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) years thereafter unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.
- D30.2 Notwithstanding C13.2 or D30.1, the Contract Administrator may permit the warranty period for a portion or portions of the Work to begin prior to the date of Total Performance if:
- (a) a portion of the Work cannot be completed because of unseasonable weather or other conditions reasonably beyond the control of the Contractor but that portion does not prevent the balance of the Work from being put to its intended use; or
- D30.2.1 In such case the date specified by the Contract Administrator for the warranty period to begin shall be substituted for the date specified in C13.2 for the warranty period to begin.
- D30.3 At least two (2) weeks prior to the expiration of the Warranty Period, or upon correction of all outstanding defects and deficiencies, whichever is later, the Contractor shall arrange, attend, and assist in the acceptance inspection of the Work. The Contract Administrator shall, on being satisfied that all outstanding defects and deficiencies in the Work have been corrected, issue a Certificate of Acceptance for the Work to be dated not earlier than two(2) years after the date of the Certificate of Total Performance, or the date that the Contractor corrects the final defects and deficiencies, whichever is the later, thereby terminating the Warranty Period. The Certificate of Acceptance will indicate acceptance of the due performance of the Contract.

**FORM H1: PERFORMANCE BOND**  
(See D11)

KNOW ALL MEN BY THESE PRESENTS THAT

\_\_\_\_\_  
(hereinafter called the "Principal"), and

\_\_\_\_\_,  
(hereinafter called the "Surety"), are held and firmly bound unto **THE CITY OF WINNIPEG** (hereinafter called the "Obligee"), in the sum of

\_\_\_\_\_ dollars (\$\_\_\_\_\_)

of lawful money of Canada to be paid to the Obligee, or its successors or assigns, for the payment of which sum the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has entered into a written contract with the Obligee for

BID OPPORTUNITY NO. 1021-2011

Sturgeon Road Bridge Replacement

which is by reference made part hereof and is hereinafter referred to as the "Contract".

NOW THEREFORE the condition of the above obligation is such that if the Principal shall:

- (a) carry out and perform the Contract and every part thereof in the manner and within the times set forth in the Contract and in accordance with the terms and conditions specified in the Contract;
- (b) perform the Work in a good, proper, workmanlike manner;
- (c) make all the payments whether to the Obligee or to others as therein provided;
- (d) in every other respect comply with the conditions and perform the covenants contained in the Contract; and
- (e) indemnify and save harmless the Obligee against and from all loss, costs, damages, claims, and demands of every description as set forth in the Contract, and from all penalties, assessments, claims, actions for loss, damages or compensation whether arising under "The Workers Compensation Act", or any other Act or otherwise arising out of or in any way connected with the performance or non-performance of the Contract or any part thereof during the term of the Contract and the warranty period provided for therein;

THEN THIS OBLIGATION SHALL BE VOID, but otherwise shall remain in full force and effect. The Surety shall not, however, be liable for a greater sum than the sum specified above.

AND IT IS HEREBY DECLARED AND AGREED that the Surety shall be liable as Principal, and that nothing of any kind or matter whatsoever that will not discharge the Principal shall operate as a discharge or release of liability of the Surety, any law or usage relating to the liability of Sureties to the contrary notwithstanding.

IN WITNESS WHEREOF the Principal and Surety have signed and sealed this bond the

\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

SIGNED AND SEALED  
in the presence of:

\_\_\_\_\_  
(Witness as to Principal if no seal)

\_\_\_\_\_  
(Name of Principal)

Per: \_\_\_\_\_ (Seal)

Per: \_\_\_\_\_

\_\_\_\_\_  
(Name of Surety)

By: \_\_\_\_\_ (Seal)  
(Attorney-in-Fact)



All demands for payment shall specifically state that they are drawn under this Standby Letter of Credit.

Subject to the condition hereinafter set forth, this Standby Letter of Credit will expire on

\_\_\_\_\_  
(Date)

It is a condition of this Standby Letter of Credit that it shall be deemed to be automatically extended from year to year without amendment from the present or any future expiry date, unless at least 30 days prior to the present or any future expiry date, we notify you in writing that we elect not to consider this Standby Letter of Credit to be renewable for any additional period.

This Standby Letter of Credit may not be revoked or amended without your prior written approval.

This credit is subject to the Uniform Customs and Practice for Documentary Credit (1993 Revision), International Chamber of Commerce Publication Number 500.

\_\_\_\_\_  
(Name of bank or financial institution)

Per: \_\_\_\_\_

(Authorized Signing Officer)

Per: \_\_\_\_\_

(Authorized Signing Officer)

**FORM J: SUBCONTRACTOR LIST**  
(See D12)

Sturgeon Road Bridge Replacement

<u>Portion of the Work</u>	<u>Name</u>	<u>Address</u>
<b><u>BRIDGE WORK</u></b>		
<b>Supply of Materials:</b>		
Black Reinforcing Steel		
Stainless Steel Reinforcing		
Structural Concrete		
High Performance Concrete (HPC) Overlay		
Sidewalk Wearing Surface Concrete (WSC) Overlay		
Galvanized Dowels & Expansion Sleeves		
Expansion Joints		
Aluminum Pedestrian Handrail		
<b>Construction/Installation/Placement:</b>		
Traffic Control		
Demolition of Existing Bridges		
Bearing Installation		
Black and Stainless Steel Reinforcing		
Placing Structural Concrete		
Placing High Performance Concrete (HPC) Overlay		
Placing Sidewalk Wearing Surface Concrete (WSC) Overlay		
Expansion Joints		
Structural Concrete		
Aluminum Pedestrian Handrail		
Electrical and Communications Conduits		
Active Transportation Lighting		
Modular Block Retaining Wall		
<b><u>ROADWORKS</u></b>		
<b>Supply of Materials:</b>		
Concrete		
Asphalt		

**FORM J: SUBCONTRACTOR LIST**  
(See D12)

Sturgeon Road Bridge Replacement

<u>Portion of the Work</u>	<u>Name</u>	<u>Address</u>
Base Course & Sub-Base		
Geotextile Materials		
Trees/Shrubs/Ground Cover		
Top Soil/Sod/Seed		
<b>Installation/Placement:</b>		
Concrete		
Asphalt		
Base Course & Sub-Base		
Geotextile Materials		
Landscaping		
<b><u>UNDERGROUND WORKS:</u></b>		
<b>Supply of Materials:</b>		
Pipes		
Subdrains		
Precast Concrete Catch Basins/Manholes/Ring Section		
Catch Basins/Manholes Frames, Covers and Boxes		
Connecting and Sewer Service Pipe		
<b>Installation/Placement:</b>		
Pipes		
Subdrains		
Precast Concrete Catch Basins/Manholes/Ring Section		
Catch Basins/Manholes Frames, Covers and Boxes		
Connecting and Sewer Service Pipe		
<b><u>OTHERS:</u></b>		
Excavation:		
Landscaping		

**FORM K: EQUIPMENT**  
(See D13)

Sturgeon Road Bridge Replacement

<b>1. Category/type: Movable Deck Hoarding</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
<b>2. Category/type: Machine for High Performance Concrete (HPC) Overlay Grooving</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
<b>3. Category/type: Removal of Underground Works and Installation of LDS</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____



**FORM K: EQUIPMENT**  
(See D13)

Sturgeon Road Bridge Replacement

<b>4. Category/type: Earthmoving / Excavation</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
<b>5. Category/type: Compaction and Grading</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
<b>6. Category/type: Concrete Paving (Slip Form)</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____

**FORM K: EQUIPMENT**  
(See D13)

Sturgeon Road Bridge Replacement

<b>7. Category/type: Asphalt Paving</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
<b>8. Category/type:</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
<b>9. Category/type:</b>
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____
Make/Model/Year: _____ Serial No.: _____
Registered owner: _____

## PART E - SPECIFICATIONS

### GENERAL

#### E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

- E1.1 These Specifications shall apply to the Work.
- E1.2 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.
- E1.2.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/Spec/Default.stm>
- E1.2.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.
- E1.2.3 Further to C2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.3 The following are applicable to the Work:

<u>City Drawing No.</u>	<u>Consultant Drawing No.</u>	<u>Drawing Name/Title</u>
B120-12-001_Sht1	G-001	Cover Page and Site Location Map
B120-12-002_Sht2	G-002	Limits of Construction and Drawing List
B120-12-003_Sht3	C-101	Site Plan – Existing Conditions
B120-12-004_Sht4	C-102	Site Plan – Proposed Conditions
B120-12-005_Sht5	C-103	Portage Avenue to Hallonquist Drive – Construction Phasing – Phase 1
B120-12-006_Sht6	C-104	Portage Avenue to Hallonquist Drive – Construction Phasing – Phase 2
B120-12-007_Sht7	B-101	Portage Avenue to Hallonquist Drive – Riverbank Stabilization Works – Plan
B120-12-008_Sht8	B-201	Portage Avenue to Hallonquist Drive – Riverbank Stabilization Works – Profiles

#### BRIDGE & RETAINING WALL WORKS

B120-12-009_Sht9	S-101	Bridge Design Data & General Notes
B120-12-010_Sht10	S-102	Bridge General Arrangement
B120-12-011_Sht11	S-103	Existing Bridge Demolition Staging
B120-12-012_Sht12	S-104	Foundation Layout
B120-12-013_Sht13	S-105	Foundation Details
B120-12-014_Sht14	S-106	Bore Hole Logs
B120-12-015_Sht15	S-107	General Excavation, Backfill and Riprap Plan
B120-12-016_Sht16	S-108	General Excavation, Backfill & Riprap Sections
B120-12-017_Sht17	S-201	Concrete Details – Southbound Abutment SU.1
B120-12-018_Sht18	S-202	Concrete Details – Southbound Abutment SU.4
B120-12-019_Sht19	S-203	Concrete Details – Northbound Abutment SU.1
B120-12-020_Sht20	S-204	Concrete Details – Northbound Abutment SU.4
B120-12-021_Sht21	S-205	Reinforcing Details – Southbound Abutment SU.1
B120-12-022_Sht22	S-206	Reinforcing Details – Southbound Abutment SU.4
B120-12-023_Sht23	S-207	Reinforcing Details – Northbound Abutment SU.1
B120-12-024_Sht24	S-208	Reinforcing Details – Northbound Abutment SU.4
B120-12-025_Sht25	S-209	Reinforcing Schedules for Abutments
B120-12-026_Sht26	S-301	Concrete Details – Southbound Piers SU.2 & 3
B120-12-027_Sht27	S-302	Concrete Details – Northbound Piers SU.2 & 3
B120-12-028_Sht28	S-303	Reinforcing Details – Southbound Piers SU.2 & 3
B120-12-029_Sht29	S-304	Reinforcing Details – Northbound Piers SU.2 & 3
B120-12-030_Sht30	S-305	Reinforcing Schedules for Piers

<u>City Drawing No.</u>	<u>Consultant Drawing No.</u>	<u>Drawing Name/Title</u>
B120-12-031_Sht31	S-401	Bearing Layout & Details
B120-12-032_Sht32	S-402	Bearing Details
B120-12-033_Sht33	S-501	Girder Layout
B120-12-034_Sht34	S-502	Concrete Details – 17.3m Girders
B120-12-035_Sht35	S-503	Concrete Details – 22.5m Girders
B120-12-036_Sht36	S-504	Reinforcing Details – 17.3m Girders
B120-12-037_Sht37	S-505	Reinforcing Details – 22.5m Girders
B120-12-038_Sht38	S-506	Girder Reinforcing Schedule & Details
B120-12-039_Sht39	S-601	Concrete Details – Southbound & Northbound Deck Layout
B120-12-040_Sht40	S-602	Concrete Details – Southbound & Northbound Approach Slab Layout & Sections
B120-12-041_Sht41	S-603	Concrete Details – Southbound & Northbound Deck & Approach Slab Details
B120-12-042_Sht42	S-604	Concrete Details – Southbound & Northbound Deck & Approach Slab Details
B120-12-043_Sht43	S-605	Reinforcing Details – Southbound & Northbound Deck Layout
B120-12-044_Sht44	S-606	Reinforcing Details – Southbound & Northbound Sidewalk Layout
B120-12-045_Sht45	S-607	Reinforcing Details – Southbound & Northbound Approach Slab Layout and Details
B120-12-046_Sht46	S-608	Reinforcing Details – Southbound & Northbound Sections and Details
B120-12-047_Sht47	S-609	Reinforcing Schedules for Decks & Approach Slabs
B120-12-048_Sht48	S-701	Bridge Pedestrian Guardrail & Aluminum Guardrail Layout
B120-12-049_Sht49	S-702	Road Pedestrian Guardrail & Traffic Barrier Railing Layout
B120-12-050_Sht50	S-703	Bridge Pedestrian Guardrail Elevations & Sections
B120-12-051_Sht51	S-704	Bridge Pedestrian Guardrail Art Panel Elevations
B120-12-052_Sht52	S-705	Retaining Wall Pedestrian Guardrail Elevations & Sections
B120-12-053_Sht53	S-706	Bridge Pedestrian Guardrail Details
B120-12-054_Sht54	S-707	Retaining Wall Fence Details
B120-12-055_Sht55	S-708	Traffic Barrier Aluminum Guardrail Sections & Details
B120-12-056_Sht56	S-709	Roadway Aluminum Guardrail Sections & Details
B120-12-057_Sht57	S-801	South Bank & North Bank Retaining Wall Layout
B120-12-058_Sht58	S-802	North Bank Retaining Wall Elevations
B120-12-059_Sht59	S-803	AT Trail & Median Retaining Wall Elevations
B120-12-060_Sht60	S-804	Retaining Wall Sections & Details
B120-12-061_Sht61	S-901	Utility Conduit Plan & Details
B120-12-062_Sht62	E-101	Electrical Layout

## **ROADWORKS**

P-3331-01_Sht63	C-105	Portage Avenue to Hallonquist Drive – STA 0+075 to STA 0+210 – Horizontal Geometry
P-3331-02_Sht64	C-106	Portage Avenue to Hallonquist Drive – STA 0+210 to STA 0+375 – Horizontal Geometry
P-3331-03_Sht65	C-107	Portage Avenue to Hallonquist Drive – STA 0+075 to STA 0+160 – Horizontal Alignment
P-3331-04_Sht66	C-108	Portage Avenue to Hallonquist Drive – STA 0+160 to STA 0+275 – Horizontal Alignment
P-3331-05_Sht67	C-109	Portage Avenue to Hallonquist Drive – STA 0+275 to STA 0+375 – Horizontal Alignment
P-3331-06_Sht68	C-201	Portage Avenue to Hallonquist Drive – STA 0+075 to STA 0+160 – Vertical Geometry
P-3331-07_Sht69	C-202	Portage Avenue to Hallonquist Drive – STA 0+160 to STA 0+275 South Bound – Vertical Geometry
P-3331-08_Sht70	C-203	Portage Avenue to Hallonquist Drive – STA 0+160 to STA 0+275 North Bound – Vertical Geometry
P-3331-09_Sht71	C-204	Portage Avenue to Hallonquist Drive – STA 0+275 to STA 0+375 South Bound – Vertical Geometry

<u>City Drawing No.</u>	<u>Consultant Drawing No.</u>	<u>Drawing Name/Title</u>
P-3331-10_Sht72	C-205	Portage Avenue to Hallonquist Drive – STA 0+275 to STA 0+375 North Bound – Vertical Geometry
P-3331-11_Sht73	C-110	Portage Avenue to Hallonquist Drive – Parking
P-3331-12_Sht74	C-206	Active Transportation Trail – West Side of Sturgeon Bridge – Horizontal & Vertical Alignment
P-3331-13_Sht75	C-207	Pedestrian Path – West Side of Sturgeon Bridge – Horizontal & Vertical Alignment
P-3331-14_Sht76	C-208	Active Transportation Trail – East Side of Sturgeon Bridge – Horizontal & Vertical Alignment
P-3331-15_Sht77	C-209	Pedestrian Path – East Side of Sturgeon Bridge – Horizontal & Vertical Alignment
P-3331-16_Sht78	C-210	Pedestrian Path – East Side of Sturgeon Bridge – Horizontal & Vertical Alignment
P-3331-17_Sht79	C-501	Portage Avenue to Hallonquist Drive – Miscellaneous Road Details
P-3331-18_Sht80	C-502	Portage Avenue to Hallonquist Drive – Aluminum Balanced Barrier Details
P-3331-19_Sht81	C-503	Portage Avenue to Hallonquist Drive – Aluminum Balanced Barrier Details
<b>LANDSCAPING</b>		
P-3331-20_Sht82	L-01	Landscape Layout and Details

## **E2. GEOTECHNICAL REPORT**

- E2.1 The geotechnical report will be available to the Contractor for viewing at Stantec Consulting Ltd.'s office at 100-1355 Taylor Ave. The report may not be copied or removed from Stantec's office.

## **E3. ENVIRONMENTAL PROTECTION PLAN**

- E3.1 The Contractor will plan and implement the Work of this Contract strictly in accordance with the requirements of this Environmental Protection Plan as herein specified.
- E3.2 The Contractor is to strictly adhere to all Regulatory Approvals and Letters of Advice including DFO, Transport Canada and the City of Winnipeg Waterway Permit. The documents available at the time of tender are presented in Appendix A and B for DFO and Transport Canada Navigable Waters, respectively.
- E3.3 Transport Canada Navigable Waters approvals are expected prior to the close of the Tender and will be provided to the Contractor upon receipt.
- E3.4 The Contractor is to adhere to the requirements of the City of Winnipeg Waterway Permit. The Waterway Permit will be attained by the City prior to the commencement of construction. The Waterway Permit will be reviewed by the Contract Administrator with the Contractor upon receipt to assess the requirements of the Permit.
- E3.5 The Contractor shall submit an Environmental Protection Plan which shall outline all environmental protection works to be utilized to complete the Works. This plan shall be submitted to the Contract Administrator at least seven (7) days prior to the commencement of any on Site work. This plan is to include such items as the location of stock piles for materials, refuelling of machinery and all items required by this Specification and the Regulatory Agencies.
- E3.6 The Contractor is advised that at a minimum the following Acts, Regulations and By-laws apply to the Work and are available for viewing online at the applicable websites ([www.canlii.ca](http://www.canlii.ca) and/or <http://www.winnipeg.ca/CLKDMIS/>) or at the office of the Contract Administrator.
- E3.7 Federal

- (a) Canadian Environmental Assessment Act (CEAA), c.37;
- (b) Canadian Environmental Protection Act;
- (c) Fisheries Act, c. F-14;
- (d) Transportation of Dangerous Goods Act and Regulations, c. 34;
- (e) Migratory Birds Convention Act and Regulations, c. 22;
- (f) Species at Risk Act, c. 29;
- (g) And any other applicable Acts, Regulations and By-laws;
- (h) Applicable Fisheries and Oceans Canada Operational Statements for Manitoba for temporary stream crossings;
- (i) *The Department of Fisheries and Oceans Freshwater Intake End-of-Pipe Fish Screen Guidelines*, DFO 1995;
- (j) *Fisheries and Oceans Policy for the Management of Fish Habitat* 1986;
- (k) *Federal Policy on Wetland Conservation* 1991;
- (l) *Transportation Association of Canada's Transportation Association of Canada National Guide to Erosion and Sediment Control on Roadway Projects*, 2005.

#### E3.8 Provincial

- (a) The Dangerous Goods Handling and Transportation Act, D12;
- (b) The Endangered Species Act, c. E111;
- (c) The Heritage Resources Act, c. H39.1;
- (d) The Noxious Weeds Act, c. N110;
- (e) The Nuisance Act, c. N120;
- (f) The Public Health Act, c. P210;
- (g) The Water Protection Act, c. W65;
- (h) Workplace Safety and Health Act, c. W210;
- (i) And current applicable associated regulations;
- (j) And any other applicable Acts, Regulations, and By-laws;
- (k) *The Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat*, Manitoba Natural Resources and DFO, 1996.

#### E3.9 Municipal

- (a) The City of Winnipeg Neighbourhood Liveability By-law No. 1/2008;
- (b) The City of Winnipeg Traffic By-law No. 1573/77 and all amendments up to and including 55/2011;
- (c) And any other applicable Acts, Regulations and By-laws.
- (d) *City of Winnipeg Best Management Practices Handbook for Activities In and Around the City's Waterways and Watercourses*, City of Winnipeg, 2005
- (e) *City of Winnipeg Motor Vehicle Noise Policies and Guidelines*
- (f) Materials Handling and Storage
  - (i) Storage of construction materials and equipment will be confined within a fenced area or at a location approved by the Contract Administrator with environmental protection (e.g. silt fence) as appropriate.
  - (ii) Construction materials will not be deposited or stored on or near watercourses unless written acceptance from the Contract Administrator is received in advance.
  - (iii) Construction materials and debris will be tied down or secured if severe weather and high wind velocities are forecasted. Work shall be suspended during extreme high wind conditions.

- (iv) Construction materials and debris will be prevented from entering watercourses. In the event that materials and/or debris inadvertently enter the land drainage system, the Contractor will be required to remove the material to an appropriate landfill or storage facility and restore the watercourse to its original condition.
- (g) Fuel Handling and Storage
  - (i) The Contractor will obtain all necessary permits from Manitoba Conservation for the handling and storage of fuel products and shall provide copies to the Contract Administrator.
  - (ii) All fuel handling and storage facilities will comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.
  - (iii) Fuels, lubricants and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act will be stored and handled within approved storage areas.
  - (iv) The Contractor will ensure that all fuel storage containers are inspected daily for leaks and spillage.
  - (v) Products transferred from the fuel storage area(s) to specific Work sites will not exceed the daily usage requirement.
  - (vi) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size will be spread on the ground to catch the fluid in the event of a leak or spill.
  - (vii) Wash, refuel and service machinery and store fuel and other materials for the machinery 100 m away from watercourses to prevent deleterious substances from entering the water.
  - (viii) The area around storage sites and fuel lines will be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.
  - (ix) The deposit of deleterious substances into water frequented by fish is prohibited under the Fisheries Act. The Contractor will take appropriate precautions to ensure that potentially deleterious substances (such as fuel, hydraulic fluids, oil, sediment, etc.) do not enter any water body.
  - (x) Machinery is to arrive on Site in a clean condition and is to be maintained free of fluid leaks.
  - (xi) A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills will be stored nearby on Site. The Contractor will ensure that additional material can be made available on short notice. Additionally, appropriate staff on site will be trained in proper handling of deleterious liquids (i.e. fueling) and trained on how to prevent and clean-up minor spills.
- (h) Waste Handling and Disposal
  - (i) The construction area will be kept clean and orderly at all times and at the completion of construction.
  - (ii) At no time during construction will personnel or construction waste be permitted to accumulate for more than one day at any location on the construction Site, other than at a dedicated storage area as may be approved by the Contract Administrator.
  - (iii) The Contractor will, during and at the completion of construction, clean up the construction area and all resulting debris shall be deposited at a Waste Disposal Ground operating under the authority of Waste Disposal Grounds Regulation, Manitoba Regulation 150/91. Exceptions are liquid industrial and hazardous wastes which require special disposal methods.
  - (iv) On Site volumes of sewage and/or septage will be removed on a weekly basis.
  - (v) The Contractor will ensure sewage, septage and other liquid wastes generated on Site are handled and disposed of by a certified disposal contractor.
  - (vi) Indiscriminate dumping, littering, or abandonment will not take place.
  - (vii) No burning of waste or other materials is permitted.

- (viii) Clearing debris will be disposed of by chipping and/or mulching with the material being used by the City of Winnipeg for future uses.
- (ix) The Contractor will use structurally suitable Site excavation material as fill within the project. Should excavated material exceed fill needs, the remainder would be stockpiled for use on other local projects.
- (x) Structurally unsuitable site excavation material will be removed by the Contractor.
- (xi) Waste storage areas will not be located so as to block natural drainage.
- (xii) Runoff from a waste storage area will not be allowed to cause siltation of a watercourse.
- (xiii) Waste storage areas will be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.
- (xiv) Equipment will not be cleaned near watercourses; contaminated water from onshore cleaning operations will not be permitted to enter watercourses.
- (xv) The Contractor will notify and receive written approval from the Contract Administrator prior to discharge from any dewatered areas. The discharge will be released into a well-vegetated area, filter bag, settling basin, or storm sewer system to remove suspended material and other deleterious substances from the discharge before it finds its way into any watercourse. Discharge from dewatering areas may require disposal via the sanitary sewer system or disposal truck in accordance with Construction Specifications, at the request of the Contract Administrator.
- (xvi) Flows will be dissipated so that dewatering discharges minimize erosion at the discharge point.
- (i) Dangerous Goods/Hazardous Waste Handling and Disposal
  - (i) Dangerous goods/hazardous waste are identified by, and will be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.
  - (ii) The Contractor will be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.
  - (iii) The Contractor will have on Site staff that is trained and certified in the handling of the dangerous/hazardous goods, when said dangerous/hazardous goods are being utilized on Site for the performance of the Work.
  - (iv) Different waste streams will not be mixed.
  - (v) Disposal of dangerous goods/hazardous wastes will be at approved hazardous waste facilities.
  - (vi) Liquid hydrocarbons will not be stored or disposed of in earthen pits on Site.
  - (vii) Used oils will be stored in appropriate drums, or tankage until shipment to waste oil recycling centres, incinerators, or secure disposal facilities approved for such wastes.
  - (viii) Used oil filters will be drained, placed in suitable storage containers, and buried or incinerated at approved hazardous waste treatment and disposal facilities.
  - (ix) Dangerous goods/hazardous waste storage areas will be located at least 100 m away from the high water line and be dyked.
  - (x) Dangerous goods/hazardous waste storage areas will not be located so as to block natural drainage.
  - (xi) Runoff from a dangerous goods/hazardous waste storage area will not be allowed to cause siltation of a watercourse.
  - (xii) Dangerous goods/hazardous waste storage areas will be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.
- (j) Emergency Response
  - (i) The Contractor will ensure that due care and caution is taken to prevent spills.
  - (ii) The Contractor will report all major spills of petroleum products or other hazardous substances with significant impact on the environment and threat to human health and safety (as defined in Table 1 below) to Manitoba Conservation, immediately



after occurrence of the environmental accident, by calling the 24-hour emergency phone number (204) 945-4888.

- (iii) The Contractor will designate a qualified supervisor as the on Site emergency response coordinator for the project. The emergency response coordinator will have the authority to redirect manpower in order to respond in the event of a spill.
- (iv) The following actions will be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on Site emergency response coordinator.
  - (i) Notify emergency-response coordinator of the accident:
    - ◆ Identify exact location and time of the accident.
    - ◆ Indicate injuries, if any.
    - ◆ Request assistance as required by magnitude of accident [Manitoba Conservation 24-hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup].
  - (ii) Attend to public safety:
    - ◆ Stop traffic, roadblock/cordon off the immediate danger area.
    - ◆ Eliminate ignition sources.
    - ◆ Initiate evacuation procedures if necessary.
  - (iii) Assess situation and gather information on the status of the situation, noting:
    - ◆ Personnel on Site.
    - ◆ Cause and effect of spill.
    - ◆ Estimated extent of damage.
    - ◆ Amount and type of material involved.
    - ◆ Proximity to waterways, sewers and manholes.
  - (iv) If safe to do so, try to stop the dispersion or flow of spill material:
    - ◆ Approach from upwind.
    - ◆ Stop or reduce leak if safe to do so.
    - ◆ Dyke spill material with dry, inert absorbent material or dry clay soil or sand.
    - ◆ Prevent spill material from entering waterways and utilities by dyking.
    - ◆ Prevent spill material from entering manholes and other openings by covering with rubber spill mats or dyking.
  - (v) Resume any effective action to contain, clean up, or stop the flow of the spilled product.
  - (vi) The emergency response coordinator will ensure that all environmental accidents involving contaminants shall be documented and reported to Manitoba Conservation according to The Dangerous Goods Handling and Transportation Act Environmental Accident Reports Regulation 439/87.
  - (vii) When dangerous goods are used on Site, materials for containment and cleanup of spill material (e.g., absorbent materials, plastic oil booms, and oversized recovery drums) shall be available on Site.
  - (viii) Minor spills of such substances that may be contained on land with no significant impact on the environment may be responded to with in-house resources without formal notification to Manitoba Conservation.
  - (ix) City emergency response, 9-1-1, shall be used if other means are not available.

Table E3.1 - Environmental Accident Reporting		
Reportable Quantities of Spills that must be Reported to Manitoba Conservation [(204) 944-4888]		
Classification	Hazard	Reportable Quantity or Level
1	Explosives	All
2.1	Compressed Gas (Flammable)	100 L *

2.2	Compressed Gas	100 L *
2.3	Compressed Gas (Toxic)	All
2.4	Compressed Gas (Corrosive)	All
3	Flammable Liquids	100 L
4	Flammable Solids	1 Kg
5.1 Packing Groups I and II	Oxidizer	1 Kg or 50 L
Packing Group III	Oxidizer	5 Kg or 50 L
5.2	Organic Peroxide	1 Kg or 1 L
6.1 Packing Group I	Acute Toxic	1 Kg or 1 L
Packing Groups II and III	Acute Toxic	5 Kg or 5 L
6.2	Infectious	All
7	Radioactive	Any discharge or level exceeding 10 m Sv/h at the package surface and 200 uSv/h at 1 m from the package surface
8	Corrosive	5 Kg or 5 L
9.1	Miscellaneous (except PCB Mixtures)	50 Kg
9.1	PCB Mixtures	500 grams
9.2	Aquatic Toxic	1 Kg or 1 L
9.3	Wastes (Chronic Toxic)	5 Kg or 5 L

\* Container Capacity (refers to container water capacity)

Source: *Environmental Accident Reporting Regulation M.R. 439/87*

(k) Noise and Vibration

- (i) Noise generating activities will be limited to the hours indicated in the City of Winnipeg Neighbourhood Liveability By-law No. 1/2008. The activities will generally be restricted to 7:00 a.m. to 7:00 p.m. weekdays with written permission of the Contract Administrator and the City of Winnipeg for any after-hours or weekend work required for special cases. No extended or alternative working hours/dates will be permitted for pile driving activities.
- (ii) The Contractor will be responsible for scheduling Work to avoid potential noise problems and/or employ noise reduction measures to reduce noise to acceptable limits. The Contractor will also demonstrate to the Contract Administrator that Works to be performed during the night-time period, on Sundays, and Holidays will not exceed the approved limit.

(l) Dust and Emissions

- (i) Construction vehicles and machinery will be kept in good working order by the Contractor through the use of inspection and maintenance.
- (ii) The Contractor will minimize construction equipment idling times and turn off machinery, when feasible.
- (iii) Dust control practices implemented by the Contractor during construction will include regular street cleaning and dampening of construction access roads and Works areas with water or approved chemicals at an adequate frequency to prevent the creation of dust.
- (iv) Only water or chemicals approved by the Contract Administrator will be used for dust control. The use of waste petroleum or petroleum by-products is not permitted.
- (v) The Contractor will ensure that trucks which are used to haul excavated material and backfill material to and from the Work site utilize tarpaulin covers during transport to prevent material from falling onto the street and creating dust.
- (vi) Stockpiled soils will be wetted down or covered with tarpaulin covers to prevent the creation of dust, when appropriate.

(m) Erosion Control

- (i) The Contractor will develop a sediment control plan prior to beginning construction in adherence with the Transportation Association of Canada National Guide to

Erosion and Sediment Control on Roadway Projects, 2005 and to the satisfaction of the Contract Administrator.

- (ii) Sediment control will be applied to all in water works to prevent the release or re-suspension of sediments to the watercourse. A turbidity curtain will be used to contain sediments from coffer dam construction and riprap placement, if warranted. This turbidity curtain should isolate as small an area as possible to complete the works, and should be completely removed once turbidity within the isolated area has returned to background levels.
- (iii) The Contractor will inspect all sediment control structures daily during heavy construction activity in the areas of the structures and after a heavy rainfall to ensure their continued integrity.
- (iv) Exposure of soils along drain slopes will be kept to the minimum practical amount, acceptable to the Contract Administrator.
- (v) Effective sediment and erosion control measures (e.g., straw mulch, erosion control blankets, interceptor ditches) will be used both during construction and until vegetation is re-established to prevent sediment-laden runoff from entering Sturgeon Creek, wetlands and other watercourses.
- (vi) All areas disturbed during construction will be landscaped and revegetated with native and/or introduced plant species in order to restore and enhance the Site and protect against soil erosion unless otherwise indicated.
- (vii) The disturbed surface will be revegetated as soon as possible and done so as to create a dense root system in order to defend against soil erosion on the right-of-way and any other disturbed areas susceptible to erosion.
- (viii) The loss of topsoil and the creation of excessive dust by wind during construction will be prevented by the addition of temporary cover crop, water or tackifier, if conditions so warrant.
- (ix) The Contractor will routinely inspect all erosion and sediment control structures and immediately carry out any necessary maintenance. Several inspections will be performed during rainy days.
- (x) Construction activities will be avoided during periods of high winds to prevent erosion and the creation of dust.
- (n) **Runoff Control**
  - (i) Measures will be undertaken to ensure that runoff containing suspended soil particles is minimized from entering the land drainage system to the extent possible to the satisfaction of the Contract Administrator.
  - (ii) Areas that are heavily disturbed and vulnerable to erosion or gullyng will be dyked to redirect surface runoff around the area prior to spring runoff.
  - (iii) Construction activities on erodible slopes will be avoided during spring runoff and heavy rain falls.
  - (iv) Soil and fill will not be stockpiled on immediate watercourse bank areas.
- (o) **Fish**
  - (i) The Contractor will adhere to all of the protection measures below to adhere to the DFO No Net Loss Policy for fish habitat.
  - (ii) Any fish trapped within the isolated area will be captured and returned to the watercourse unharmed. Fish includes fin fish, crayfish and mussels (clams).
  - (iii) A buffer of vegetation will be maintained when working along waterways, where possible.
  - (iv) The duration of work and amount of disturbance to the bed and banks of the water body will be minimized.
  - (v) Use only clean rock for riprap, and haul it in from an appropriate land-based source. Avoid using poor quality limestone that breaks down quickly when exposed to the elements or acid generating rocks typical from metal mines. All rock will be clean and free of fine materials and of appropriate size to resist displacement during high flow events.

- (vi) The rock is placed such that it does not constrict the channel or change the hydraulics in a way that might damage the bed and/or banks of the watercourse or interfere with fish passage.
- (vii) Where grading of stream banks is required they are sloped by pulling material back from the water's edge. Stabilize any waste materials removed from the work site, above the ordinary high water mark, to prevent them from entering any water body. Spoil piles could be contained with silt fence, flattened, covered with biodegradable mats or tarps, and/or planted with preferably native grass or shrubs.
- (viii) Shoreline vegetation will be retained to the greatest extent possible to maximize the stability of the banks.
- (ix) Operate machinery from outside of the water and in a manner that minimizes disturbance to the banks of the water body.
- (x) The intake of any pumps used in surface waters will be screened to meet the Department of Fisheries and Oceans' Freshwater Intake End-of-Pipe Fish Screening Guidelines (1995) and water withdrawal rates will not exceed 10% of the instantaneous stream flow at the time.
- (p) Wildlife
  - (i) No clearing of trees, shrubs or vegetation is permitted between May 1 and July 31st of any year to protect nesting and breeding season for migratory birds and other wildlife, unless otherwise identified by a Project Biologist.
  - (ii) No one will disturb, move or destroy migratory birds' nests.
  - (iii) If a nest is encountered, work will cease in the immediate area and the Contract Administrator will be contacted for further direction.
  - (iv) In the event that species at risk are encountered during the project construction, all work will cease in the immediate area, the site will be made safe and the Contract Administrator will be contacted.
- (q) Wetlands
  - (i) The Contractor will implement the following environmental protection measures to prevent the new loss of wetland functions, in accordance with the Federal Policy on Wetland Conservation:
    - (i) The Contractor will clearly mark wetland limits near the construction footprint prior to commencement of the Work and will remain marked throughout the construction period.
    - (ii) Wetlands will not be disturbed without written permission from the Contract Administrator.
    - (iii) Should additional wetlands be encountered during construction, construction in that area will halt until the area is properly marked.
    - (iv) Construction equipment will avoid the marked wetland areas as much as possible, where feasible.
    - (v) The Contractor will not discharge water into adjacent wetlands without written permission from the Contract Administrator, having confirmed the quality of the water to be discharged and the capacity of the receiving wetland.
    - (vi) Any fish located within the wetlands to be disturbed by the project will be captured and returned to a nearby watercourse unharmed.
- (r) Vegetation
  - (i) The Contractor will clearly mark the disturbance limit prior to commencement of the Work and will remain marked throughout the construction period.
  - (ii) Vegetation will not be disturbed without written permission from the Contract Administrator.
  - (iii) The Contractor will protect plants or trees which may be at risk of accidental damage. Such measures may include protective fencing or signage and will be approved in advance by the Contract Administrator.

- (iv) The Contractor will limit the removal of trees and snags (standing dead trees); surface disturbance and vegetation clearing.
- (v) Herbicides and pesticide will not be used adjacent to any surface watercourse.
- (vi) Trees or shrubs will not be felled into watercourses.
- (vii) Areas where vegetation is removed during clearing, construction decommissioning activities, will be revegetated as soon as possible in accordance with the landscaping plans forming part of the Contract, or as directed by the Contract Administrator.
- (viii) Trees damaged during construction activities will be examined by bonded tree care professionals. Viable trees damaged during construction activities will be pruned according to good practices by bonded tree care professionals.
- (ix) Damaged trees which are not viable will be replaced at the expense of the Contractor.
- (s) Landscaping
  - (i) Construction waste (excluding common construction gravel, sand, etc.) will be removed to a minimum depth of 600mm below final grade in all areas that are to be backfilled with suitable material and re-vegetated in accordance with the City of Winnipeg Standard Construction Specifications.
  - (ii) Topsoil will be stripped prior to construction and salvaged for use during landscaping. Surplus topsoil will be properly stockpiled for use in other projects.
  - (iii) The Contractor will adhere to the landscaping plan for the maintenance of initial stages and development stages of the plant community.
- (t) Heritage Resources
  - (i) If heritage material is located during the construction and soil removal process, all Work will cease and the Contractor will immediately contact the Contract Administrator. The Historic Resource Branch, Manitoba Culture, Heritage, Tourism and Sport or the Project Archaeologist, will be contacted by the Contract Administrator to determine the nature and extent of the archaeological material and to arrange for its recovery. The archaeological remains will be recovered by salvage excavation upon authorization by the Contract Administrator, having consulted with the Historic Resources Branch, Manitoba Culture, Heritage, Tourism and Sport.
  - (ii) The Contractor will be prepared to continue his Work elsewhere on the project while the Archaeologist investigates the find and determines its heritage value.
  - (iii) The Contractor is advised that he may be denied access to such areas of the project until such time as a thorough archaeological investigation is conducted or the find is deemed to have no heritage value.
  - (iv) Construction and excavation work will not resume until the Contract Administrator, having consulted with the Historic Resources Branch, Manitoba Culture, Heritage, Tourism and Sport, or the Project Archaeologist, authorizes a resumption of Work.
  - (v) If human remains are uncovered during the construction and soil removal process, all Work will cease and the Heritage Resources Branch, Manitoba Culture, Heritage, Tourism and Sport will be contacted by the Contract Administrator. The Historic Resources Branch will contact the City of Winnipeg Police.
  - (vi) If the human remains are not considered forensic, (i.e., no foul play suspected), they will be removed by the Historic Resources Branch, Manitoba, Culture, Heritage, Tourism and Sport or the Project Archaeologist and turned over to the Province.
  - (vii) If the human remains are considered forensic, the City of Winnipeg Police will be responsible for their removal.
  - (viii) Additional information may be obtained by contacting: Archaeological Assessment Services, Historic Resources Branch.
- (u) Construction Traffic
  - (i) Workforce parking will be limited to the areas designated for such as detailed in the Contract Documents, or as otherwise may be directed by the Contract Administrator.

- (ii) Large equipment will be equipped with flashing beacons and/or an audible “back up” warning device that is audible when the transmission is in reverse.
- (iii) The Contractor will adhere to the Standard Provisions of the Standard Construction Specifications, and of the Manual of Temporary Traffic Control in Work Areas on City Streets of the City of Winnipeg Public Works Department.
- (iv) The Contractor’s laydown area, construction Site and access road will be fenced and gated to secure the Site and materials and to discourage pedestrian entrance to construction areas and to control any potential hazard to the public, particularly children.
- (v) For circumstances where the Contract Administrator has accepted Site access of special equipment or material, the Contractor will provide adequate flagmen for traffic control in the vicinity of any public buildings.
- (v) Access
  - (i) The Contractor will maintain access to affected residential properties.
  - (ii) The Contractor will provide or maintain general and off-street access to any affected business during construction.

#### E3.10 Measurement and Payment

- E3.10.1 Environmental Protection Plan will be considered incidental to E4, “Mobilization and Demobilization”. No measurement and payment will be made within this section.

### **E4. MOBILIZATION AND DEMOBILIZATION**

#### E4.1 Description

- E4.1.1 This Specification shall cover all operations relating to the mobilization and demobilization of the Contractor to the Site, as specified herein.
- E4.1.2 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 works hereinafter specified.

#### E4.2 Scope of Work

- (a) The Work under this Specification shall include but not be limited to:
  - (i) Mobilizing and demobilizing on-site Work facilities;
  - (ii) Supplying, setting up, laying out, and removing site office facilities as detailed in E5, “Site Office Facilities”;
  - (iii) Supplying and installing secure chain link fencing around the site;
  - (iv) Maintaining and removing any access roadways;
  - (v) Supplying and installing chain link fencing around the site;
  - (vi) Restoring all Site facilities

#### E4.3 Materials

- E4.3.1 The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials to be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.
- E4.3.2 All materials supplied under this Specification shall be of a type approved by the Contract Administrator and shall be subject to inspection and testing by the Contract Administrator.
- E4.3.3 Work Site Construction Fencing
  - (a) The bridge construction Site and the staging area shall be protected from the public by a chain link fence. Lockable gates, with locks and keys, shall be provided at entrances to the Site. The area to be protected from the public is indicated on the Drawings.

- (b) The Work Site construction fencing shall not allow the public access to the temporary pedestrian crossing but shall allow access to Emergency Services via gates, removal of panels, removal of the fence at this location, or some other means that will not inhibit the access of the emergency personnel to the temporary pedestrian crossing.
  - (c) The Contractor shall be responsible for maintenance of the Work Site construction fencing.
- E4.3.4 The Contractor's Site supervisor is required to carry, at all times, a cellular telephone, with voice mail.
- E4.3.5 This section also includes travel and accommodation, set-up and demobilization of Site offices, storage conveniences and other temporary facilities, construction plant, and other items not required to form part of the permanent works and not covered by other prices.
- E4.4 Equipment
  - (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- E4.5 Construction Methods
  - E4.5.1 Layout of On-Site Work Facilities
    - (a) The Contractor shall mobilize all on-site Work and other temporary facilities.
    - (b) Possible locations for the Contractor's staging are shown on the Drawings. The Contractor shall coordinate with relevant parties to make arrangements for use of these areas.
    - (c) Upon completion of construction activities, the Contractor shall remove all on-site Work and other temporary facilities.
  - E4.5.2 Secure Site Fencing
    - (a) A minimum 1.8 m high chain-link secure fence around the site lay-down and Work site areas shall be installed prior to commencement of site activities.
    - (b) The fencing shall remain secure and in place during all construction facilities.
    - (c) The fencing shall be removed upon demobilization of on-site Work facilities.
    - (d) Fencing shall be complete with lockable gates
  - E4.5.3 Access Roadway
    - (a) The Contractor shall maintain any access roadway they install.
    - (b) The access road shall be maintained on a regular basis to provide continual unrestricted site access, to the satisfaction of the Contract Administrator.
    - (c) Upon completion of the Work, the area shall be restored to its original condition. The Limits of Work Area will be reviewed at the Pre-Construction Meeting. If the Contractor requests a Change in the Limits of the Work Area, they shall do so formally in writing at least ten (10) business days prior to mobilization. The Contract Administrator will respond within five (5) business days with a response; the Contract Administrator has the right to dismiss the request.
  - E4.5.4 Restoration of Existing Facilities
    - (a) Upon completion of the Work and demobilization, the Contractor shall restore existing facilities.
- E4.6 Quality Control
  - E4.6.1 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.

- (b) 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.

#### E4.6.2 Access

- (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

#### E4.6.3 The intent of the Limits of the Work Area is to preserve existing trees and vegetation by minimizing removals.

### E4.7 Measurement and Payment

#### E4.7.1 Mobilization and demobilization will not be measured and will be paid for at the Contract Lump Sum Price for "Mobilization and Demobilization", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Mobilization and demobilization will be paid for at a percentage of the Contract Lump Sum Price, measured as specified herein. These percentages shall be as follows:

- (a) 30% when the Contract Administrator is satisfied that construction has commenced.
- (b) 60% when Substantial Performance has been met.
- (c) 10% upon completion of the project.

## E5. SITE OFFICE FACILITIES

### E5.1 Description

- (a) This Specification shall cover all operations relating to the supply of site office facilities, 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 Works as hereinafter specified.

### E5.2 Materials

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- (b) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

### E5.3 Equipment

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

### E5.4 Construction Methods

#### E5.4.1 Site Office Facilities

- (a) The Contractor shall supply the Contract Administrator's site office facilities meeting the following requirements:
  - (i) A site office shall be provided for the exclusive use of the Contract Administrator;



- (ii) The office shall be conveniently located within the site lay-down area near the Work site;
- (iii) The office shall be a newer 10 ft by 60 ft trailer or building, having a ceiling height of 2.4 m and adequate windows (complete with security bars) to provide for cross ventilation, with door entrance(s) with suitable lock(s);
- (iv) The office shall be suitable for all weather use. It shall be equipped with suitable heating and air conditioning systems, so that the interior room temperature can be maintained between 20 to 22°C at any outside ambient temperature;
- (v) The office shall be adequately lighted with fluorescent fixtures and have a minimum of ten – 120 volt AC electrical receptacles;
- (vi) The office shall be furnished with three office desks and chairs, one drafting table, one meeting table, one stool, one legal size filing cabinet, two bookcases, and a minimum of twelve (12) chairs;
- (vii) Two separate land lines for a fax machine and a computer modem shall also be supplied and serviced by the Contractor;
- (viii) One refrigerator, approximately 5 ft<sup>3</sup> and one mid-size microwave shall be supplied by the Contractor;
- (ix) A bottled water supply, with associated consumables, shall be supplied fresh regularly by the Contractor;
- (x) A portable flush or chemical-type toilet, lavatory, and mirror shall be located near the site office building. The toilet shall have a locking door and be for the exclusive use of the Contract Administrator and personnel from the City;
- (xi) The site office building and the portable toilet shall be cleaned on a weekly basis. The Contract Administrator may request additional cleaning when he deems it necessary;
- (xii) A minimum of three parking stalls shall be made available for use by the Contract Administrator immediately adjacent to the site office; and
- (xiii) All site office facilities and furnishings shall be approved by the Contract Administrator;
- (b) The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the site office facilities.
- (c) The site office facilities shall be provided from the date of the commencement of the Work to the date of Total Performance unless otherwise approved in writing by the Contract Administrator.

#### E5.5 Measurement and Payment

- E5.5.1 The supply of site office facilities will be considered incidental to E4, "Mobilization and Demobilization." No measurement and payment will be made within this section.

### E6. PROTECTION OF EXISTING TREES

- E6.1 The Contractor shall take the following precautionary steps to prevent damage from construction activities:
- (a) All trees will have a 3m radius protective zone calculated from the circumference at the base of the trunk which will remain free of digging, trenching, grade changes, stock piling of materials and soil compaction, except as minimum to construct berm or swales throughout the duration of the Contract. Protective fencing around these areas is required.
  - (b) Trees within and immediately adjacent to proposed construction and those identified to be at risk by the Contract Administrator are to be strapped with 25 x 100 x 2400 mm wood planks, or suitably protected as approved by the Contract Administrator. Do not use nails or other fasteners that penetrate the tree trunk. The width and length of strapping may be reduced to suit the tree being protected as approved by the Contract Administrator.
  - (c) Excavation shall be performed in a manner that minimizes damage to the existing root systems. Where possible, excavation shall be carried out such that the edge of the

excavation shall be a minimum of 1.5 times the diameter (measured in inches) where 1 inch diameter equals 1 foot measured from the outside edge of the trunk of the tree at 6 inches above grade. Where roots must be cut to facilitate excavation, they shall be pruned neatly at the face of excavation. They must be properly trimmed with sharp tools to prevent crushing or being pulled by construction equipment. No paint is required. All exposed roots must be mulched until the excavated area is filled with clean earth to avoid exposure to sunlight and desiccation.

- (d) Operation of equipment within the dripline of the trees shall be kept to the minimum required to perform the Work required. Equipment shall not be parked, repaired, refuelled; construction materials shall not be stored, and earth materials shall not be stockpiled within the driplines of trees. The dripline of a tree shall be considered to be the ground surface directly beneath the tips of its outermost branches. The Contractor shall ensure that the operations do not cause flooding or sediment deposition on areas where trees are located.
- (e) Work on-site shall be carried out in such a manner so as to minimize damage to existing tree branches. Where damage to branches does occur, they shall be neatly pruned.
- (f) Repair, replace and maintain tree protection materials during construction until the Project completion.
- (g) Carefully remove safety fencing and strapping material without harming the tree as soon as the construction and restoration Work is complete.

E6.2 All damage to existing trees caused by the Contractor's activities shall be repaired to the requirements and satisfaction of the Contract Administrator and the City Forester or his designate.

E6.3 Measurement and Payment

E6.3.1 Protection of existing trees will be considered incidental to E4, "Mobilization and Demobilization." No measurement and payment will be made within this section.

## **E7. WATER OBTAINED FROM THE CITY**

E7.1 Further to clause 3.7 of CW 1120, the Contractor shall pay for all costs, including sewer charges, associated with obtaining water from the City in accordance with the Waterworks and Sewer By-laws.

## **E8. TRAFFIC AND PEDESTRIAN CONTROL MANAGEMENT**

E8.1 Description

- (a) This Specification shall cover all operations relating to the supply, erection, and maintenance of all applicable traffic control devices in accordance with the provision contained in the latest edition of the "Manual of Temporary Traffic Control in Work Areas on City Streets," and Clauses 3.6 and 3.7 of the latest version of the City of Winnipeg Standard Construction Specification CW 1130, and as specified herein.
- (b) This Specification shall include all operations related to establishing and executing the public access and traffic control plan as specified herein.
- (c) 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 Works as hereinafter specified.

E8.2 Scope of Work

E8.2.1 General

- (a) The City of Winnipeg is responsible for traffic control related to the movement of vehicles through the Project area in the lanes that are not under construction (excluding lane-at-a-time areas). The City shall bear all costs associated with these Works. This includes:

- (i) Installation of poly post lane delineation for Northbound and Southbound traffic;
  - (ii) Turning restrictions and related signage for Sturgeon Road and side streets;
  - (iii) All regulatory signage;
  - (iv) Traffic signal modifications and installations (temporary signal poles and indicators, relocations, and reinstallations);
  - (v) Daily maintenance of all items above.
- (b) The Work 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 Works as hereinafter specified, excluding that being performed by the City of Winnipeg as listed above in E8.2.1(a). This generally includes:
- (i) Installation of barricades in areas under construction, including chevrons or other directional signage to facilitate construction vehicle access and prevent general traffic access;
  - (ii) Lane closures and barricades to facilitate lane-at-a-time construction, notably in the Portage intersection and at the north limit of the project area;
  - (iii) Adjustment of barricades to provide bus stop bays out of main traffic lanes where possible;
  - (iv) Installation and adjustment of sidewalk barricades stating "sidewalk closed";
  - (v) Maintaining access for emergency vehicles to Grace Hospital
  - (vi) Maintaining access to all bus stops (or relocated bus stops);
  - (vii) Maintaining at least one pedestrian crossing of Sturgeon Road at each side street (Portage Avenue and Hallonquist Drive);
  - (viii) Assisting Traffic Services in the setup and closing down of traffic staging between all Phases of work, including sweeping and any clean up associated with these operations;
  - (ix) Securing Work areas to provide safe pedestrian and vehicular access; and
  - (x) Daily maintenance of all items listed above.

#### E8.2.2 Temporary Lane Closure

- (a) The Contractor may temporarily close access to Grace Hospital as indicated on the Drawings for additional staging and work area as required and as approved by the Contract Administrator. The Contractor shall request a temporary lane closure 48 hours prior to desired lane closure. The lane shall be closed during construction of approaches to the hospital, unless otherwise approved by the Contract Administrator.

#### E8.3 Materials

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- (b) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

#### E8.4 Equipment

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

#### E8.5 Notification

- (a) The Contractor shall notify the City of Winnipeg Customer Service at 986-5640, one (1) Calendar Day in advance of any traffic lane closures.

## E8.6 Construction Methods

### E8.6.1 General

- (a) The Contractor shall provide and maintain flagmen in accordance with the "Manual of Temporary Traffic Control in Work Areas on City Streets", issued by the City of Winnipeg.
- (b) The Contractor shall take all other safety measures necessary to cope with any peculiar or unusual circumstances that have not been set out in the above-mentioned manual and shall, at all times, ensure that maximum protection is afforded to the road users and that his operations in no way interfere with the safe operation of traffic.
- (c) If any pedestrian traffic is disrupted or rerouted at the site, the Contractor shall be responsible for supplying and installing all necessary signs and protection to the satisfaction of the Contract Administrator.
- (d) Improper signing will be sufficient reason for the Contract Administrator or Inspector to immediately shut down the entire job.
- (e) Barricades supplied and installed by the Contractor shall show the telephone number(s) at which he can be reached twenty-four (24) hours per day, seven (7) days per week.
- (f) During the hours when the Contractor is not working, equipment and stockpiled materials shall be left in such a location so as not to interfere with or present a hazard to motorists or pedestrians.
- (g) Should the Contractor be unable to maintain pedestrian or vehicular access to a residence or business, he shall review the planned disruption with the business or residence and the Contract Administrator, and take reasonable measures to minimize the impact. The Contractor shall provide a minimum of twenty-four (24) hours notification to the affected residence or business and the Contract Administrator, prior to disruption of access.

### E8.6.2 Safety Precautions

- (a) The Contractor shall provide flagmen, barricades, railings, signs, and warning lights as required at all times to secure the safety of the public and shall comply with all provincial statutes and laws in force in Manitoba applicable to the Work of this nature.

## E8.7 Quality Control

### E8.7.1 Inspections

- (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.
- (b) 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.

### E8.7.2 Access

- (c) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

## E8.8 Measurement and Payment

- E8.8.1 Traffic and pedestrian control will not be measured and will be paid for at the Contract Lump Sum Price for "Traffic Control", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Traffic and pedestrian control will be paid for at a percentage of the Contract Lump Sum Price for "Traffic Control" specified as follows:

- (a) 30% when the Contract Administrator is satisfied that construction has commenced.
- (b) 60% when Substantial Performance has been met.
- (c) 10% upon completion of the project.

## **E9. SUPPLY AND INSTALL DETECTABLE WARNING SURFACE TILES**

### **E9.1 Description**

- E9.1.1 This specification covers the supply and installation of detectable warning surface tiles in sidewalk ramps and multi-use path ramps.

### **E9.2 Specifications and Drawings**

#### **E9.2.1 Referenced Standard Construction Specifications and Standard Details**

- (a) CW 3235 - Renewal of Existing Miscellaneous Concrete Slabs
- (b) CW 3240 - Renewal of Existing Curbs
- (c) CW 3310 - Portland Cement Concrete Pavement Works
- (d) CW 3325 - Portland Cement Concrete Sidewalk
- (e) SD-229C - Curb Ramp for Concrete Pavement
- (f) SD-229D - Curb Ramp for Asphalt Overlay

#### **E9.2.2 SDE Drawings**

- (a) SDE-229A - Curb Ramp Layout for Intersections
- (b) SDE-229AA - Detectable Warning Surface Tile in Curb Ramps for Intersections, Layout Option 1
- (c) SDE-229AC – 300x300 Detectable Warning Surface Tile, Layout Option 3
- (d) SDE-229AD – 300x300 Detectable Warning Surface Tile, Layout Option 3 DETAIL
- (e) SDE-229AE – Curb Ramp for Pedestrian Corridor with a Traffic Control Device
- (f) SDE-229AF – Detectable Warning Surface Tile Orientation for Offset Intersections
- (g) SDE-229BB – Detectable Warning Surface Tile in Curb Ramps for Medians
- (h) SDE-229E - Curb Ramp Depressed Curb

### **E9.3 Materials**

#### **E9.3.1 Acceptable Detectable Warning Surface Tile product is:**

- (a) 610 x 1220mm (2'x 4') Cast in Place (Federal Yellow).
- (b) 300 x 300mm (1'x1') Cast in Place (Federal Yellow).

Manufacturer - ADA Solutions Inc.,  
Supplier -  
Brock White Canada  
879 Keewatin Street  
Winnipeg, Manitoba

Attention: Bernie Giesbrecht  
Ph: 204-479-8089

or

Manufacturer - Armor Tile Tactile Systems  
Supplier –  
Alsip's Building Products  
1 Cole Avenue  
Winnipeg, Manitoba

Attention: Jason Alsip  
Ph. 204-667-3330

E9.3.2 Detectable warning surface tiles shall be Federal Yellow (USA); or Safety Yellow (Canada).

E9.3.3 Detectable warning surface tiles shall be cast in place type with ribs. (Anchored type is not allowed)

E9.3.4 Truncated domes on detectable warning surface tiles shall be in accordance with ADA Accessibility Guidelines (ADAAG).

#### E9.4 Construction Methods

##### E9.4.1 Selection of Layout Options

- (a) Select the appropriate design layout for detectable warning surface tiles according to the following prioritized order:
- (b) Layout Option One – Install detectable warning surface tiles in accordance with SDE-229A and SDE-229AA.
- (c) If two 610mm x 1220mm tiles would physically overlap each other, or would be within 150mm of each other, or if one tile would lie within the circulation path towards the other tile, then install the detectable warning surface tiles according to the following order, Layout Option Two(2) or Three(3).
- (d) Layout Option Two – Separate the tiles by moving either one or both tiles along the curb line in opposite directions, in accordance with this Specification, and keeping the ramp and pedestrian road crossing as perpendicular to the road as is possible, as directed by the Contact Administrator.
- (e) Layout Option Three – Install detectable warning surface tiles in accordance with SDE-229AC and SDE-229AD.

#### E9.5 General

E9.5.1 Construct curb ramps, sidewalk ramps and multi-use paths in accordance with the referenced Standard Construction Specifications, Standard Details, and SDE drawings.

E9.5.2 Detectable warning surface tile shall not be placed at private approaches or alleys.

E9.5.3 All curb ramps opposite each other shall have the same width.

E9.5.4 Construct the lip of the depressed curb in accordance with SDE – 229E.

E9.5.5 Construct ramp slopes in accordance with SD-229C and SD-229D. Use a ramp slope with preference for a slope as close to 5% maximum as possible.

E9.5.6 Construct flare and curb taper slopes according to the following:

- a) If the curb taper is within a grassed area, construct the curb taper 900mm in length.
- b) When the flare and curb taper are in a full width sidewalk and the sidewalk area at the top of the ramp is <1500mm in width, construct the flare and curb taper at 5% slope to allow safe passage for wheelchairs in this area.
- c) When the flare and curb taper are in a full width sidewalk and the sidewalk area at the top of the ramp is ≥ 1500mm in width, construct the flare and curb taper at 10% slope.

E9.5.7 Install the detectable warning surface tile in accordance with E9.9.1.

E9.5.8 Trim the corner of the tile at curb radii in accordance with SDE-229AA and SDE-229AD.

- E9.5.9 Install the detectable warning surface tiles as shown on the referenced drawings or as directed by the Contract Administrator.
- E9.5.10 Orient the detectable warning surface tiles perpendicular to the crossing direction.
- E9.5.11 Locate gratings, access covers and other appurtenances outside of the sidewalk ramps, depressed curbs, rest areas, and gutters in front of the depressed curbs, as directed by the Contract Administrator.
- E9.6 Medians and Refuge Islands
- E9.6.1 Where the distance from back of curb to back of curb is 1.32m or greater, install one detectable warning surface tile 50mm from the back of each curb.
- E9.6.2 Where the distance from back of curb to back of curb is less than 1.32m, place the tiles 50mm from the back of curb and cut the tile(s) to fill the remaining area between the curbs.
- E9.7 2.0m Wide Depressed Curb for Multi-use Paths
- E9.7.1 Construct a curb ramp with a 2.0m depressed curb at high volume collector and regional street intersections in accordance with SDE-229E, in accordance with Public Works Department guidelines and as directed by the Contract Administrator.
- E9.7.2 Construct the concrete ramp 2.0m wide and a minimum of 1.50m deep from back of curb.
- E9.7.3 Construct the curb ramp in accordance with SD-229C and SD229D.
- E9.7.4 Install one 610mm x 1220mm tile centered to the 2.0m wide depressed curb. The part of the tile nearest the curb must be 50mm from the back of curb similar to tile placement in SDE-229AA.
- E9.8 3.5m Wide Depressed Curb for Multi-use Paths
- E9.8.1 Construct a curb ramp with a 3.5m depressed curb at low volume collector and residential street intersections in accordance with SDE-229E, in accordance with Public Works Department guidelines and as directed by the Contract Administrator.
- E9.8.2 Construct the concrete ramp 3.5m wide and a minimum of 1.50m deep from back of curb.
- E9.8.3 Construct the curb ramp in accordance with SD-229C and SD229D.
- E9.8.4 Install two (2) tiles in each concrete ramp, one (1) on each side for each direction. Place the short edge of each tile 150mm from the edge of the concrete ramp, with both tiles in line with each other transversely across the concrete ramp. The tile(s) nearest the curb must be 50mm from back of curb similar to tile placement in SDE-229AA.
- E9.8.5 Saw cut the middle of the concrete slab, perpendicular to the curb and to a depth of D/4. Cut additional sawcuts as directed by the Contract Administrator.
- E9.9 Installation Instructions
- E9.9.1 Installation Instructions for Cast In Place Inline Dome Detectable/Tactile Warning Surface Tile
- (a) During Cast In Place Detectable/Tactile Warning Surface Tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
  - (b) The specifications of the structural embedment flange system and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers. Do not set Cast In Place tiles in asphaltic concrete.
  - (c) The physical characteristics of the concrete shall be consistent with the contract specifications. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as 2 concrete blocks or sandbags (12 kg) shall be placed on each tile.

- (d) Prior to placement of the Cast In Place Detectable/Tactile Warning Surface Tile system, the contract drawings shall be reviewed.
- (e) Pour and finish the concrete using typical mason's tools, however, 12 kg weights, and a large non-marring rubber mallet are specific to the installation of the Cast In Place Detectable/Tactile Warning Surface Tile system. A vibrating mechanism can be employed, if desired. The vibrating unit should be fixed to a soft base such as wood, at least 300mm square.
- (f) The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile. Remove the plastic sheeting after the concrete has set.
- (g) When preparing to set the tile, it is important that NO concrete be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Holes in the tile perimeter allow air to escape during the installation process. Concrete will flow through the large holes in each embedment flange on the underside of the tile. This will lock the tile solidly into the cured concrete.
- (h) Drill additional 6mm vent holes in the ribs under the tile as required to help seat the tile in the concrete.
- (i) The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. The tile shall be placed in accordance with the contract drawings.
- (j) The Cast In Place Detectable/Tactile Warning Surface Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the surface of the truncated domes are flush to the adjacent concrete surface. Embedment of the tile so the top of the truncated domes are flush with the adjacent concrete will reduce the possibility of damage due to snow clearing operations. The embedment process should not be accomplished by stepping on the tile as this may cause uneven setting which can result in air voids under the tile surface.
- (k) While concrete is workable, a 3/8" radius edging tool shall be used to create a finished edge of concrete, a steel trowel shall then be used to finish the concrete around the tile's perimeter.
- (l) During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external force placed on the tile that may rock the tile causing a void between the underside of tile and concrete.
- (m) Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets. Two suitable weights of 12kg each shall be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.
- (n) If required, individual tiles can be bolted together using 1/4 inch or equivalent hardware. This can help to ensure that adjacent tiles are flush to each other during the installation process. Tape or caulking can be placed on the underside of the bolted butt joint to ensure that concrete does not rise up between the tiles during installation. Any protective plastic wrap which was peeled back to facilitate bolting or cutting, should be replaced and taped to ensure that the tile surface remains free of concrete during the installation process.
- (o) Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.
- (p) Tiles can be cut using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.
- (q) Bolt 300mm x 300mm tiles together prior to placing in plastic concrete. This ensures that the surface of the tiles are flush with each other.



E9.10.1 Detectable Warning Surface Tiles will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for the "Items of Work" listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Items of Work:

Detectable Warning Surface Tiles:

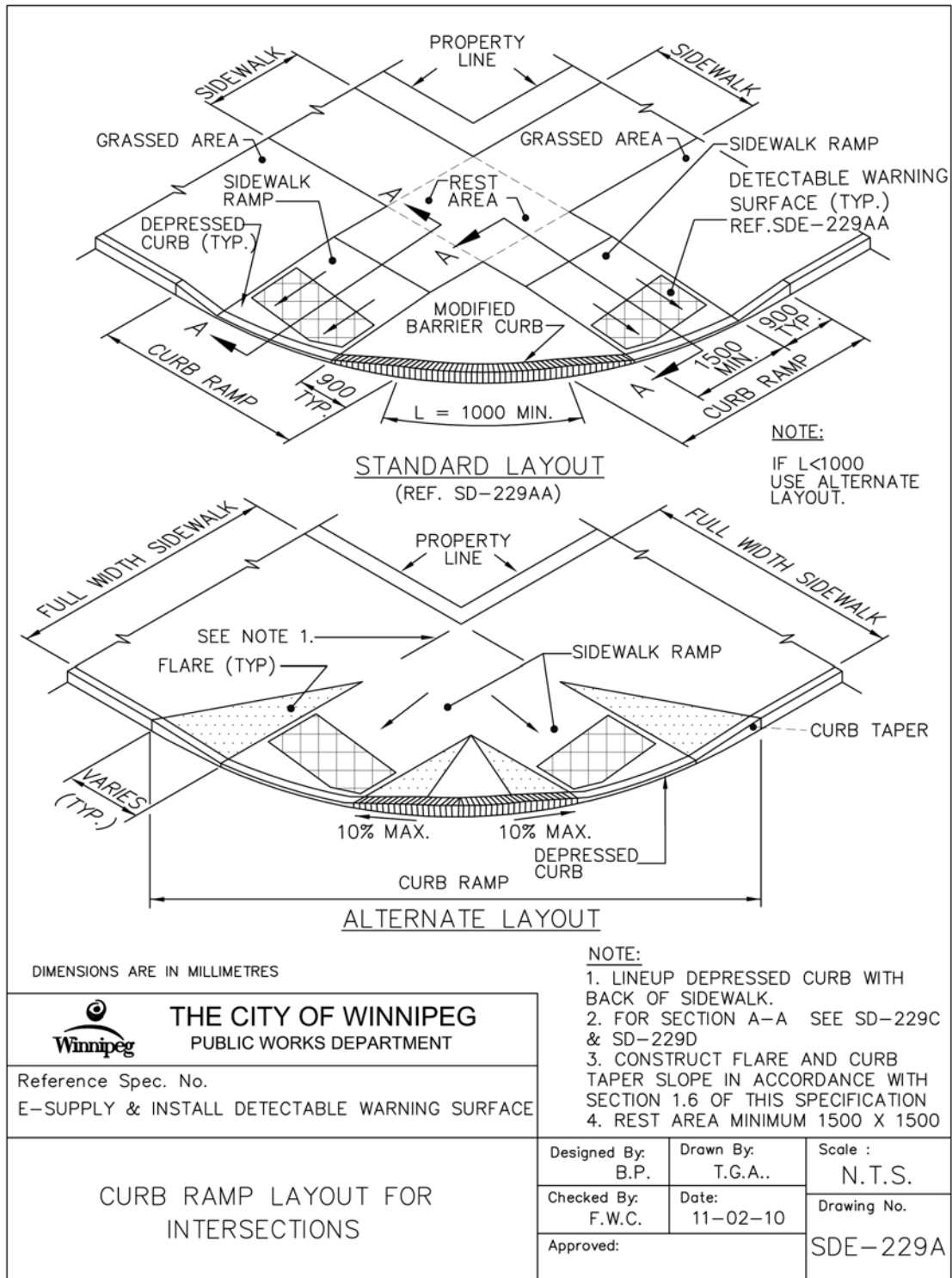
(i) 610mmx1220mm tiles

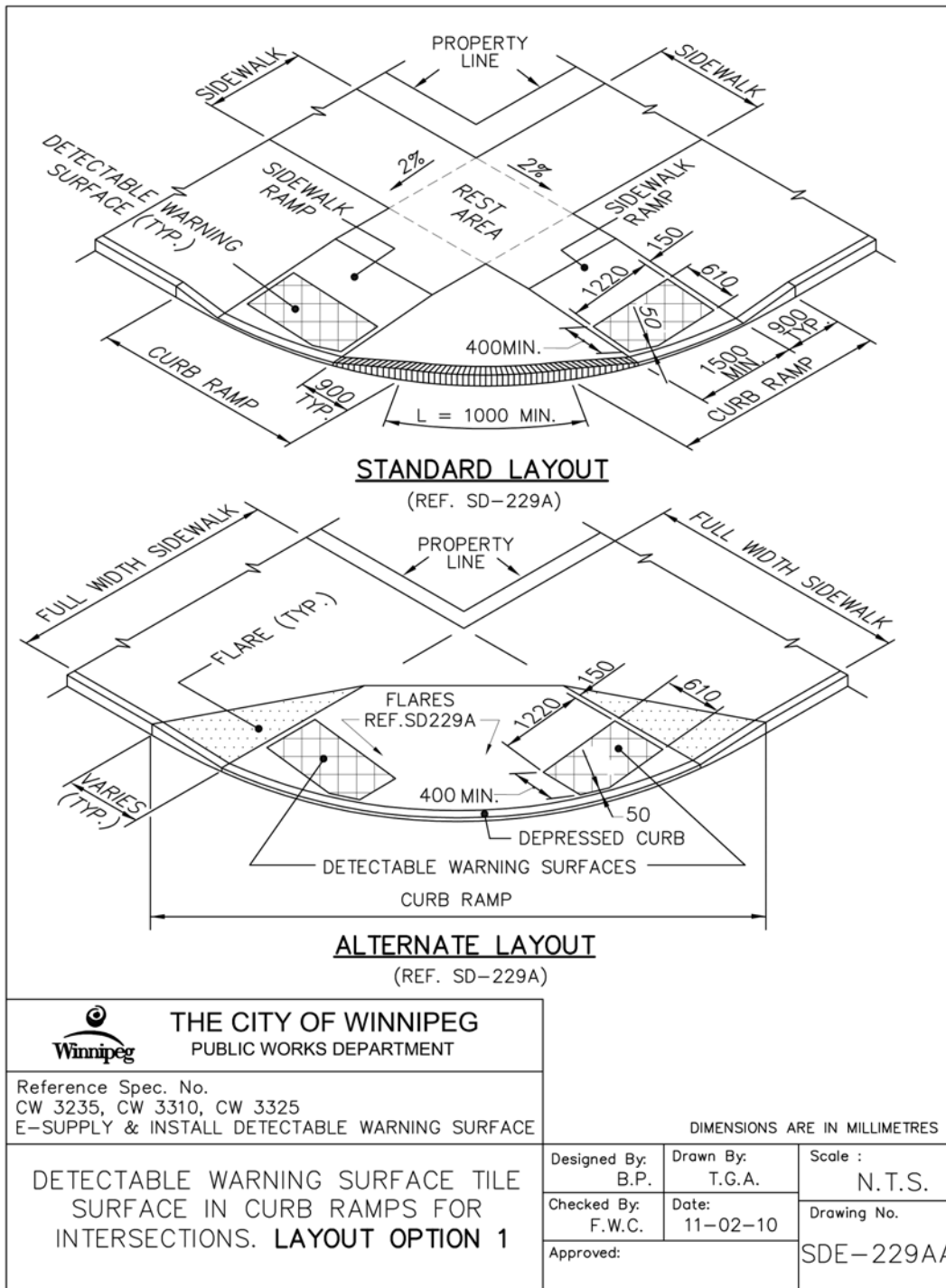
E9.10.2 The area under the detectable warning surface tile is part of the concrete sidewalk ramp and will be paid in accordance with CW 3235 or CW 3325.

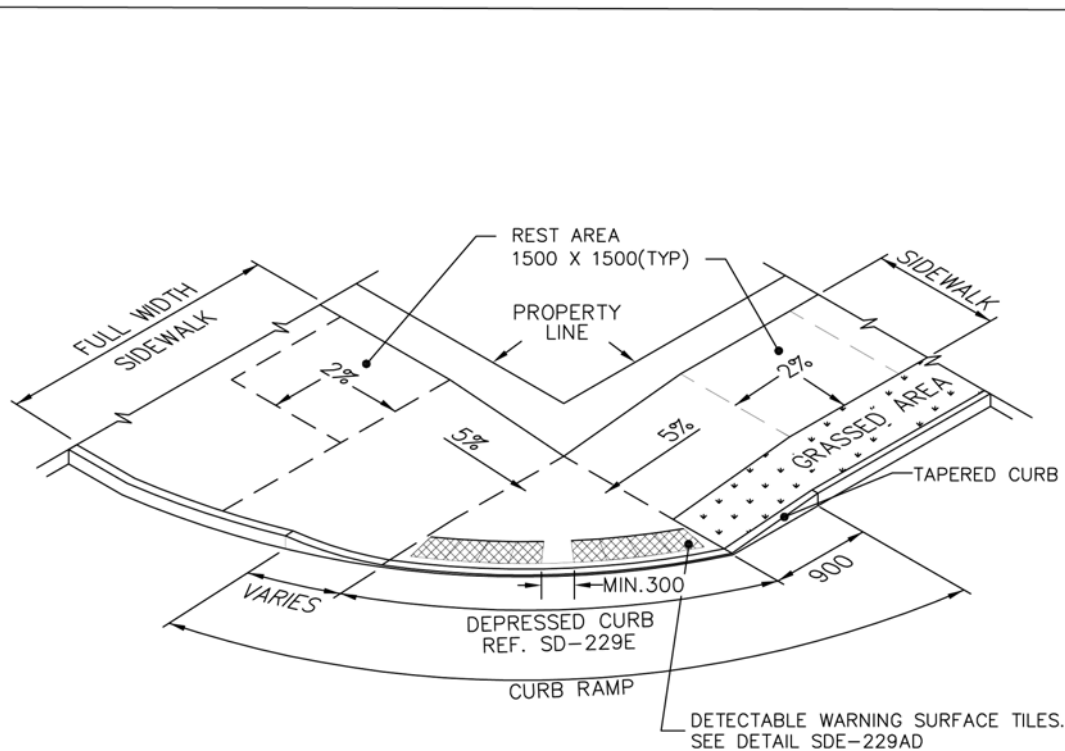
E9.10.3 The concrete sidewalk ramp and the concrete ramp for multi-use paths will be paid as 100mm sidewalk in accordance with CW 3235 or CW 3325.

E9.10.4 Curb ramp will be paid in accordance with CW 3240 or CW 3310.

## DRAWINGS







**NOTES:**

1. PLACE 300x300 DETECTABLE WARNING SURFACE TILES IN ACCORDANCE WITH "SELECTION OF LAYOUT OPTIONS" IN THIS SPECIFICATION.



**THE CITY OF WINNIPEG**  
 PUBLIC WORKS DEPARTMENT

Reference Spec. No.

E-SUPPLY AND INSTALL DETECTABLE WARNING SURFACE TILES

**300 X 300 mm DETECTABLE  
 WARNING SURFACE TILE  
 LAYOUT OPTION 3**

DIMENSIONS ARE IN MILLIMETRES

Designed By:  
 B.P.

Drawn By:  
 R.R.

Scale :  
 N.T.S.

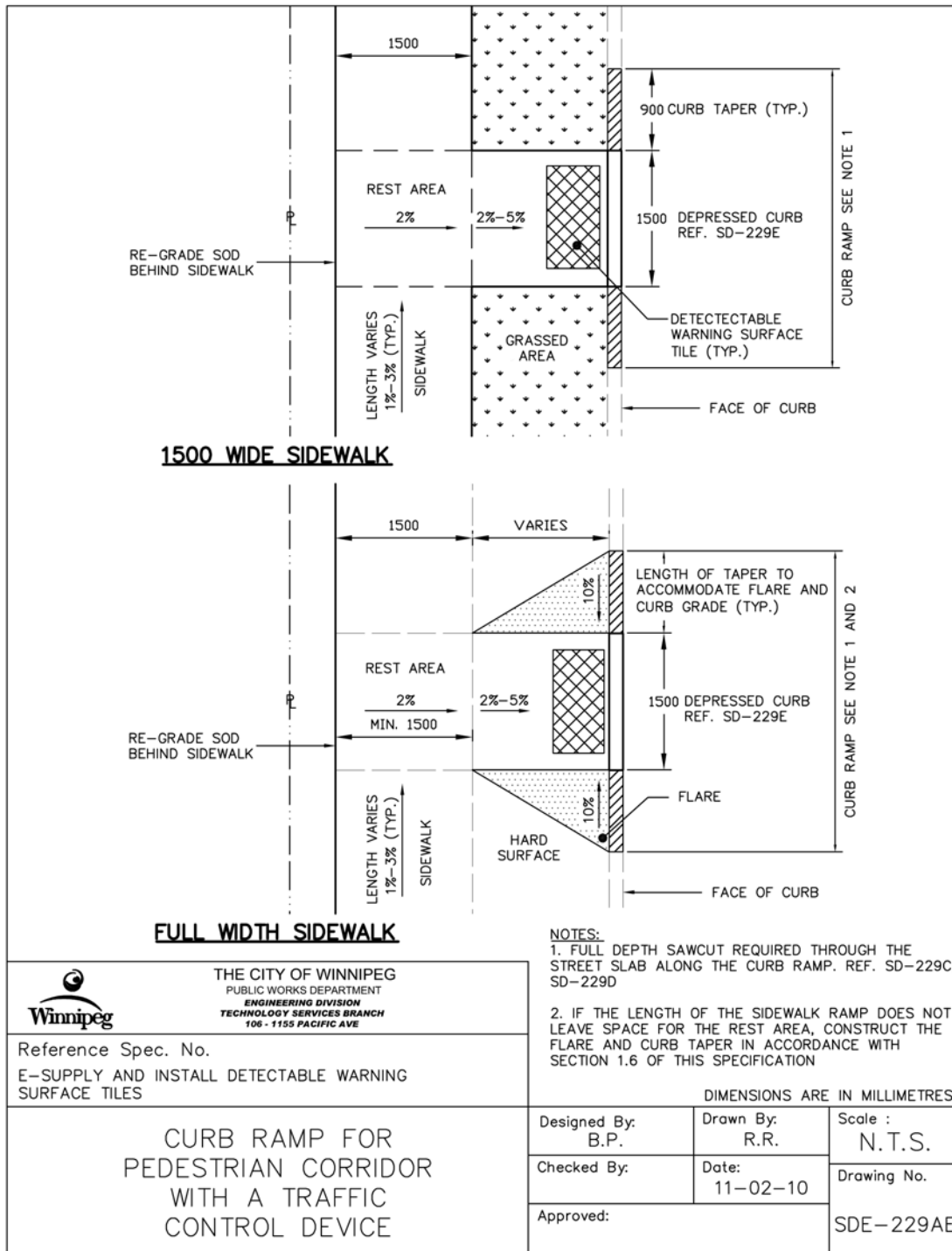
Checked By:

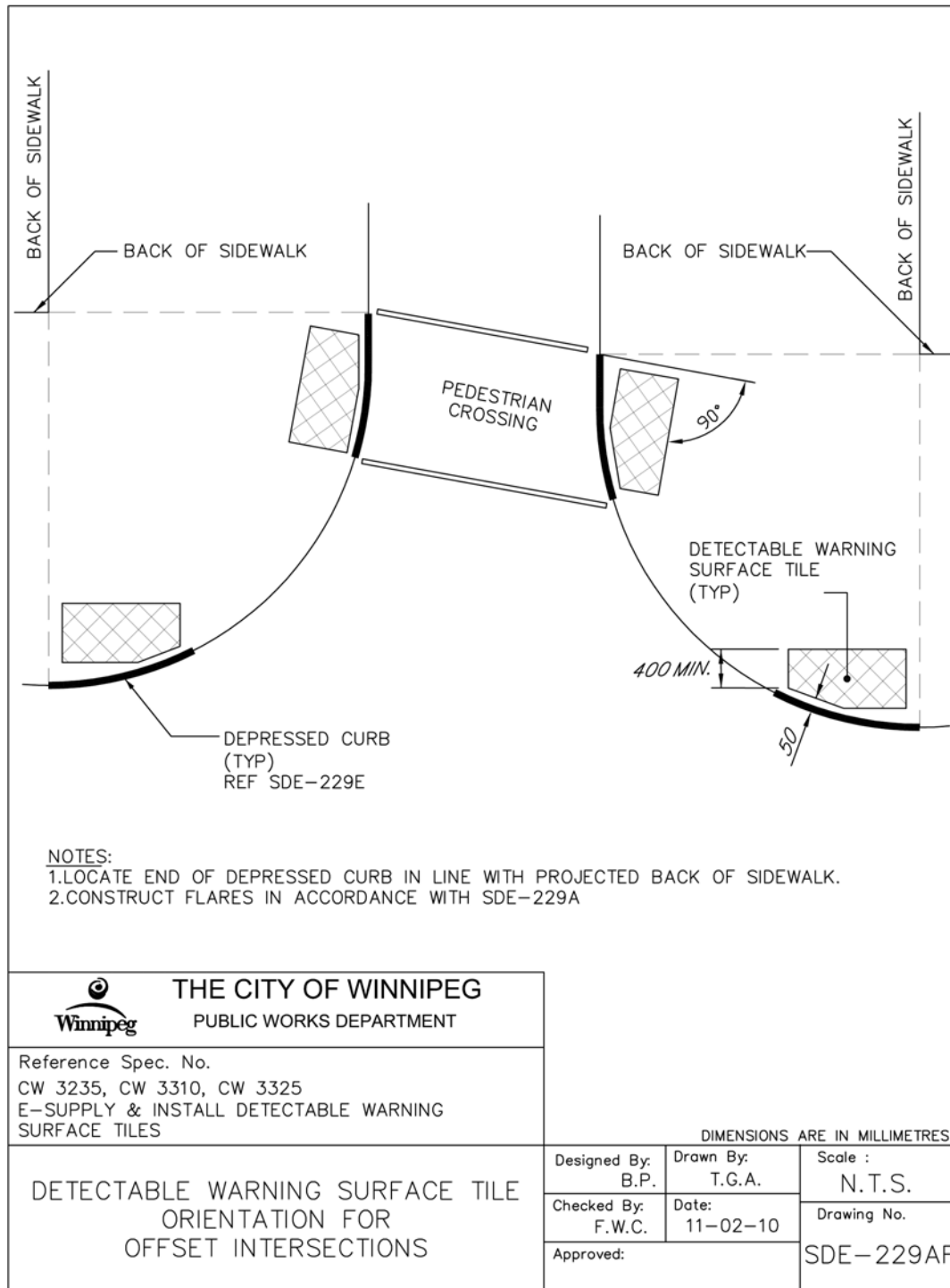
Date:  
 11-02-10

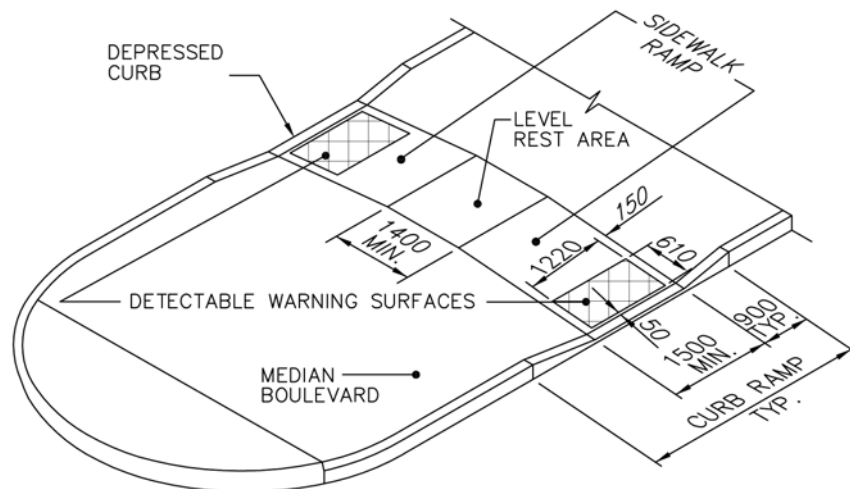
Drawing No.

Approved:

SDE-229AC







MEDIAN SIDEWALK CROSSING  
 (REF. SD-229B)

**NOTE:**

1. FOR NARROW MEDIANS AND REFUGE ISLANDS < 1.32m IN WIDTH, PLACE DETECTABLE WARNING SURFACE FULL WIDTH, MAINTAINING 50mm SPACING FROM BACK OF CURB.



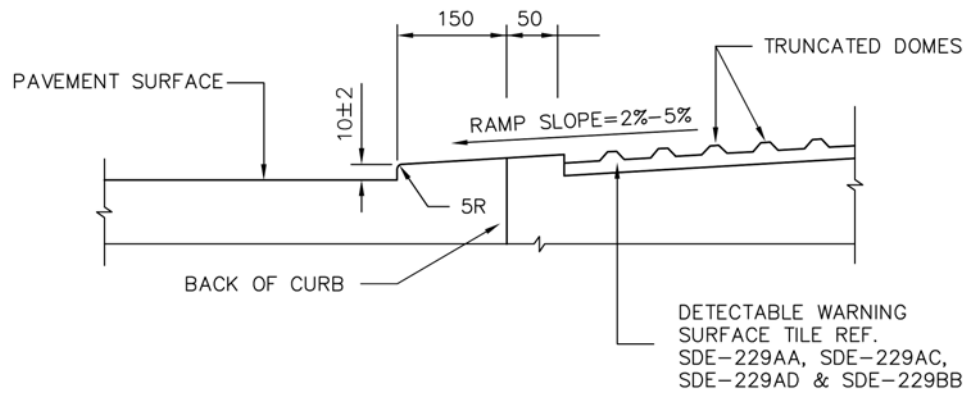
**THE CITY OF WINNIPEG**  
 PUBLIC WORKS DEPARTMENT

Reference Spec. No.  
 CW 3235, CW 3310, CW 3325  
 E-SUPPLY & INSTALL DETECTABLE WARNING SURFACE

DIMENSIONS ARE IN MILLIMETRES

DETECTABLE WARNING SURFACE TILE  
 IN CURB RAMPS FOR  
 MEDIANS


Designed By: B.P.	Drawn By: T.G.A.	Scale : N.T.S.
Checked By: F.W.C.	Date: 11-02-10	Drawing No.
Approved:		SDE-229BB



### DEPRESSED CURB

#### NOTES:

- 1) SIDEWALK RAMP SURFACE SHALL BE GIVEN A PARALLEL TEXTURED BROOM FINISH.
- 2) INSTALL DETECTABLE WARNING SURFACE SO THAT THE TOP OF THE TRUNCATED DOMES ARE FLUSH WITH THE SURFACE OF THE ADJACENT SIDEWALK.

 <b>THE CITY OF WINNIPEG</b> PUBLIC WORKS DEPARTMENT		DIMENSIONS ARE IN MILLIMETRES		
Reference Spec. No. CW 3235, CW 3310, CW 3325 E-SUPPLY & INSTALL DETECTABLE WARNING SURFACE				
<b>CURB RAMP          DEPRESSED CURB</b>		Designed By: B.P.	Drawn By: T.G.A.	Scale : <b>N.T.S.</b>
		Checked By: F.W.C.	Date: 11-02-10	Drawing No.
		Approved:		<b>SDE-229E</b>



## **E10. BRIDGE DEMOLITION**

### **E10.1 Description**

- (a) This Specification shall cover all operations related to the demolition and removal of the existing bridge.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishings 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.

### **E10.2 Scope of Work**

- (a) The Work under this Specification shall involve the following:
  - (i) Removal of all existing components of the existing bridge;
  - (ii) Piles are to be removed completely or to a minimum of 600mm below the existing grade. In addition the requirements of E3, "Environmental Protection Plan" shall be strictly adhered to and shall govern;
  - (iii) All material from the demolished bridge shall be removed from Site by the Contractor in accordance with the Contractor's Environmental Protection Plan; and
  - (iv) Excavation or any other works beyond the limits shown on the Drawings to facilitate the demolition of the existing bridge.

### **E10.3 Materials**

#### **E10.3.1 General**

- (a) The Contractor shall be responsible for design and construction works related to the demolition and removal of the existing bridges and is subject to the approval of the Contract Administrator.

### **E10.4 Submittals**

- (a) The Contractor shall prepare a demolition plan. The plan shall include the design and drawings, Sealed by an Engineer Registered in the Province of Manitoba, the sequence and methods to be used to demolish and remove the existing bridges. The demolition plan shall be in strict accordance with the Regulatory Approvals and Letters of Advice and E3, "Environmental Protection Plan."
- (b) The demolition plan shall indicate the sequence, machinery, methods and proposed access to accomplish the demolition of the existing bridges.
- (c) The demolition plan shall be submitted a minimum of 14 days prior to the commencement of the demolition of either existing bridge.

### **E10.5 Measurement and Payment**

**E10.5.1** Bridge demolition will not be measured and will be paid for at the Contract Lump Sum Price for "Bridge Demolition", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E10.5.2** Demolition of the existing bridges will be paid for at a percentage of the Contract Lump Sum Price for "Bridge Demolition" specified as follows:

- (a) 50% of this pay item will be paid upon the completion of the demolition of the bridge in Phase 1.
- (b) 50% of this pay item will be paid upon the completion of the demolition of the bridge in Phase 2.

## **E11. TEMPORARY GRADE SEPARATION WALL**

### **E11.1 Description**

- (a) This Specification shall cover all operations related to the supply and installation of a temporary grade separation wall.
- (b) The work to be done by the Contractor under this Specification shall include the furnishings 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.

### **E11.2 Scope of Work**

- E11.2.1 The Work to be completed under this Specification includes construction of a temporary grade separation wall as indicated on the Phasing Drawings using one of the following methods:
  - (a) Installation of Temporary Shoring;
  - (b) Installation of a Geosynthetic Reinforcement Wrapped-Face Retaining Wall complete with Structural Backfill;
  - (c) Installation of a Temporary Mechanically Stabilized Earth (MSE) Wall; or
  - (d) Alternative method as approved by the Contract Administrator.
- E11.2.2 Completion of the Temporary Grade Separation Wall will be in accordance with the Construction Phasing Drawings.
- E11.2.3 Limits of Work are indicated on the Phasing Drawings provided by the Contract Administrator.
- E11.2.4 Contractor shall design and implement the required connections or details between the modular block retaining wall and the temporary grade separation wall to facilitate the phasing and construction of the Work.
- E11.2.5

### **E11.3 General**

- (a) The Contractor shall be responsible for design, construction and removal where required of the temporary grade separation wall and is subject to the approval of the Contract Administrator.
- (b) The design will also indicate a transverse connection to be made to the bridge abutment modular block wall.

### **E11.4 Submittals**

- (a) The Contractor shall prepare the design and drawings, Sealed by an Engineer Registered in the Province of Manitoba for the temporary grade separation wall as shown on the Drawings. Dimensions are shown on the Drawings for the proposed grade separation wall, the Contractor may, at his/her discretion, change the location, size and limits of the grade separation wall. All details of the temporary grade separation wall including the material, size, limits, installation procedures, transverse connection to bridge abutment modular block wall, removal procedures or if required the elevation the shoring will be cut-off to and subsequently buried.
- (b) The design and drawings for the temporary grade separation wall are to be submitted to the Contract Administrator for review a minimum of 14 days prior the installation of the temporary grade separation wall.
- (c) The Professional Engineer who designed the grade separation wall system shall inspect the grade separation wall system during construction, and certify, in writing to the Contract Administrator, that construction is in conformance with the approved design.

#### E11.5 Materials

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- (b) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

#### E11.6 Measurement and Payment

- E11.6.1 Temporary Grade Separation Wall will not be measured and will be paid for at the Contract Lump Sum Price for "Temporary Grade Separation Wall," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

### E12. STRUCTURAL EXCAVATION

#### E12.1 Description

- (a) This Specification shall cover all operations related to excavation for the abutments and approach slabs.
- (b) The work to be done by the Contractor under this Specification shall include the furnishings 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.

#### E12.2 Materials

##### E12.2.1 General

- (a) The Contractor shall be responsible for the excavation, stockpiling and removal of all materials as set forth in this Specification. Materials to be stockpiled shall be handled in careful and workmanlike manner, to the satisfaction of the Contract Administrator.
- (b) The Contractor shall be responsible for design, construction and removal of any temporary shoring deemed necessary by the Contractor to ensure the safety of the workers.

##### E12.2.2 Excavation

- (a) Excavated material shall include the excavation and satisfactory disposal of all surplus concrete pavement, asphalt pavement, ballast, earth, gravel, sand, clay, silt and all other material of whatever character which may be encountered.

#### E12.3 Equipment

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

#### E12.4 Construction Methods

##### E12.4.1 Scope of Work

- (a) Excavation: The excavation of material to a depth as shown on the Drawings for the abutments.
- (b) The limits for structural excavation works are as shown on the Drawings. The Contractor shall include construction access for all excavation works as the limits shown on the Drawings to not specifically include construction access requirements.
- (c) Off-site disposal of all excavated materials.
- (d) Dewatering and or precipitation removal of the excavations as may be required for construction of the structure in the dry.

**E12.5 Survey Monuments**

- (a) The Contractor shall avoid damaging survey monument and shall take all necessary precautions to protect the same. The Contract Administrator at the sole expense of the Contractor will rectify any damage to the survey monuments.

**E12.6 Measurement and Payment**

- E12.6.1** Structural excavation will not be measured and will be paid for at the Contract Lump Sum Price for "Structural Excavation", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E13. STRUCTURAL BACKFILL**

**E13.1 Description**

- (a) This Specification shall cover all operations related to backfill work as herein specified and in the latest versions of City of Winnipeg Standard Construction Specifications CW 3110 and CW 3170, and as shown on the Drawings.
- (b) This Specification shall cover all granular backfill including abutments to the limits shown on the Drawings.
- (c) The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supply, and all things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

**E13.2 Referenced Specifications and Drawings**

- (a) The latest version of the City of Winnipeg Standard Construction Specifications
  - (i) CW 3110 – Subgrade, Sub-Base, and Base Course Construction; and
  - (ii) CW 3170 – Earthwork and Grading.

**E13.3 Scope of Work**

- (a) The Work under this Specification shall involve:
  - (i) Supplying and placing Backfilling suitable excavated site material, clay, granular backfill and free draining backfill at the abutments;
  - (ii) Supplying and placing granular backfill for the north and south approach slabs;
  - (iii) Supplying and placing granular backfill for reinforced roadway slab;
  - (iv) Supplying and placing granular backfill for the approach sidewalk slabs;
  - (v) Supplying and placing structural backfill for all other elements required to construct the Works.
  - (vi) The limits of structural backfill are as shown on the Drawings.

**E13.4 Submittals**

- (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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.

**E13.5 Materials**

**E13.5.1 General**

- (b) All materials supplied under this Specification shall be of type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.

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

#### E13.5.2 Handling and Storage of Materials

- (a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.
- (b) 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 for any materials taken the Contract Administrator for testing purposes.
- (c) All material shall be accepted by the Contract Administrator at least seven (7) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials in whole or in part, so not conform to the Specification detailed herein, or are found to be defective in manufacture, or have become damaged in transit, storage or handling operation, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

#### E13.5.3 Granular Backfill

- (a) Granular Backfill Material
  - (i) Granular sub-base material shall be in accordance with CW 3110 Sub-Base Materials 50 mm MAX AGG.
- (b) Granular Base Material
  - (i) Granular base material shall be in accordance with CW 3110 Base Course Material.

#### E13.5.4 Free Draining Granular Backfill Material

- (a) Free draining granular backfill shall consist of hard crushed stone, free from organic material meeting the gradation and material requirements of concrete coarse aggregate as per E17.5.5(c) or approved equal in accordance with B6.

#### E13.5.5 Clay Borrow Material

- (a) Clay borrow material shall be of a type approved by the Contract Administrator.

#### E13.5.6 Suitable Site Backfill

- (a) Suitable Site backfill material shall be of a type approved by the Contract Administrator.

#### E13.5.7 Geotextile Fabric

- (a) The non-woven geotextile shall conform to:
  - (i) Mass 240 g/m<sup>2</sup> min in accordance with ASTM D5261
  - (ii) Grab Tensile Strength 60 N min in accordance with ASTM D 4632
  - (iii) Mullen Burst Strength 2000 kPa min in accordance with ASTM D3786
  - (iv) The non-woven geotextile shall be Armtex 250 supplied by Armtex Construction Products and Century Petroleum Construction, Geotex 701 supplied by Specialty Construction or ProPex 4552 supplied by Brock White Company Canada or equal in accordance with B7 as accepted by the Contract Administrator.

#### E13.6 Equipment

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

#### E13.7 Construction Methods

##### E13.7.1 Backfilling

- (b) All materials shall be accepted by the Contract Administrator at least seven (7) 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 Specification 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.
- (c) Any backfill material that does not meet the gradation and/or compaction requirements of this Specification shall be removed and replaced by the Contractor at his own expense, to the satisfaction of the Contract Administrator.
- (d) Backfill materials shall be free of frozen lumps and shall be placed and compacted in an unfrozen state. Backfill shall not be placed on frozen subsoil.

#### E13.7.2 Geotextile Fabric

- (a) Install geotextile fabric under all backfill material.
- (b) Unroll geotextile fabric as smooth as possible.
- (c) Install the geotextile fabric in the longest continuous practical length, free from tension, stress, folds, wrinkles and creases.
- (d) Install geotextile fabric in accordance with this Specification and procedures recommended by the manufacturer.
- (e) Overlap joint a minimum of 600 millimetres and as indicated on the Drawings.
- (f) Install pins as required to hold geotextile fabric in place.
- (g) Cut or fold geotextile fabric to conform to curves.
- (h) Construction vehicles shall be permitted directly on the geotextile fabric.
- (i) Remove or replace geotextile fabric improperly installed or damaged as directed by the Contract Administrator.

#### E13.7.3 Backfill Operations

- (a) The Contract Administrator shall be notified at one (1) working day in advance of any backfilling operation. No backfill shall be placed against any concrete until approved by the Contract Administrator and in no case before the curing requirements of E17, "Structural Concrete" are met.
- (b) The geotextile fabric shall be placed prior to any backfilling operations.
- (c) The abutments shall be backfilled with backfill materials described below to the grade line as shown on the Drawings. Backfill materials shall be free of frozen lumps and shall be placed and compacted in an unfrozen state. Backfill shall not be placed on frozen subsoil.
- (d) The Contractor shall be required to provide necessary water or equipment during compaction of backfill material to achieve the required densities.
- (e) The Contractor shall place backfill material in 150 mm lifts and shall compact each lift. The backfill shall be compacted to 100% Standard Proctor.

#### E13.7.4 Embankment Slope Backfill

- (a) Backfill the embankment slopes where required producing the embankment grades shown on the Drawings. Use suitable Site backfill or clay backfill compacted to a minimum of 98% Maximum Standard Proctor Density.

#### E13.7.5 Erosion Control

- (a) The Contractor shall perform the following erosion control works:
  - (i) Exposure of soils along creek slopes shall be kept to a minimum practical amount, acceptable to the Contract Administrator.
  - (ii) Areas that are heavily disturbed and vulnerable to erosion or gullyng shall be diked to redirect runoff around the area prior to spring runoff.

- (iii) Sediment control fencing, or other such erosion control structures, shall be employed whenever construction activity increases the potential for runoff to carry sediment into a drainage channel or other watercourse. Sediment control fencing shall be supplied, placed, measured and paid for as per E24, "Silt Fence Barrier." Erosion control blankets shall be supplied, placed, measured and paid for as per E27, "Erosion Control Blanket (ECB)." The Contractor shall inspect all such structures daily during heavy construction activity in the areas of the structures and after heavy rainfall to ensure their continued integrity.
- (iv) The loss of topsoil and the creation of excessive dust by wind during construction shall be prevented by the addition of temporary cover crop, water or tackifier, if conditions so warrant.
- (v) Within the limits of construction and where slopes are bare and erodible, the surface water runoff into the creek is to be intercepted by cut-off trenches constructed near the creek's edge to reduce the deposition of sediments in the creek.
- (vi) All erosion control necessary due to runoff from the roadway/sidewalk and embankment areas.

#### E13.8 Quality Control

##### E13.8.1 Inspection

- (a) All workmanship and materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operation 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 previously been given. The Contract Administrator reserves the right to reject any materials or works, which are not in accordance with requirements of this Specification.

##### E13.8.2 Materials

- (a) All material supplied and placed under this Specification shall be subject to testing and acceptance by the Contract Administrator in accordance with E13.5 and E13.7 of this Specification.

##### E13.8.3 Quality of Backfill Material

- (a) The Standard Proctor Density for granular backfill material shall be determined at the optimum moisture content in accordance with standard laboratory Proctor Compaction Test Procedure. The field density of each backfill layer shall be 100% of the applicable Proctor Density, as specified in E13.7.4 of this Specification.
- (b) Quality control test will be used to determine the acceptability of each backfill layer, as place and compacted by the Contractor before any succeeding layer may be applied.
- (c) The field density of the compacted layers shall be verified by Field Density Tests in accordance with ASTM Standard D155560-64, Test for Density of Solid in Place by the Sand-Cone Method, or equivalent as accepted by the Contract Administrator.
- (d) The frequency and number of tests to be made shall be as determined by the Contract Administrator. The Contract Administrator will select the Testing Agency.
- (e) Holes made by removal of samples from the layer shall be promptly filled by the Contractor with appropriate material and thoroughly compacted so as to conform in every way with the adjoining compacted material.

##### E13.8.4 Access

- (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

**E13.8.5 Corrective Action**

- (a) Any backfill material that does not meet the gradation and/or compaction requirements of the Specification shall be removed and replaced by the Contractor at his own expense, to the satisfaction of the Contract Administrator.

**E13.9 Measurement and Payment**

**E13.9.1** Structural backfill will be measured on a volume basis and will be paid for at the Contract Unit Price per cubic metre for the "Items of Work" listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Items of Work:

Structural Backfill:

- (i) Granular Backfill
- (ii) Free Draining Granular Backfill
- (iii) Clay Backfill or Suitable Site Material

**E14. SUPPLYING AND DRIVING STEEL PILES**

**E14.1 Description**

- (a) This specification shall cover all operations related to the pre-boring for piles, supplying, handling, hauling, storing, supplying and installing pile tips, aligning and driving, splicing, cutting off of piles at the required elevations for the steel bearing piles;
- (b) Steel piles, steel "H" piles, and "H" Piles shall be considered one and the same for the Drawings and this Specification.
- (c) The work to be done by the Contractor under this Specification shall include the furnishings 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 References and Related Specifications**

- (a) All reference standards and related specifications shall be current issue or latest revision as of December 1, 2011.

**E14.2.2 References**

- (a) CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- (b) CSA W59, Welded Steel Construction (Metal Arc Welding)
- (c) AASHTO/AWS D1.5M/D1.5 Bridge Welding Code
- (d) City of Winnipeg's Approved Products List

**E14.3 Submittals**

The Contractor shall submit the following to the Contract Administrator:

- (a) Copies of Mill Test Certificates showing chemical analysis and physical tests for piling material. Piling material without this certification will be rejected.
- (b) Details of the proposed pile driving system and manufacturer's specifications and catalogue for all mechanical hammers to be used to perform preconstruction wave equations analysis and determine adequacy of the driving system and hammer and the preliminary pile driving criteria.
- (c) Certificate of mass for gravity or drop hammers. If this certificate is not available, the gravity or drop hammers shall be weighed in the presence of the Contract



Administrator. Hammers so weighed shall have the exact mass marked on them. Gravity hammers shall weigh at least 1.5 ton but in no case shall the mass of the hammer be less than the combined mass of the pile and pile cap.

- (d) Proof of certification for the welders conducting the Work (if applicable). All welders shall satisfy one of the following requirements:
  - (i) Welders qualified in accordance with the requirements of AASHTO/AWS D1.5M/D1.5,
  - (ii) Valid Canadian Welding Bureau (CWB) Welding ticket, or
  - (iii) Valid "Welder's Licence" as issued by the Mechanical and Engineering Division,
- (e) Department of Labour and Manpower, Province of Manitoba, with a minimum of 5 years of experience welding on steel structures.
- (f) Welding procedures specific to the Work.
- (g) Detailed design notes and Shop Drawings for proposed splice connections and pile tip installations that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba (if applicable).

#### E14.4 Materials

##### E14.4.1 Steel Bearing Piles

- (a) Steel bearing piles shall conform to the requirements of CAN/CSA G40.21M, Grade 350W. All piles crushed excessively or bent through negligence or carelessness in driving operations shall be replaced by the Contractor at his own expense unless, at the discretion of the Contract Administrator, the damage is so slight that the pile can be repaired properly by the Contractor at his own expense.

##### E14.4.2 Pile Tips

- (a) Pile tips shall conform to the requirements of CAN/CSA G40.21M, Grade 300W. Pile tips shall be Hard-Bite Point Model HP-77750-B.

##### E14.4.3 Splice Plates

- (a) Splice Plates shall conform to the requirements of CAN/CSA G40.21M, Grade 350W.

##### E14.4.4 Welding Materials

- (a) The Contractor is responsible for supplying all welding materials. All welding materials shall conform to the requirements of Welded steel construction (Metal Arc Welding) shall conform to the requirements and satisfy the testing procedures of CSA W59 and Welded Highway & Railway Bridges - AWS D1.1 of The American Welding Society & Addendum.

##### E14.4.5 Abutment Pile Casing

- (a) The abutment pile casing as detailed on the Drawings, are to 600mm diameter, 2.8mm thick aluminized type 2 corrugated steel pipe.

##### E14.4.6 Abutment Pile Casing Material

- (a) The abutment pile casing file material is to be 13mm diameter regular river wash material, also known as pea gravel. The Contract Administrator shall approve the abutment pile casing material prior to placing

#### E14.5 Construction Methods

##### E14.5.1 Handling and Storage

- (a) Piling shall be handled, hauled and stored in a manner that avoids damage to the piling materials. Loading and unloading shall be by crane, loader or other appropriate hoisting equipment.

- (b) The Contractor, in the handling and lifting of the piles, will not be permitted to drag them along the ground.
- (c) If piles are damaged due to the Contractor's handling operations, the Contractor shall, at his own expense, replace all damaged piles with piles meeting the requirements of this Specification and as shown on the Drawings.

#### E14.5.2 Location and Alignment

- (a) The piles shall be driven in the positions shown on the Drawings or as directed by the Contract Administrator. Piles shall be driven vertically unless shown otherwise on the Drawings, and shall not deviate more than 2 percent out-of-plumb. Batter piles shall be driven to the batter specified, and shall not deviate more than 2 percent from the batter specified. Piles shall not be more than 75 mm off center measured at cut-off elevation.
- (b) Piles shall not be jacked or pulled into their final positions.

#### E14.5.3 Driving Steel Bearing Piles

- (a) Piles shall be driven to the depths as shown on the Drawings or as directed by the Contract Administrator. All piles shall be driven to practical refusal which shall consist of three consecutive sets of 13 hammer blows per 25 mm of pile penetration. To minimize the risk of damage to the piles, the pile driving can be terminated if the penetration for a set of 13 hammer blows is less than 13 mm. The Contractor shall remove any surface and/or shallow depth obstructions to obtain the required penetration of the piles.
- (b) Pile driving equipment to be used by the Contractor shall be of such capacity that the required bearing and penetration shall be obtained without damage being done to the piles. The piles shall be driven using a hammer capable of delivering a minimum of 30 kJ at the pile head. The hammer energy is to be verified by the dynamic testing as outlined in this specification. Driving of all piles shall be continuous and without interruption until the pile has been driven to cut-off elevation or the refusal criteria has been met.
- (c) If the Contractor can demonstrate conclusively that special methods, other than providing a higher capacity hammer, are necessary to advance the pile to the required penetration, such supplementary methods will be subject to the Contract Administrator's approval.
- (d) Pile driver leads shall be used to support the piles while they are being driven and shall be braced to the supporting crane so as to hold the piles securely and accurately in the required position during driving. Leads shall be of sufficient length to be supported firmly on the ground. The use of hanging or swinging leads will not be allowed unless they can be held in a fixed position during the driving operations. Batter piles shall be driven with inclined leads.
- (e) The heads of steel piles shall be squared and protected by a cap of a design approved by the Contract Administrator. The cap shall be designed to hold the axis of the pile in line with the axis of the hammer. The top of the cap shall have a timber shock block.
- (f) If upheaval does occur, the Contractor shall re-drive the lifted piles to the specified elevations. The Contractor shall excavate material that has boiled up during pile driving operations. The elevation of all piles previously driven or redriven shall be confirmed to detect uplift. If uplift of 5 mm or more occurs in any pile, that pile shall be redriven to its original elevation and thereafter to the required final driving resistance. If cavities remain around the piles after driving, the cavities shall be filled with sand or other approved material to the satisfaction of the Contract Administrator.
- (g) The Contractor shall ensure the safety of all personnel during pile driving operations. In particular, overhead protection shall be provided for all personnel located adjacent to the pile driving lead and under the pile driving hammer. The overhead protection

shall be designed and constructed so as to safely withstand forces from falling debris or other matter.

- (h) Pre-boring is not to exceed the length of the abutment pile casing pipes.

#### E14.5.4 Pile Cut-Offs

- (a) The piles shall be cut off level at the required elevations as specified on the Drawings or as directed by the Contract Administrator.

#### E14.5.5 Splicing Piles and Installing Pile Tips

- (a) The Contractor shall splice piles and install pile tips in accordance with the Drawings, welding procedures, Shop Drawings and the following:
  - (i) The butting ends of the driven pile and its extension or the pile and the pile tip shall be cut square to give reasonable bearing between the mating surfaces.
  - (ii) The butting surface shall be bevelled to facilitate a full penetration butt weld. Temporary clamping plates may be used as required.
  - (iii) Before welding over previously deposited metal, the slag shall be removed. This requirement shall apply to successive layers, to successive beads, and to the cratered area when welding is resumed after any interruption.
  - (iv) All butt welds shall have the root of the initial weld arc-air gouged, to sound metal and cleaned by grinding and wire brushing before welding is started from the second side.
  - (v) Material to be welded shall be preheated in accordance with CSA W59.
  - (vi) The piles shall not have more than one splice per pile unless otherwise approved by the Contract Administrator. The location of the splice(s) shall be approved by the Contract Administrator.

### E14.6 Dynamic Testing of Steel Piles

#### E14.6.1 Description

- (a) The dynamic testing shall be performed to monitor and confirm hammer and driving system performance, assess pile installation stresses and integrity, as well as to evaluate pile capacity. The Contractor shall secure the services of a Dynamic Testing Consultant with demonstrated experience in similar projects. Dynamic testing shall be performed on at least 2 piles per side as required by the Dynamic Testing Consultant.

#### E14.6.2 Reference and Related Specifications

- (a) All related Specifications and reference Standards shall be current issue or latest revision at the first date of tender advertisement.
  - (i) References
    - ◆ ASTM D-4945-00, "Standard Test Method for High Strain Dynamic Testing of Piles".
    - ◆ Specifications for Supplying and Driving Steel Bearing Pile".

#### E14.6.3 Submittal

- (a) At least 14 days prior to driving the test piles, the Contractor shall submit specifications for the pile driving equipment to the Contract Administrator.

#### E14.6.4 Material

- (a) Equipment and Personnel
  - (i) The dynamic testing work will be carried out using the Contractor's pile driving equipment and the Pile Driving Analyzer (PDA) equipment provided by the Dynamic Testing Consultant.
  - (ii) The PDA testing equipment shall conform to the requirement of ASTM D-4945-08, "Standard Test Method for High Strain Dynamic Testing of Piles". An engineer with documented experience shall operate the Pile Driving Analyzer in

the field. An engineer with at least five years related experience shall carry out the analysis of the PDA data and sign the engineering reports.

- (iii) The Contractor shall provide the pile driving equipment, operators, labor and power supply to the test pile locations for the duration of the dynamic testing. The Contractor shall provide a step ladder or other safe lifting means to enable attachment of cables to the pile head. The pile driving equipment shall be the same as that to be used for the pile driving work.

#### E14.6.5 Execution

##### (a) Construction Access

- (i) The Dynamic Testing Consultant shall prepare and attach the gages to the pile after the pile has been driven to the depth identified by the Contract Administrator. Driving shall then continue using routine pile installation procedures. When the level of the gages is within 0.3 m of the ground surface, water surface, or a pile template, driving shall be halted to remove the gages from the pile. If additional driving is required, the pile shall be spliced and the gages shall be reattached to the head of the extension pile segment prior to the resumption of driving.
- (ii) The Contractor must take good care to ensure that no damage is done to the dynamic monitoring transducers, cables, or equipment.

##### (b) Dynamic Testing Program

- (i) The selected piles shall be driven to attain static capacity of at least 2.0 times the pile design capacity. Adjustments to the preliminary driving criteria may be made by the Contract Administrator based upon the dynamic testing results.
- (ii) All or part of the tested piles as determined by the Geotechnical Engineer shall be re-struck with dynamic testing. The re-strike driving sequence shall be performed with a warmed up hammer and shall consist of striking the piles for about 10 to 20 blows or until the pile penetrates an additional 50 mm, whichever occurs first.
- (iii) The Contract Administrator may request additional piles to be dynamically tested if the hammer and/or driving system is replaced or modified, the pile type or installation procedures are modified, the pile capacity requirements are changed, unusual blow counts or penetrations are observed or any other piling behavior that differs from normal installation.

##### (c) Dynamic Testing Reports

- (i) Within one day pile testing, the Dynamic Testing Consultant shall prepare a hand written daily field report summarizing the dynamic testing results. As a minimum, the daily reports shall include the calculated driving stresses, transferred energy, and estimated pile capacity at the time of testing. Variations from previous trends in the dynamic test data shall also be noted. Daily field reports shall be faxed or emailed to the Contract Administrator.
- (ii) The Dynamic Testing Consultant shall prepare and submit a written report not later than 7 days after the test completion. This report shall include the results of dynamic test(s) and shall contain a discussion of the pile capacity obtained from the dynamic testing. The report shall also discuss hammer and driving system performance, driving stress levels, and pile integrity. CAPWAP analyses shall be performed on dynamic testing data obtained from the end of initial driving and the beginning of re-strike of all tested piles or as instructed by the Contract Administrator. CAPWAP analyses shall be performed by an engineer with demonstrated experience.

#### E14.7 Quality Control / Quality Assurance

##### E14.7.1 Quality Control

- (a) The Contractor shall provide a detailed survey of all of the pile locations and provide that to the Contract Administrator prior to cutting off any piles for that pile cap. The

Contractor shall replace any piles, or add additional pile(s), for piles that do not meet the following tolerances: +/-2% out of alignment for battered piles, +/-2% out of plumb for vertical piles, and 75 mm off centre of the specified locations. Any modifications required to the pile cap, due to piles out of tolerance or due to required additional piles to compensate for out of tolerance piles, shall be carried out as detailed by the Contract Administrator at the Contractor's own costs.

- (b) The Contractor shall replace any piles, or add additional pile(s), to compensate for piles that do not meet the specified refusal criteria. Any modifications required to the pile cap, required due to additional piles, shall be carried out as detailed by the Contract Administrator at the Contractor's own costs.

#### E14.7.2 Quality Assurance

- (a) All welds will be inspected visually by the Contract Administrator. The Contractor shall allow the Contract Administrator unhindered access to the piling and shall assist the Contract Administrator in carrying out any inspection, including suitable access.

#### E14.7.3 Pile Driving Records

- (a) The Contractor shall keep a record of each and every pile driven. The records shall give the date, time, diameter, length, location, type, total depth of penetration, rate of penetration, number of blows per 300 mm, penetration of the last five blows, steam, air or diesel pressure and the kind and size of hammer used in driving. Any unusual phenomena shall be noted and recorded, especially if they indicate possible damage to the pile.
- (b) Energy output of driving equipment at the time of final set shall be carefully recorded by the Contractor, along with the final penetration readings, and reported immediately to the Contract Administrator. The required set per blow will be subject to acceptance by the Contract Administrator, in regard to the specified driving equipment and piles permitted.

### E14.8 Measurement and Payment

#### E14.8.1 Supplying Steel Piles

Supplying steel piles will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Supply Steel Piles," which price shall be payment in full for performing operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

#### E14.8.2 Driving Steel Piles

Driving steel piles will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Drive Steel Piles," which shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

The measurement for the driving of steel piles shall be the total linear metres supplied less fifty (50) percent of the number of linear metres of piling cut-off after driving, except where piles are driven to their final elevation without requirement for a cut-off.

### E15. PRECAST CONCRETE GIRDERS

#### E15.1 Description

This Specification shall cover the supply of all material, labour, plant, and equipment required to complete the work as hereinafter specified and as shown on the Drawings including but not necessarily confined to the following:

- (a) Supply of all materials and the fabrication of prestressed precast concrete box girders as shown on the drawings, including delivery and erection.
- (b) Design and implementation of temporary bracing for lateral stressing.

- (c) The supply of all cables, anchorages and other incidental materials for lateral stressing (when applicable).
- (d) Storage of fabricated girders until delivered to the Site for erection.

## E15.2 References and Related Specifications

All reference standards and related specifications shall be current issue or latest revision at the first date of tender advertisement.

### E15.2.1 References

- CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction
- CAN/CSA-A23.2, Methods of Test and Standard Practices for Concrete
- CAN/CSA-A23.4/CSA-A251, Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products
- CAN/CSA-A3001, Cementitious Materials for Use in Concrete
- CAN/CSA – G30.14, Deformed Steel Wire for Concrete Reinforcement
- CAN/CSA – G30.18, Billet-Steel Bars for Concrete Reinforcement
- CAN/CSA – G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel
- CAN/CSA G 164, Hot Dip Galvanizing of Irregularly Shaped Articles
- CAN/CSA G 279, Steel for Pre-stressed Concrete Tendons
- CAN/CSA W47.1, Certification of Companies for Fusion Welding of Steel
- ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished
- ASTM A496 Standard Specification for Steel Wire, Deformed for Concrete Reinforcement
- ASTM C 260, Standard Specification for Air-Entraining Admixtures for Concrete
- ASTM C 494, Standard Specification for Chemical Admixtures for Concrete
- ASTM C 1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

### E15.2.2 Related Specifications

- Specification E16, "Reinforcing Steel"
- Specification E17, "Structural Concrete"

### E15.2.3 • Submittals

The Contractor shall submit the following to the Contract Administrator:

- (a) Certificate of Compliance with the CPCI Precast Concrete Certification Program for Structural, Architectural And Specialty Precast Concrete Products and Systems, Group B, Bridge Products. Proof of this certification shall be provided to the Contract Administrator.
- (b) Concrete mix design that meets the minimum compressive strengths ( $f'_c$  and  $f'_{ci}$ ) as shown on the Drawings shall be stamped, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba. Any changes to the concrete mix design shall be reviewed by the Contract Administrator prior to the Contractor implementing the change.
- (c) Stressing calculations shall be stamped, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba and include the following:
  - (i) Copies of the stressing sequence and strand elongation calculations as well as all data required for checking these calculations. Separate elongation calculations will be required for each significant variation in the Modulus of Elasticity of the strand.

- (ii) A calibration graph for each jack, calibrated not more than 6 months prior to stressing operation.
- (iii) The proposed method of tensioning the draped strands, including a comprehensive description and drawing of the proposed hold-up and hold-down devices.
- (iv) The proposed sequence of stressing and destressing operations.
- (v) The anchorage losses experienced by the Contractor under similar loading applications, and the proposed method of measuring the anchorage losses during the stressing operation.
- (vi) A copy of the proposed "Record of Concrete Strength" and "Record of Pre-Tensioning" forms to be used by the Contractor.
- (d) Copies of the stress-strain curve for the prestressing steel and the lateral stressing cables.
- (e) Copies of all reports, including but not limited to: "Record of Concrete Strength" form, "Record of Pre-Tensioning" form and material quality control test results.
- (f) Letter of Validation from the Canadian Welding Bureau (CWB) and CWB approved welding procedures for the Contractor's miscellaneous metal supplier. The Contractor's miscellaneous metal supplier shall fulfill the requirements of CSA W47.1, Division 2.1 (minimum).
- (g) Loading, handling, and transportation procedures, including the proposed route and all traffic control procedures shall be stamped, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.
- (h) Bending procedures for strands extended at girder ends.

### E15.3 Materials

Manufacturer's specifications for the concrete for the precast concrete girder shall be strictly followed and shall supersede this Specification should any discrepancies exist.

#### E15.3.1 Concrete

Concrete shall have minimum compressive strengths ( $f'_c$  and  $f'_{ci}$ ) as shown on the Drawings and meet the requirements of CSA-A23.1, Exposure Class C-1, Air Content Category 1 for hardened concrete.

##### (a) Coarse Aggregate

- (i) The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CSA A23.1, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 1% shall pass a 75  $\mu$ m 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.
- (ii) Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1, Table 12, for concrete exposed to freezing and thawing.

##### (b) Fine Aggregate

- (i) Fine aggregate shall meet the grading requirements of CSA A23.1, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75  $\mu$ m 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, Table 12.

##### (c) Admixtures

- (i) Air-entraining admixtures shall conform to the requirements of ASTM C 260.

- (ii) Chemical admixtures shall conform to the requirements of ASTM C 494 or C 1017 for flowing concrete.
- (d) Cementitious Materials
  - (i) Cementitious materials shall conform to the requirements of CSA-A3001.
  - (ii) 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.
  - (iii) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class CI and the substitution shall not exceed 15% by mass of cement.



#### E15.3.2 Grout

- (a) Grout shall have a compressive strength of 45 MPa @ 28 days and shall be non-shrink, non-metallic. Admixtures to be used in grout must be approved by the Contract Administrator. Grout specified within this Specification section shall be used for the grouting the post-tensioning ducts as well as the precast girder shear keys.
- (b) Shear key preparation shall include light sand blasting prior to grout installation as deemed acceptable to the Contract Administrator.

#### E15.3.3 Prestressing Steel

- (a) Prestressing steel shall be Grade 1860 MPa and shall conform to the requirements of CSA Standard G279 and this Specification.

- (b) Tagging

Size of strand, coil number, heat number and the mark of the Manufacturer shall be recorded on a tag attached securely to each reel. The tag shall also identify the strand with its own stress-strain curve.

- (c) Stress-Strain Curves

One stress-strain curve shall be provided by the Manufacturer for each reel.

- (d) Testing

Should the Contract Administrator consider it necessary, approval of the prestressing strand, in addition to the requirements of CSA G 279, shall be based on tests carried out by the Contractor in a testing laboratory satisfactory to the Contract Administrator. The Contractor shall test a minimum of three representative specimens of the strands to be used in the girders. The results of these tests shall be supplied to the Contract Administrator. The Contract Administrator may also require the Contractor to supply additional representative specimens for independent testing.

Where the strand has rusted in storage, the use of such material will be subject to the approval of the Contract Administrator. The Contract Administrator, at his discretion, may require physical tests at the Contractor's expense in order to determine whether the material is suitable to be used in the girder.

All strands that:

- (i) are contaminated by substances having a deleterious effect on the steel or concrete or on the bond strength of concrete to strand or,
- (ii) sustain physical damage,
- (iii) shall be replaced either by the Contractor or cleaned to the satisfaction of the Contract Administrator.

#### E15.3.4 Reinforcing Steel

- (a) Reinforcing steel shall be Grade 400 MPa and shall conform to the requirements of CSA Standard G30.18 and section E16, "Reinforcing Concrete," of this Specification.

#### E15.3.5 Stainless Steel Reinforcing

- (a) Stainless steel reinforcing shall be in accordance with E16, "Reinforcing Concrete," of this Specification.

#### E15.3.6 Materials for Lateral Stressing

- (a) The Contractor shall supply all cables and anchorages with end fittings for grouting, as required for lateral stressing.

- (i) Anchorages

Anchorage for post-tensioned work shall be capable of accommodating the number of strands specified and of sustaining, without appreciable slip, the loads that will be applied. Anchorages will be subject to the approval of the Contract Administrator.

(ii) Ducts

Ducts for enclosing the cables shall be rigid ferrous metal sheathing cast into the girders. The duct material shall be such that it is possible to obtain mortar-tight ducts following smooth curves in the correct locations in the concrete girders.

The type of ferrous metal selected for the ducts shall minimize the friction between the cables and the duct walls.

Duct sizes shall be as shown on the Drawings and are subject to the approval of the Contract Administrator.

E15.3.7 Structural Inserts

- (a) Structural inserts shall be Dayton Superior Type F-57 expanded coil ferrule insert, galvanized. Insert to come as a unit with 25mm diameter, 50mm long, A307 bolts, with lock washers, galvanized. Galvanizing to be in accordance with CSA G164.

E15.3.8 Other Materials

Miscellaneous metal, anchor inserts and lifting devices and all other incidental materials shall be supplied as shown on the Drawings and shall be subject to the approval of the Contract Administrator.

E15.4 Manufacturer

E15.4.1 General

- (a) All precast concrete components shall be plant manufactured by a manufacturer currently engaged in the special process of precast and prestressed concrete work. This manufacturer shall be a registered member of the Canadian Prestressed Concrete Institute
- (b) All plant casting operations for the production of prestressed and precast concrete shall be under the direct supervision of a Registered Professional Engineer in the Province of Manitoba.
- (c) The casting operations of the manufacturer shall be continuously open to inspection by representatives of the Contract Administrator. Complete and up-to-date copies of all shop drawings together with a complete set of the Contract Drawings and Specifications shall be kept available for their use.
- (d) During production of the precast members, weight checks shall be carried out on completed units when requested by the Contract Administrator.
- (e) Mark each member with identifying number and date of casting.

E15.4.2 Tolerances

- (a) The distance centreline to centreline of bearings shall not vary by more than 6.5 mm from the lengths shown on the plans, when measured 12 hours after the completion of the stress transfer.
- (b) Cross-sectional dimensions including the locations of the prestressing steel shall not vary from those shown on the plans by more than 3.5 mm.
- (c) The bottom surface of members at the bearing areas shall be in a true level plan, which does not vary by more than 1.5 mm from a true straight edge placed in any direction across the area or plate.

E15.4.3 Formwork

- (a) The faces of the forms shall be smooth to impart a good finish to the concrete and particular care shall be taken to ensure the verticality and rigidity of the side forms of deck units forming surfaces which will be in contact with each other after erection. The faces of the forms shall be treated with a release agent to ensure that stripping may be carried out without damage to the concrete. Care shall be taken to maintain all embedded material free of the release agent.

- (b) Forms shall be constructed as to allow for the redistribution of loading and the movement of the member, which will take place upon application of the prestressing force.
- (c) Outside Forms
  - (i) The faces of the forms shall be smooth so as to impart a good finish to the concrete. Forms shall result in precast prestressed girders that conform to the shape, lines and dimensions as shown on the Drawings and within the tolerances described in Section E15.4.2 of this Specification. Forms shall be properly braced or tied together to maintain position and shape.
  - (ii) Forms shall be designed for the rate and method of concrete placement and constructed to allow for the redistribution of loading and the movement of the form that will take place upon application of the prestressing force.
  - (iii) The faces of the forms shall be treated with a release agent to ensure that stripping may be carried out without damage to the concrete. Care shall be taken to prevent the release agent from coming in contact with any reinforcement, pre-stressing stand or embedded materials.
  - (iv) Forms shall include temporary openings to facilitate the removal of all foreign substances prior to placing the concrete.
  - (v) Recesses at the ends of the girders to facilitate positioning of prestressing strands will not be allowed.

(d) Void Forms

Void forms shall be positioned accurately and be strong enough to withstand all pressures and uplift forces without excessive distortion. The void forms shall be well secured and remain in place during the operations of placing and vibrating concrete so that their correct positions with respect to the horizontal and vertical axes of the girder will be maintained within the limits of the dimensional tolerances.

All void forms shall be vented to alleviate expansion forces from occurring during curing. Each void form shall have 15 mm round vent holes in both the bottom and top slabs.

The void forms and retaining devices shall be tested by the Contractor and accepted by the Contract Administrator prior to the fabrication of the girders to ensure that the shape and position of the void forms are maintained throughout girder fabrication.

E15.4.4 Stressing

- (a) The Contractor shall submit to the Contract Administrator the following at least 7 days prior to the start of stressing operations.
  - (i) Copies of the stressing sequence and of the strand elongation calculations as well as all data required for checking these calculations. Separate elongation calculations will be required for each significant variation in the modulus of elasticity of the strand.
  - (ii) A calibration graph for each jack to be used in the stressing operation.
  - (iii) The proposed method of tensioning the strands.
  - (iv) The proposed method of distressing and the distressing sequence.
  - (v) The anchorage losses experienced by the Contractor under similar loading applications, and the proposed method of measuring the anchorage losses during the stressing operation.
  - (vi) A copy of the proposed "Record of Concrete Strength" form, and the "Record of Pre-Tensioning" to be used by the Contractor.
  - (vii) Camber calculations of girder at release.
- (b) The elongation calculations, distressing sequence and all other items having an effect upon the design a performance of the members shall be prepared by a Professional Engineer Registered in Manitoba and the required submissions shall be stamped by the Professional Engineer.

- (c) The submission of the stressing calculations to the Contract Administrator shall in no way relieve the Contractor of the Full responsibility for the success or failure of the stressing operations.
- (d) The initial force in each strand shall be as shown on the plans or as specified by the Contract Administrator. Prior to the stressing of the strands to the initial force, a 2.2 kN load shall be applied to each strand to eliminate slack and equalize stresses. For the first member stressed, the 2.2 kN load shall be applied to all strands and then rechecked before stressing any of the strands to the initial force.
- (e) A pre-calibrated pressure gauge, tensionmeter or load cell shall be used as a check on the elongation, the accuracy of which shall be verified by the Contractor whenever the Contract Administrator considers it necessary.
- (f) Before the stressing operation begins, the Contractor shall have filled out on the approved "Record of Pre-tensioning" form the calculated jack gauge reading, the required gross elongation (based on estimated anchorage losses), and the required net elongation of each strand. During the stressing operation, the Contractor shall record the actual jack gauge reading, the measured gross elongation, the measured anchorage losses, and then calculate the actual net elongation for each strand.
- (g) The actual net elongation of a strand shall not vary from the required net elongation by more than 3.5 mm. The actual anchorage losses encountered shall be used to modify the gross elongation required, if the actual net elongations are consistently greater or less than the required net elongation.
- (h) At no time shall the actual jack pressure exceed the pressure corresponding to the calculated gross elongation by the 5 percent. If the required gross elongation is not obtained by stressing to this maximum allowable jack pressure at one end of the member, it will be necessary to complete the stressing from the other end of the member.
- (i) A copy of the "Record of Pre-Tensioning" form shall be submitted to the Contract Administrator upon completion of the pre-tensioning of each member.
- (j) Tensioning shall be carried out in a manner such that the jack is coaxial with the tendon or strand. If the strands are tensioned individually, care shall be taken to ensure the unravelling of the strand does not take place.
- (k) For pre-tensioned members, the Contract Administrator has allowed for a stress loss due to an increase in temperature of the prestressing strands from the time of tensioning to the time of initial set of the concrete. In order to verify the design value used for this stress loss, the Contractor shall keep an accurate record of the temperature of the concrete in each member from the time of placing of the concrete until the completion of the steam curing of the first three (3) members fabricated and every third member thereafter. The results shall be plotted on the graph with the ambient air temperature of the same member.
- (l) Transfer of the pre-tensioning force shall be carried out by a method approved by the Contract Administrator. If the strands are to be cut, the distressing sequence shall be approved by the Contract Administrator.
- (m) All pre-tensioning strands shall be cut off flush with the end of the member and the exposed ends of the pre-tensioning strands and a 50 mm strip of adjacent concrete shall be cleaned and painted. Cleaning shall be by abrasive blast to remove all dirt and residue that is not firmly bonded to the metal or concrete surfaces. The surfaces shall be immediately coated with 25 mm coat of zinc-rich paint approved by the Contract Administrator. The paint shall be thoroughly mixed at the time of application and shall be worked into any voids in the pre-tensioning strands.

#### E15.4.5 Reinforcing Steel

- (a) Reinforcing steel shall be placed accurately in the positions shown on the plans, and shall be retained in such positions by means of bar accessories and wires so that the bars shall not be moved out of alignment, during or after the deposition of concrete. Bar accessories shall be galvanized or shall be made from non-rusting material.

- (b) Reinforcing steel shall be kept free of all foreign materials in order to ensure a positive bond between the concrete and steel. The Contractor shall remove any material, which has been deposited on the steel before concrete is placed.
- (c) Intersection bars shall be tied positively at each intersection.

#### E15.4.6 Placing of Anchorages

- (a) The anchorages shall be centred in the positions shown on the Drawings. The anchorages shall be fastened securely to the forms to prevent displacement during the placing and vibrating of concrete. The joints between the forms and anchorages shall be taped to prevent leakage of concrete mortar. The placement tolerance shall be as per CSA A23.4.

#### E15.4.7 Placing of Ducts

- (a) The method of supporting the ducts shall be in accordance with CSA A23.4 requirements and shall be reviewed by the Contract Administrator. The Contractor shall ensure that the ducts are held true to the locations shown on the Drawings as specified in CSA A23.4.
- (b) The ducts shall be fixed securely in place and supported at the spacing shown on the Drawings in order to prevent horizontal or vertical displacements of the ducts during the placing and vibrating of concrete. In the event that the duct support spacing is not indicated on the Drawings, the maximum spacing shall be 1 metre.
- (c) All duct couplers and duct connections to anchorages shall be well taped with waterproof tape to prevent the entry of concrete and moisture into the ducts. The ends of the ducts shall be plugged temporarily to prevent entry of debris or other materials prior to the threading of cables.

#### E15.4.8 Depositing of Concrete

- (a) Concrete shall be deposited carefully and well worked by vibrating so that it shall fill the forms completely and make complete contact with all reinforcing bars, prestressing strands, and anchorages.
- (b) The concrete shall be deposited in such frequent locations in the forms that there shall be no necessity for moving large quantities of concrete from place to place in the forms. The concrete shall be placed in layers not exceeding 600 mm in depth and each layer shall be vibrated into place by methods, which will not permit the ingredients to separate. The Contractor shall provide and use different personnel on the depositing equipment and on the vibrating equipment to ensure that each batch of concrete shall be properly worked into place as deposited.
- (c) The buckets, chutes or any other equipment used to deposit concrete in the members shall be positioned as close to the top of the forms as possible to keep the free fall of the concrete to a minimum.
- (d) The depositing of concrete in each unit shall be a single continuous complete operation so that each unit shall be monolithic without joints.
- (e) Before any concrete shall be deposited, the interior of the forms shall be made free of all chips, earth, shavings, sawdust, rubbish or other foreign substances.

#### E15.4.9 Testing of Concrete

- (a) Concrete compressive strength requirements will consist of a minimum strength, which must be attained before various loads, or stresses are applied to the concrete. With the exception of the concrete strengths required for:
  - (i) Transfer of the pre-tensioning forces.
  - (ii) Subjecting a member to freezing temperatures.
  - (iii) Hauling and erecting a member.
- (b) All concrete shall attain the minimum strength as shown the Drawings and indicated in this Specification at the age of 28 days. The compressive strength of the concrete is to be determined in accordance with CSA Standard A23.2-2000.

- (c) The minimum number of test cylinders that a Contractor shall mould from each separately mixed batch of concrete to be placed in a member is as follows:
- (i) Two (2) cylinders to be tested prior to the transfer of the pre-tensioning forces where applicable.
  - (ii) Three (3) cylinders for the 28 day strength.
  - (iii) Two (2) cylinders to be tested prior to the member being hauled to the site and erected, where applicable.

In the event that the strength of the concrete cylinder(s) tested prior to the transfer of the pre-tensioning forces is less than the strength required for transferring the pre-tensioning forces, the Contractor shall mould and test additional cylinders from each subsequent batch of concrete. The number of additional cylinders to be moulded and tested for the purpose of establishing the required concrete strength for the transfer of the pre-tensioning forces will be determined by the Contract Administrator.

All test cylinders shall be cured under the same conditions as the member until such time as the steam curing or moist curing of the member has been completed.

In addition to the moulding of the specified number of test cylinders the Contractor will be required to perform the following tests on every separate batch of concrete to be placed in a member:

- (iv) slump
- (v) air
- (vi) temperature

and to record the results of such tests. The Contractor shall be responsible for maintaining an up-to-date record of all test results on a "Record of Concrete Strength" form approved by the Contract Administrator. A separate "Record of Concrete Strength" form is to be prepared for each member and the strengths of the test cylinders as well as the pertinent data are to be listed in the same order as the batches of concrete were placed in the forms. A complete set of test results is to be submitted to the Contract Administrator within seven (7) days after the date that the 28 day cylinders from the last member were tested. All costs involved in performing and recording the previously mentioned tests will be the responsibility of the Contractor.

- (d) The Contract Administrator at his own discretion and at the Owner's expense may make any other tests deemed necessary on the concrete, on the components of the concrete as well as on any finished or partially finished member. The Contractor must allow the Contract Administrator unhindered access to the concrete, concrete components and members and to also assist the Contract Administrator in carrying out any test.

#### E15.4.10 Vibrating Concrete

- (a) Vibrators shall only be used when acceptable to the concrete supplier.
- (b) External vibration shall be used when sections are too small or inaccessible for the internal type.
- (c) Internal vibrators shall be used in all sections, which are sufficiently large, and they shall be supplemented by platform or screed-type vibrators in the event that satisfactory top surfaces cannot be obtained with the internal type alone; internal vibrators shall be supplemented with vibrators operated against outside of the forms to improve vertical surfaces.
- (d) Vibrators shall be of sturdy construction, adequately powered and capable of transmitting to the concrete not less than 3,600 impulses per minute when operating under load. The vibration shall be sufficiently intense to cause the concrete to flow or settle readily into place and to visibly affect the concrete over a radius of at least 450 mm from the vibrator when used in concrete having 25 mm slump.

- (e) A sufficient number of vibrators shall be employed so that at the required rate of placement, vibration and complete compaction are obtained throughout the entire volume of each layer of the concrete. At least one extra vibrator shall be on hand for emergency use. Form vibrators shall be attached to the forms in such a manner as to transmit the vibration to the concrete effectively and the vibrators shall be raised in lifts as filling of the forms proceeds; the dimension of each lift being not more than the height of concrete visibly affected by the vibration. The form vibrators shall be spaced horizontally apart at distances not greater than the radius through which the concrete is visibly affected.
- (f) Internal vibrators shall be kept constantly moving vertically in the concrete and they shall be applied at points uniformly spaced that are not farther apart than the radius over which the vibrator is visibly effective. The vibrator shall not be held in one location long enough to draw a pool of grout from the surrounding concrete. Internal vibrators shall be applied close enough to the forms to vibrate the surface concrete effectively but care shall be taken to avoid hitting the forms with sufficient force to damage them.
- (g) With form or internal vibrators, the vibration shall be such that the concrete becomes uniformly plastic and there shall be at least 20 seconds of vibration per square foot of surface of each layer of the concrete, computed on the basis of the visibly affected radius and taking overlapping into consideration.
- (h) Surface vibrators shall be applied only long enough to embed the coarse aggregate and to bring enough mortar to the surface for satisfactory screeding.
- (i) Care will have to be exercised so as not to damage the prestressing steel in any way, and so that the vibration is not transferred through the steel to concrete already poured and which is at the stage between the initial and final set.
- (j) The tops of all members shall receive a screeded, untrowelled surface.
- (k) Immediately after the removal of the forms, any defects in the concrete shall be brought to the Contract Administrator's attention and they shall be repaired as directed by the Contract Administrator, provided the defects are not extensive enough to cause rejection of the member.
- (l) Honeycomb, if any, shall be repaired as soon as the forms are taken off, subject to the approval of the Contract Administrator. When approved by the Contract Administrator, repairs shall be accomplished by removing any aggregate that is loose or that is not thoroughly bonded to the surrounding concrete, washing the sound concrete with clean water, using a wire brush to remove any loose particles and by applying an approved epoxy resin to the dried areas to be patched immediately prior to the applying of cement mortar. Patched areas shall be rubbed flush with the surrounding surface after the cement mortar has hardened.
- (m) Holes made by hold-up or hold-down devices or other fabrication equipment, shall be cleaned of all oil or grease, washed with clean water and then, without delay, patched flush with the surface of the member with the cement mortar
- (n) All objectionable fins, projections, offsets, steaks, or other surface imperfections shall be totally removed to the Contract Administrator's satisfaction by approved means.

#### E15.4.11 Concrete Finish

- (a) The top surfaces of box girders shall be finished to produce even indentations at right angles to the longitudinal centreline of the girders. The indentations shall be 5 mm (minimum), full amplitude, and spaced not greater than 15 mm apart.
- (b) The Contractor shall construct a 25 mm deep recess around all lifting devices. These recesses shall be rectangular in shape with vertical sides, and the distance between the lifting device and the vertical sides shall not exceed 50 mm.
- (c) Immediately after the removal of the forms, all defects in the concrete shall be repaired as directed by the Contract Administrator, provided the defects are not extensive enough to cause rejection of the girder. Should the top surface exhibit

excessive laitance or "frothing", or any other deleterious effects, the Contractor shall repair the concrete to the satisfaction of the Contract Administrator.

- (d) Honeycomb, if any, shall be repaired as soon as the forms are taken off. When approved by the Contract Administrator, repairs shall be accomplished by: removing all aggregate that is loose or that is not bonded thoroughly to the surrounding concrete, washing the sound concrete with clean water, using a wire brush to remove any loose particles, applying an approved epoxy resin to the dried areas, and applying a cementitious mortar. The cementitious mortar shall have the same quality and mix as that used for the concrete. Patched areas shall be rubbed flush with the surrounding surface after the cementitious mortar has hardened.
- (e) Holes made by hold-up or hold-down devices or other fabrication equipment, shall be cleaned of all oil and grease, washed with clean water and then, without delay, patched flush with the surface of the girder with the approved cementitious mortar.
- (f) All objectionable fins, projections, offsets, streaks, and other surface imperfections shall be removed totally to the Contract Administrator's satisfaction by approved means.
- (g) Finally, the concrete surface shall be wetted down thoroughly and all air pockets and other surface cavities shall be filled carefully with the approved cementitious mortar. When sufficiently dry, the surface shall be rubbed down to leave a smooth and uniform finish. Cement washes of any kind will not be allowed.
- (h) If, in the Contract Administrator's opinion, repairs to the concrete are not satisfactory or will be detrimental to the strength or long-term durability of the girder, the Contractor shall, and as directed by the Contract Administrator, replace the girder.

#### E15.4.12 Curing

- (a) Concrete shall be either moist cured for a minimum of three days from the time of casting or steam cured until the concrete has reached a strength (fci) as shown on the plans or as specified by the Contract Administrator.
- (b) If steam curing is used, it shall not be applied until after the initial set has taken place. Initial set shall be considered to have taken place four (4) hours after the completion of concrete placing. The cylinders used to determine the concrete strength shall be cured under the same conditions as the member in question.
- (c) From the time of pre-tensioning to the time of initial set, the ambient air temperature of the member shall not vary by more than  $\pm 3^{\circ}\text{C}$ . During steam curing the ambient air temperature shall rise at a rate not to exceed  $15^{\circ}\text{C}$  per hour to a maximum temperature of  $70^{\circ}\text{C}$ .
- (d) An air temperature recording thermometer approved by the Contractor Administrator shall be laced on the top of the member after placing of concrete is completed and the thermometer shall not be removed until after steam curing has been completed. A graph showing the ambient air temperature plotted against the time of day shall be submitted to the Contract Administrator by the Contractor upon completion of the steam curing for each member. The graph shall be properly identified as to the hour, day, month and year, as well as to the times of the completion of placing concrete, and of the start and completion of steam curing.
- (e) Once curing has been completed, the temperature of the concrete shall not be allowed to fall at a rate exceeding  $15^{\circ}\text{C}$  per hour.
- (f) The members shall not be subjected to freezing temperatures until reaching the design strength (f'c) as shown on the plans.

#### E15.4.13 Grouting

- (a) Grout shall be mixed preferably in a colloidal grout mixer of the roller type or a high speed stirring mixer capable of operating from 1,800 to 2,000 r.p.m. The mixing shall be done at high speeds for 2 or 3 minutes, followed by slow agitation until the grout is used up.



- (b) From the mixer, the grout shall pass through a strainer into positive displacement grouting pumps equipped with a re-circulating device for use when the grout is not being injected.
- (c) The member shall be kept from freezing for at least 72 hours beyond the completion of grouting or mortaring operations, providing that the preceding temperatures have not been below 15.6°C. In the event that the preceding temperatures are below 15.6°C, the 72 hours may be extended by the Contractor Administrator.
- (d) The Contractor shall take not less than six (6) standard cubes at his own cost during each day of grouting operations for 7 and 28 day strength determinations. The results of these tests as well as the slump, air tests and grout temperature shall be supplied to the Contractor Administrator.
- (e) The Contractor must take steps as to ensure the ducts will not have air pockets upon completion of grouting. Grout admixtures to increase flowability are acceptable. Admixtures must be reviewed by the Contract Administrator.

#### E15.4.14 Handling, Storage and Loading

- (a) Lifting devices shall be cast into the concrete at the locations as shown on the Shop Drawings.
- (b) The lifting devices shall be of such a nature as to avoid twisting, racking, or other distortions while handling, storing, moving and erecting the girders. The devices shall be anchored fully to the main body of concrete. The devices shown on the Drawings are minimum requirements and the Contractor shall satisfy himself as to the adequacy of the devices. The girders shall be picked up only by the lifting devices.
- (c) The Contractor shall be responsible for storage of the girders from the completion of their fabrication until they are required for erection. The Contractor may have to store, free of charge, all or portions of the Substantial Performance date, depending upon the actual construction progress.
- (d) During storage and hauling, the girders shall be maintained in an upright position and shall be supported within 50 mm on the inside of the bearing area. Extreme care shall be exercised during the handling and storage of the precast girders to avoid twisting, cracking or other distortion that may result in damage to the girder.

#### E15.4.15 Handling and Transportation of Girders

- (a) The Contractor shall load and transport all of the girders in accordance with the following:
  - (i) The Contractor shall be responsible for the design, supply, installation and removal of temporary wind bracing and lateral stability bracing for girders as may be required during all of the Contractor's handling operations, including loading and transporting of the girders.
  - (ii) Should the Contractor choose to transport the girders to a storage location, he shall also be responsible for the unloading procedures. The submission of design calculations and Shop Drawings for the temporary wind bracing and lateral stability bracing to the Contract Administrator shall in no way relieve the Contractor of the full responsibility for the success or failure of the design.
- (b) All loading and transporting of the girders shall be under the direction of a Professional Engineer, registered in the Province of Manitoba. The Engineer shall be experienced in bridge girder loading and transporting and shall be present for girder loading and transporting.
- (c) The members shall not be transported until the concrete design strength ( $f_c$ ) has been reached.
- (d) Extreme care shall be exercised during the handling and transportation of the precast girders to avoid twisting, cracking or other distortion that may result in damage to the girder.

- (e) The Contractor shall be responsible for protecting the girders at restraint points on the vehicle. Any damaged corners or surfaces of the girders are to be regarded as honeycomb and repaired in accordance with E15.6.2(c) of this Specification.
- (f) The Contractor and the Contract Administrator shall visually inspect the girders once they have been loaded on the hauling equipment and immediately prior to the unloading. Extensive cracking of the girders during transportation will be basis for rejection by the Contract Administrator.
- (g) When transporting bridge girders, the Contractor shall be responsible for ensuring that all of the required permits have been acquired and the conditions of all permits are met.
- (h) The Contractor shall submit his proposed route for transporting the girders including traffic control procedures as part of the proposed loading and transporting procedure. In all traffic control situations, the flagmen must be trained and properly attired in flagman's vest and approved headgear with approved flagman's stop/slow paddle or fluorescent red flag. The proper advance signing must also be in place. For an example of traffic control procedures at an intersection see drawing S-TMP-6, "Traffic Control for Trucks Hauling Extra-Long Bridge Girders" which is appended to this Specification.
- (i) No loose timber blocking will be permitted for use as temporary works for any aspect of girder handling, storage and transportation.
- (j) It is the Contractor's responsibility to ascertain the actual weight of the girders. The concrete in the precast prestressed girders may be denser than regular concrete and the girders contain a high percentage of reinforcement and stressing strands that also tend to increase the weight of the girders.

E15.5 Shop drawings, sealed by a Professional Engineer Registered in the Province of Manitoba shall be submitted to the Contract Administrator a minimum of fourteen (14) days prior to the box girder fabrication.

## E15.6 Erection

### E15.6.1 Submittals

The Contractor shall submit the following to the Contract Administrator:

- (a) A schedule and detailed plan clearly illustrating the method and sequence by which the Contractor proposes to unload and erect the precast prestressed concrete girders. The girder erection procedure shall include detailed design notes and Shop Drawings that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba necessary to describe the following:
  - (i) Proposed lifting methodology, devices, their locations on girders and patching procedures after erection.
  - (ii) Type and capacity of equipment.
  - (iii) Sequence of operation, including position of cranes, trucks with girders, and traffic accommodation.
  - (iv) Detailed crane position on the ground, particularly adjacent to substructure elements, such as piers and abutments, with details of load distribution on wheels and outriggers. If approved by the Contract Administrator, details of crane position on the structure, showing wheel loads and axle spacing of equipment moving on structure.
  - (v) Loads and their position from crane wheels and outriggers during all positions of lifting when crane is on or adjacent to the structure.
  - (vi) Details of temporary falsework, including proposed methods to be used to ensure stability and the required splice elevations and structure shape prior to placing concrete and details of release (if applicable).
  - (vii) Method of providing temporary supports for stability.

- (viii) Details of lifting of units, showing vertical forces at lifting devices.
- (ix) Provisions for control and adjustment of errors for width and positioning of curbs or exterior units (if applicable).
- (x) Complete details of blocking for bearings where necessary to constrain movement due to horizontal forces and/or gravity effects.
- (xi) Provide an "As Constructed" detailed survey of the substructure showing the following:
  - ◆ Location and elevation of all bearing seats;
  - ◆ Shim height at each bearing location, if applicable;
  - ◆ Top of girder elevations at each bearing (and each splice location where applicable).
- (xii) Detailed design notes and Shop Drawings for the bearings that are stamped signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.

#### E15.6.2 General

- (a) Written proof of the concrete strength of the precast prestressed concrete box girders shall be submitted to the Contract Administrator at least three (3) business days prior to the erection of the precast prestressed concrete box girders.
- (b) Unloading and erection of the concrete girders shall be under the direction of a Professional Engineer licensed to practice in the Province of Manitoba. The Professional Engineer shall be experienced in bridge girder erection and be present for all stages of the girder erection.
- (c) Any girder that in the opinion of the Contract Administrator has been damaged or otherwise rendered useless by the improper handling by the Contractor shall be replaced by the Contractor at his own expense.
- (d) It is the Contractor's responsibility to ascertain the actual weight of the girders. The concrete in the precast prestressed girders may be denser than regular concrete and may contain a high percentage of reinforcing steel and stressing strands that also tend to increase the weight of the girders.
- (e) Loose timber blocking will not be permitted for use as temporary works for any aspect of girder erection.
- (f) Before taking possession or erection of the girders, the Contractor shall verify that the lengths of the girders, the layout of the substructure units, the elevations of the bearing seats, and the location of the anchor bolts are in accordance with the Drawings and Specifications. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.

#### E15.6.3 Box Girders

- (a) All box girders shall be placed tightly against each other in order to obtain virtually no lateral movement of the bearings when the girders are pulled together during lateral stressing operations.
- (b) The total erected width of the channel and box girders shall not exceed the sum of the individual widths of the girders by more than approximately 25 mm for each span. The Contractor shall attempt to distribute the discrepancy equally on either side of the centreline of structure.
- (c) Care shall be exercised to prevent dirt from falling in between the girders. All dirt that does fall in between the girders shall be removed.
- (d) The Contractor shall ensure that the foam rubber pads around the lateral stress ducts are placed correctly to prevent the leakage of grout during grouting operations. In the event that any leakage occurs, it will be the responsibility of the Contractor to carry out all required remedial measures.

#### E15.6.4 Lifting Hooks and Lifting Holes

- (a) After the Contract Administrator has approved the erection positions of the girders, all lifting hooks shall be cut off flush with the top of the girders.
- (b) All lifting holes shall be filled with an approved grout.

#### E15.6.5 Lateral Stressing

- (a) The Contractor shall submit to the Contract Administrator the following at least 7 days prior to the start of lateral stressing operations.
  - (i) Copies of the stressing sequence and of the strand elongation calculations as well as all data required for checking these calculations. Separate elongation calculations will be required for each significant variation in the modulus of elasticity of the strand.
  - (ii) A calibration graph for each jack to be used in the stressing operation.
  - (iii) The proposed method of tensioning the strands.
  - (iv) The proposed method of distressing and the distressing sequence.
  - (v) The anchorage losses experienced by the Contractor under similar loading applications, and the proposed method of measuring the anchorage losses during the stressing operation.
  - (vi) A copy of the proposed "Record of Lateral Post-Tensioning" form to be used by the Contractor.
- (b) The elongation calculations, distressing sequence and all other items having an effect upon the design a performance of the members shall be prepared by a Professional Engineer Registered in Manitoba and the required submissions shall be stamped by the Professional Engineer.
- (c) The submission of the stressing calculations to the Contract Administrator shall in no way relieve the Contractor of the full responsibility for the success or failure of the stressing operations.
- (d) A pre-calibrated pressure gauge, tensionmeter or load cell shall be used as a check on the elongation, the accuracy of which shall be verified by the Contractor whenever the Contract Administrator considers it necessary.
- (e) Before the stressing operation begins, the Contractor shall have filled out on the approved "Record of Lateral Post-tensioning" form the calculated jack gauge reading, the required gross elongation (based on estimated anchorage losses), and the required net elongation of the each strand. During the stressing operation, the Contractor shall record the actual jack gauge reading, the measure gross elongation, the measured anchorage losses, and then calculate the actual net elongation for each strand.
- (f) The actual net elongation of a strand shall not vary from the required net elongation by more than 3.5 mm. The actual anchorage losses encountered shall be used to modify the gross elongation required, if the actual net elongations are consistently greater or less than the required net elongation.
- (g) At no time shall the actual jack pressure exceed the pressure corresponding the calculated gross elongation by the 5 percent. If the required gross elongation is not obtained by stressing to this maximum allowable jack pressure at one end of the member, it will be necessary to complete the stressing from the other end of the member.
- (h) A copy of the "Record of Lateral Post-Tensioning" form shall be submitted to the Contract Administrator upon completion of the pre-tensioning of each member.
- (i) Tensioning shall be carried out in a manner such that the jack is coaxial with the tendon or strand. If the strands are tensioned individually, care shall be taken to ensure the unravelling of the strand does not take place.

- (j) Transfer of the post-tensioning force shall be carried out by a method approved by the Contract Administrator. If the strands are to be cut, the distressing sequence shall be approved by the Contract Administrator.
- (k) All post-tensioning strands shall be cut off flush with the end of the member and the exposed ends of the pre-tensioning strands and a 50 mm strip of adjacent concrete shall be cleaned and painted. Cleaning shall be by abrasive blast to remove all dirt and residue that is not firmly bonded to the metal or concrete surfaces. The surfaces shall be immediately coated with 25 mm coat of zinc-rich paint approved the Contract Administrator. The paint shall be thoroughly mixed at the time of application and shall be worked into any voids in the pre-tensioning strands.

#### E15.6.6 Removal of Falsework and Site Clean-up

- (a) Upon completion of the erection and before final acceptance, the Contractor shall remove all temporary falsework. He shall remove all piling, excavated or surplus materials, rubbish and temporary buildings, replace or renew any damaged fences, and restore in an acceptable manner all property damaged during the execution of the Work. Disposal of surplus materials shall be in a manner and location satisfactory to the Contract Administrator.
- (b) The Contractor shall leave the bridge site, roadway and adjacent property in a neat restored and presentable condition, satisfactory to the Contract Administrator. When requested by the Contract Administrator, the Contractor shall provide written evidence that affected property owners and/or regulatory agencies have been satisfied.

#### E15.7 Quality Assurance

- (a) The Contractor shall provide an office within the plant facilities for the exclusive use of the Contract Administrator for the duration of the contract that is equipped with a desk, two (2) chairs, a digital telephone and an internet connection. Upon completion of the project, all equipment and the office space will be returned to the Contractor in an "as-is" condition.
- (b) The Contract Administrator, at his discretion, may complete other tests deemed necessary on:
  - (i) The concrete;
  - (ii) The concrete constituent materials; or
  - (iii) Any finished or partially finished girder.
- (c) The Contractor shall allow the Contract Administrator unhindered access to the concrete, concrete constituent materials and girders and shall assist the Contract Administrator in carrying out any test.
- (d) During production of the precast girders, the Contractor shall weigh completed girders to verify the mass when requested by the Contract Administrator.
- (e) Records showing details of members installed, temporary bracing installed or removed and weather conditions shall be kept daily and be available to the Contractor Administrator upon request.

#### E15.8 Measurement and Payment

##### E15.8.1 Supply of Precast Concrete Girders

Supply of precast concrete girders will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for "Supply Precast Concrete Girders," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

##### E15.8.2 Erection of Precast Concrete Girders

Erection of precast concrete girders will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for "Erection of Precast Concrete Girders," which price shall

be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## **E16. REINFORCING STEEL**

### **E16.1 Description**

- (a) This Specification shall cover all operations relating to the supply, fabrication, and placement of black and stainless reinforcing steel, and associated bar accessories, as specified herein and as shown on the Drawings.
- (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

### **E16.2 Referenced Specifications and Drawings**

- (a) The latest edition and subsequent revisions of the following:
  - (i) ASTM A955M – Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement;
  - (ii) ASTM A615M – Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement;
  - (iii) ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete;
  - (iv) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
  - (v) CAN/CSA G30.18 – Billet-Steel Bars for Concrete Reinforcement;
  - (vi) Reinforcing Steel Institute of Canada – Reinforcement Steel Manual of Standard Practice.

### **E16.3 Scope of Work**

- (a) The Work under this Specification shall involve supplying and placing all black and stainless steel reinforcing, as shown on the Drawings for the following Works:
  - (i) Abutments
  - (ii) Deck and backwalls
  - (iii) Approach slabs
  - (iv) Reinforced road slabs
  - (v) Traffic barriers
  - (vi) Sidewalks on the bridge deck and approach
  - (vii) Pier Cap

### **E16.4 Submittals**

- (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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of any fabrication, the qualifications of the Contractor, and the qualifications of Operators, the Shop Drawings including bar lists, and the mill certificates, including corrosion test results in accordance with ASTM A955M.
- (c) 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 a Certificate of Compliance from the Manufacturer stating that the stainless steel

materials supplied comply with the provisions of ASTM A955M and these Specifications, including corrosion resistance.

- (d) Shop Drawings shall be submitted in accordance with the latest edition of the Reinforcement Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada (RSIC).

## E16.5 Materials

### E16.5.1 General

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- (b) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

### E16.5.2 Handling and Storage of Materials

- (a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the latest edition and all subsequent revisions of CAN/CSA-A23.1, "Storage of Materials", except as otherwise specified herein.
- (b) Bundles of reinforcing steel shall be identified by tags containing bar marks.
- (c) The Contractor shall handle and store the reinforcing steel in a manner that ensures it is not damaged or contaminated with dirt or other materials.
- (d) The reinforcing steel shall not be placed directly on the ground. Timber pallets shall be placed under the reinforcing steel to keep them free from dirt and mud and to provide easy handling.

### E16.5.3 Handling and Storage of Stainless Steel Reinforcing

- (a) Stainless steel reinforcing shall be stored separately from other reinforcing steel with the bar tags maintained and clearly visible until placing operations commence. Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.
- (b) Chains or steel bands used for shipping shall not be in direct contact with stainless steel reinforcing. Use wood or other soft material to protect the bars, or use nylon or polypropylene slings.
- (c) Nylon or polypropylene slings shall be used for moving stainless steel reinforcing.
- (d) Keep carbon steel tools, chains, slings, etc. off stainless steel reinforcing.

### E16.5.4 Reinforcing Steel

- (a) Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) Black steel as shown on the Drawings and shall conform to the requirements of CAN/CSA G30.18, Grade 400W.
- (c) Stainless steel, as shown on the Drawings, shall be a high-manganese, low-nickel, nitrogen-strengthened austenitic stainless steel. Stainless steel reinforcing shall meet or exceed the minimum requirements of ASTM A955M, 300 Series, minimum Grade 420, of the Types listed below in Table E16.1, "Type of Stainless Steel Reinforcing". Reinforcing deformations shall conform to the requirements of ASTM A615M. All hooks and bends shall be bent using pin diameters and dimensions recommended by RSIC.
- (d) If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete Works exhibit flaws in manufacture or fabrication, such material shall be immediately removed from the site and replaced with acceptable reinforcing steel.
- (e) All reinforcing steel shall be straight and free from paint, oil, millscale, and injurious defects. Rust, surface seams, or surface irregularities will not be cause for rejection, provided that the minimum dimensions, cross sectional area, and tensile properties of a hand-wire-brushed specimen are not less than the requirements of ASTM A955M.



<b>TABLE E16.1 TYPE OF STAINLESS STEEL REINFORCING</b>		
Common or Trade Name	AISI Type	UNS Designation
Type 316 LN	316 LN	S31653
Type 2205	Duplex 2205	S31803
Type XM-28	XM-28	S24100

#### E16.5.5 Bar Accessories

- (a) Bar accessories shall be of types suitable for each type of reinforcing and acceptable to the Contract Administrator. They shall be made from a non-rusting material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (b) Bar chairs, bolsters, and bar supports shall be made from cementitious material. No plastic or PVC, or galvanized bar supports shall be used.
- (c) The use of pebbles, pieces of broken stone or brick, plastic, metal pipe, and wooden blocks, will not be permitted.
- (d) Placing of bar supports shall be done to meet the required construction loads.
- (e) Tie wire shall be the following:
  - (i) Black, soft-annealed 1.6 mm diameter wire for black steel reinforcing;
  - (ii) Nylon-, epoxy-, or plastic-coated wire for black steel reinforcing; and
  - (iii) Stainless steel, fully annealed 1.6 mm diameter wire, Type 316 or 316L for stainless steel reinforcing.
- (f) Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices that may be approved by the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

#### E16.5.6 Mechanical Splices

- (a) Mechanical splices shall be stainless steel, meeting the requirements of ASTM A955M, Type 316L, Type 2005, or Type XM-28.

#### E16.5.7 Bonding Agent/Grout

- (a) Epoxy resin shall conform to the requirements of ASTM C881. Type I or Type IV, Grade 3 epoxy shall be used for bonding reinforcing steel into hardened concrete. An approved product is Hilti RE500 or equal, as approved by the Contract Administrator in accordance with B6 "Substitutes".
- (b) An aggregate filler may be used in accordance with manufacturer's directions when the drilled hole is sized for the head of a stud rather than a shaft only.
- (c) Bonding agents for bonding reinforcing steel into holes in hardened concrete other than epoxy resin may be permitted provided that they develop a minimum pullout resistance of 50 kN within 48 hours after installation.
- (d) Fabrication of stainless steel reinforcing shall take place in an area isolated from carbon steel reinforcing to prevent surface contamination.
- (e) Stainless steel reinforcing shall be stored separately from carbon steel reinforcing.
- (f) All equipment shall be cleaned prior to bending stainless steel reinforcing.

## E16.6 Equipment

### E16.6.1 General

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- (b) All tools used for stainless steel reinforcing shall be stainless steel and shall not be contaminated with iron or non-stainless steel.

## E16.7 Construction Methods

### E16.7.1 Fabrication of Reinforcing Steel

- (a) All reinforcing steel shall be fabricated in accordance with the latest edition of the Reinforcement Steel Manual of Standard Practice by the RSIC, to the lengths and shapes as shown on the Drawings.
- (b) Stainless steel reinforcing shall be bent to the proper shape in a plant that has suitable devices for bending stainless steel as recommended in Reinforcing Steel Institute of Canada (RSIC) Manual of Standard Practice. Heating shall not be used as an aid in bending. The equipment used in the plant shall not cause any surface contamination or damage to the surface of the bars. Stainless steel shall be tagged, indicating the mill and fabricator, stainless steel type and grade, and bar mark number including stainless designation.

### E16.7.2 Fabrication of Stainless Steel Reinforcing

- (a) Fabrication of the solid stainless steel reinforcing shall be such that the bar surfaces are not contaminated with deposits of iron and non-stainless steels.
- (b) The stainless steel reinforcing shall be mechanically or chemically de-scaled prior to fabrication, leaving a totally passive stainless steel finish free of millscale, slag, or oxidation. Iron contamination shall be removed with picking paste or by wire brushing. Wire brush cleaning shall be done with stainless steel brushes only.
- (c) All hand tools shall be stainless tools that have not been previously used on carbon steel.

### E16.7.3 Placing and Fastening of Reinforcing Steel

- (a) General
  - (i) Reinforcing steel shall be placed accurately in the positions shown on the Drawings and shall be retained in such positions by means of a sufficient number of bar accessories so that the bars shall not be moved out of alignment during or after the depositing of concrete. The Contract Administrator's decision in this matter shall be final.
  - (ii) Reinforcing steel shall be free of all foreign material in order to ensure a positive bond between the concrete and steel. The Contractor shall also remove any dry concrete which has been deposited on the steel from previous pouring operations before additional concrete may be placed. Intersecting bars shall be tied positively at each intersection.
  - (iii) Splices in reinforcing steel shall be made only where indicated on the Drawings. Prior acceptance by the Contract Administrator shall be obtained where other splices must be made. Welded splices shall not be permitted. (iv) reinforcing steel shall be placed to provide a clear space between the reinforcing bars as shown on the Drawings to accurately place preformed holes where necessary.
  - (iv) Reinforcing steel shall not be straightened or re-bent in a manner that will injure the metal. Bars with bends not shown on the Drawings shall not be used.
  - (v) Heating of reinforcing steel shall not be permitted without prior acceptance by the Contract Administrator.

- (vi) Reinforcing steel shall be placed within the tolerances specified in CAN/CSA A23.1.
  - (vii) The Contractor shall supply and place all necessary support accessories to ensure proper placement of reinforcing steel. All reinforcement shall be accurately placed in the positions shown on the Drawings, and firmly tied and chaired before placing the concrete.
  - (viii) Distances from the forms shall be maintained by means of stays, spacers, or other approved supports. Spacers and supports for holding reinforcing steel at the required location and ensuring the specified concrete cover over the reinforcing steel shall be as specified in E16.5.5, "Bar Accessories".
  - (ix) Welding or tack welding is not permitted.
  - (x) Unless otherwise shown on the Drawings, the minimum distance between bars shall be 40 mm.
- (b) Placing Stainless Steel Reinforcing
- (i) Stainless steel reinforcing will be rejected if:
    - ◆ Any area of contamination of the stainless steel by iron exceeds 100 mm in length;
    - ◆ Two or more areas of iron contamination greater than 25 mm in length occur along the length of the bar; or
    - ◆ There are frequent small occurrences of rust contamination along the full length of the bar.
  - (ii) If stainless steel reinforcing bars have been rejected due to excessive iron contamination, the Contractor may attempt to treat the bar to remove the contamination. This treatment can be accomplished by mechanical cleaning with a stainless steel wire brush, or by a polishing machine, or by chemical treatment, pickling. If the treatment(s) are not successful, the contaminated bar(s) shall be replaced at no cost to the Owner.
  - (iii) If the stainless steel reinforcing is mechanically damaged, the bars will be rejected and the Contractor shall replace the rejected bars at no cost to the Owner. Any cuts into a bar, sharp tears, or flattening of the deformations on the bars will be cause for rejection.
  - (iv) Bars shall be tied at all intersections, except where spacing is less than 250 mm in each direction, when alternate intersections may be tied.
  - (v) All tools used for placing shall be stainless steel and shall not be contaminated with iron or non-stainless steel.
  - (vi) For lapping steel reinforcing bars at the joints and intersection, an ample supply of stainless steel wire shall be provided. The wire shall not be contaminated with non stainless steel.
  - (vii) Proper stainless steel cutting pliers shall be used and the bending and tying of the wires done as neatly as possible.
  - (viii) Twisted ends of the tie wire shall be bent away from forms and surfaces so that they do not project into the concrete cover over the reinforcing steel.

#### E16.7.4

##### Splicing

###### (a) General

- (i) Splices shall only be provided as shown on the Drawings. Splices other than as shown on the Drawings will not be permitted without the written approval of the Contract Administrator.
- (ii) For lapped splices, the bars shall be placed in contact and wired together in such a manner as to maintain a clearance of not less than the required minimum clear distance to other bars, and the required minimum distance to the surface of the concrete. In general, suitable lap lengths shall be supplied as detailed on the Drawings. If this information is not detailed on the Drawings, a minimum of thirty-five (35) bar diameters lap length shall be provided.

## E16.8 Quality Control

### E16.8.1 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.
- (b) 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.
- (c) A minimum of one (1) Business Day advance notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for inspection of the reinforcing steel.
- (d) After all reinforcing steel has been placed, a final inspection shall be made prior to the placement of concrete to locate any damage or deficiencies. All visible damage or any deficiencies shall be repaired to the satisfaction of the Contract Administrator before concrete is placed.

### E16.8.2 Access

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

## E16.9 Quality Assurance

### E16.9.1 Testing

- (a) Quality Assurance testing shall be used to determine the acceptability of the reinforcing steel supplied by the Contractor.
- (b) The Contractor shall provide, without charge, the samples of reinforcing steel required for Quality Assurance Tests and provide such assistance and use of tools and construction equipment as is required.

## E16.10 Measurement and Payment

- E16.10.1 Supplying and placing reinforcing steel will be measured on a mass basis and will be paid for at the Contract Unit Price per kilogram for the "Items of Work" listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Items of Work:

Supplying and placing reinforcing steel:

- (a) Supply and Place Black Reinforcing Steel
- (b) Supply and Place Stainless Steel Reinforcing

## E17. STRUCTURAL CONCRETE

### E17.1 Description

- (a) This Specification shall cover all operations relating to the preparation of Portland Cement structural concrete for, and all concreting operations related to, the construction of structural concrete works as specified herein and as shown on the Drawings.
- (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.

## E17.2 Referenced Specifications and Drawings

- (a) The latest edition and subsequent revisions of the following:
  - (i) ACI 309 – Guide for Consolidation of Concrete;
  - (ii) ACI 347 – Guide to Formwork for Concrete;
  - (iii) American Concrete Publication SP4 – Formwork for Concrete;
  - (iv) ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings;
  - (v) ASTM C131 – Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine;
  - (vi) ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete;
  - (vii) ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete;
  - (viii) ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete;
  - (ix) ASTM C494 – Standard Specification for Chemical Admixtures for Concrete;
  - (x) ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete;
  - (xi) ASTM C1202 – Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration;
  - (xii) ASTM C1399 – Standard Test Method for Obtaining Average Residual-Strength of Fibre-Reinforced Concrete;
  - (xiii) ASTM C1609 – Standard Test Method for Flexural Performance of Fibre-Reinforced Concrete (Using Beam with Third Point Loading);
  - (xiv) ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types);
  - (xv) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
  - (xvi) CAN/CSA A3001 – Cementitious Materials for Use in Concrete;
  - (xvii) CAN/CSA G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel;
  - (xviii) CAN/CSA G164-M92 – Hot Dip Galvanizing of Irregularly Shaped Articles;
  - (xix) CAN/CSA O121 – Douglas Fir Plywood;
  - (xx) CAN/CSA-S6 – Canadian Highway Bridge Design Code;
  - (xxi) CAN/CSA S269.1 – False Work for Construction Purposes;
  - (xxii) CAN/CSA S269.3 – Concrete Formwork;
  - (xxiii) ICRI Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers, and Polymer Overlays;
  - (xxiv) Ministry of Transportation Ontario MTO Lab Test Method LS 609 – Petrographic Analysis of Coarse Aggregate; and
  - (xxv) Ontario Provincial Standard Specification OPSS 1010 – Material Specification for Aggregates – Base, Sub-base, Select Subgrade, and Backfill Material.

### E17.3 Scope of Work

- (a) The Work under this Specification shall involve the following structural concrete Works:
  - (viii) Abutments
  - (ix) Deck and backwalls
  - (x) Approach slabs
  - (xi) Reinforced road slabs
  - (xii) Traffic barriers
  - (xiii) Sidewalks on the bridge deck and approach
  - (xiv) Pier Cap
- (b) The Work under this Specification shall include the supply and placement of the aluminum railing pre-set anchor units.

### E17.4 Submittals

#### E17.4.1 General

- (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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) 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 proposed materials to be used.

#### E17.4.2 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 outlines on the concrete mix design statement as shown on the Manitoba Ready Mix Concrete Association website ([www.mrmca.com](http://www.mrmca.com)). In addition, the mix design statement must indicate the expected method of placement (buggies, chute, or pump) 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;
  - (viii) Quantity of other admixtures; and
  - (ix) The dosage and type of synthetic fibres.

- (c) The concrete mix design statements must be received by the Contract Administrator a minimum of ten (10) Business Days prior to the scheduled commencement of concrete placement for each of the concrete types. The concrete mix designs must be received by the City of Winnipeg a minimum of five (5) Business Days prior to the scheduled commencement of concrete placement for each 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 with the requirements of the CAN/CSA A23.1 Clause 4.3.2.3.2.
- (e) Any change in the constituent materials of any approved mix design shall require submission of a new concrete mix design statement, mix design, and 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 any necessary adjustments and associated resubmissions.

#### E17.4.3 Concrete Mix Design Test Data

##### (a) Concrete

- (i) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, test data showing that the concrete to be supplied will meet the performance criteria stated in this Specification for each concrete type.
- (ii) The Contractor shall submit at a minimum, the test data to prove that the minimum compressive strength, flexural strength for Fibre Reinforced Concrete (FRC) only, air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. In addition, test data shall be submitted to support requirements for post-cracking residual strength index ( $R_i$ ) and fibre dispersion in accordance with the requirements of the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6, Section 15, Fibre Reinforced Structures, Clause 16.6. Testing for  $R_i$  of concrete shall be completed in accordance with E17.8.5(e).
- (iii) Testing for air void system shall be completed in accordance with E17.8.5(c).
- (iv) Testing for rapid chloride permeability shall be completed in accordance with E17.8.5(d).
- (v) 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 line should the Contractor choose to pump the concrete into place.

##### (b) Aggregates

- (i) The Contractor shall furnish, in writing to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, 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 A23.2-2A.
- (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 A23.2-27A.
- (c) The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

E17.4.4 Notification of Ready Mix Supplier

- (a) The Contractor shall submit to the Contract Administrator the name and qualifications of the Ready Mix Concrete Supplier that he is proposing to use, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement. 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.

E17.4.5 Temporary False Work, Formwork and Shoring Works

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, detailed design calculations and Shop Drawings for any temporary Works, including false work, formwork, and shoring, that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.
- (b) Design Requirements
  - (i) The Contractor shall design false work, formwork and shoring for the new Bridge structural deck overhangs to be released prior to the placement of the High Performance Concrete (HPC) overlay. The formwork shall not extend beneath the underside of the girders.
  - (ii) All forms shall be of wood, metal or other materials as approved by the Contract Administrator.
  - (iii) The false work, 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 the requirements of the CAN/CSA S269.1. 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.
  - (iv) The false work, formwork, and shoring for these Works shall be designed to safely support all vertical and lateral loads until such loads can be supported by the concrete all in accordance with the requirements of CAN/CSA S269.3. All



proposed fastening methods to the existing deck superstructure must be submitted to the Contract Administrator for review and approval. Drilling into the precast concrete girders will not be accepted.

- (v) The loads and lateral pressures outlined in Part 3, Section 102 of ACI 347 and wind loads as specified by the Manitoba Building Code shall be used for design. Additional design considerations concerning factors of safety for formwork elements and allowable settlements outlined in Section 103 of the above reference shall apply.
- (vi) As a minimum, the following spacings shall apply, for studding and waling:
- (vii) 20-mm plywood: studding 400 mm centre to centre (max.),
- (viii) Walers 760 mm centre to centre (max.)
- (ix) Forms shall be designed and constructed so that the completed Work will be within minus 3 mm or plus 6 mm of the dimensions shown on the Drawings.
- (x) Formwork shall be designed to provide camber, where applicable, to maintain the specified tolerance to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete, due to construction loads.
- (xi) Slots, recesses, chases, sleeves, inserts, bolts, hangers, and other items shall be accommodated in the design, in coordination and cooperation with the trade concerned. No openings in structural members are to be shown on the Shop Drawings without the prior written approval of the Contract Administrator.
- (xii) Shores shall be designed with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.
- (xiii) Mud sills of suitable size shall be designed beneath shores, to be bedded in sand or stone, where they would otherwise bear on soil. The soil below shores must be adequately prepared to avoid settlement during or after concreting. Shores must not be placed on frozen ground.
- (xiv) Shores shall be braced horizontally in two directions and diagonally in the same two vertical planes so that they can safely withstand all dead and moving loads to which they will be subjected.
- (xv) All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.
- (xvi) Formwork shall be designed to have sufficient strength and rigidity so that the resultant finished concrete conforms to the shapes, lines, and dimensions of the members shown on the Drawings.
- (xvii) Forms shall be designed to be sufficiently tight to prevent leakage of grout or cement paste.
- (c) 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 any Work on site until the Shop Drawings have been reviewed and approved in writing by the Contract Administrator. 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.
- (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.

E17.4.6 Screed for Structural Deck Concrete

- (a) Plans for anchoring support rails shall be submitted to the Contract Administrator for review and acceptance at least ten (10) Business Days prior to the scheduled commencement of concrete placement. The Contract Administrator's written acceptance must be received by the Contractor prior to the installation of any anchorage devices.

E17.4.7 Moveable Deck Hoarding

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of the structural deck concrete 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 the structural deck concrete to proceed unhindered inside the hoarding.

E17.4.8 Concrete Structural Deck Pour Sequence and Schedule

- (a) The Contractor shall pour the structural deck concrete in accordance with the pour sequence as outlined in the Drawings. Should the Contractor opt to submit an alternate construction pour sequence for the structural deck concrete, the Contractor shall submit the proposed alternate construction pour sequence to the Construction Administrator for review, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement.
- (b) The Contractor shall submit to the Contract Administrator for review, at least ten (10) Business Days prior to the placement of concrete, details of the construction joints.
- (c) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to scheduled commencement of concrete placement, the proposed concrete placement schedule for all other structural concrete placements of this Specification.

E17.5 Materials

E17.5.1 General

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- (b) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

E17.5.2 Handling and Storage of Materials

- (a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the latest edition and all subsequent revisions of CAN/CSA-A23.1.

E17.5.3 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 17.1.

TABLE 17.1  
 REQUIREMENTS FOR HARDENED CONCRETE

Type of Concrete	Location	Nominal Compressive Strength MPa	Class of Exposure	Air Content Category	Max Aggregate Size	Special Requirements	Minimum Post Residual Cracking Index
Type 1	Caissons	40 @ 28 Days	C-1	1	20 mm	-	-
Type 2	Pier Caps	40 @ 28 Days	C-1	1	20 mm	Synthetic Fibers	0.15
Type 3	Structural Deck, Abutments, Approach Slabs, Reinforced Road Slab	45 @ 28 Days	C-1	1	20 mm	Synthetic Fibers	0.15
Type 4	Sidewalk, Traffic Barriers,	35 @ 28 Days	C-1	1	20 mm	Synthetic Fibers	0.15

#### E17.5.4 Working Base Concrete

- (a) Working base concrete shall be placed in the locations as shown on the Drawings.
- (b) Working base shall be concrete meeting the requirements of CSA A 23.1 latest edition, for S-2 class of exposure, except as follows:
  - (i) 20 MPa at 28 days

#### E17.5.5 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 Standard Test Method A23.2-27A. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA Standard Test Method A23.2-1 4A or CSA A23.2-25A 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 CAN/CSA A23.1, 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 CAN/CSA A23.1, Table 12.

(c) Coarse Aggregate - Standard

- (i) The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CAN/CSA A23.1, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 2% shall pass a 75 µm 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) Coarse aggregate when tested for abrasion in accordance with the requirements of the 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 CAN/CSA A23.1, Table 12, for concrete exposed to freezing and thawing.

E17.5.6 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.

E17.5.7 Cementitious Materials

- (a) Cementitious materials shall conform to the requirements of CAN/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 CI or F and the substitution shall not exceed 30% 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.

E17.5.8 Water

- (a) Water to be used for all operations in the Specification, including mixing and curing of concrete or grout, surface texturing operations, and saturating the substrate shall conform to the requirements of CAN/CSA A23.1 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.

E17.5.9 Corrosion Inhibitor

- (a) Corrosion inhibitor shall be MCI 2005 NS at a dosage of 1 L/m<sup>3</sup>, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".

E17.5.10 Synthetic Fibres

- (a) The synthetic fibres shall consist of 100% virgin polypropylene high performance macro fibres, 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 CHBDC CAN/CSA S6, "Fibre-Reinforced Structures", Clause 16.6.

E17.5.11 Formwork

- (a) Formwork materials shall conform to CAN/CSA A23.1, 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 CAN/CSA "O121". 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 used by the Contractor unless specifically shown on the Drawings.

E17.5.12 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, "Substitutes".

E17.5.13 Permeable Formwork Liner

- (a) Formwork liner shall be Texel Drainaform, Hydroform, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes". 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, such as structural deck overhangs. The Contractor shall provide conclusive evidence that the paper-lined form proposed for use will not stain or otherwise blemish the hardened concrete surface.

E17.5.14 Curing Compound

- (a) Curing compound shall conform to the requirements of ASTM C309, either Type D with fugitive dye or Type 2.
- (b) Type 2 shall only be used on surfaces that will not be exposed to view.

E17.5.15 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, "Substitutes".

E17.5.16 Bonding Agents

(a) Latex Bonding Agent

- (i) Latex bonding agent shall be Acryl-Stix, SikaCem 810, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes". Polyvinyl acetate-based latexes will not be permitted. Planicrete AC by MAPEI is approved for use as a latex bonding agent on concrete greater than 28 days in age.

(b) Latex Bonding Agent

- (i) The grout for bonding the structural deck concrete to the precast concrete girders shall be mixed in an agitating hopper slurry pump and shall consist of the following constituents, by weight:
  - (i) 1 part water;
  - (ii) 1 part latex bonding agent; and
  - (iii) 11/2 parts Type GUSF Portland cement.
- (ii) The consistency of the bonding grout shall be such that it can be brushed on the existing concrete surface in a thin, even coating that will not run or puddle in low spots.

E17.5.17 Epoxy Adhesive

- (a) Epoxy adhesive for bonding concrete to steel shall be one of the following approved products: 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, "Substitutes".

E17.5.18 Epoxy Grout

- (a) Epoxy grout shall be one of the following approved products: 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, "Substitutes".

E17.5.19 Cementitious Grout

- (a) Cementitious grout shall be nonshrink and non-metallic. Approved products are 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, "Substitutes". The minimum compressive strength of the grout at 28 days shall be 40 MPa.

E17.5.20 Patching Mortar

- (a) 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.

E17.5.21 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. Approved 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, "Substitutes".

E17.5.22 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 t ASTM D1751 or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".

E17.5.23 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 DSM System" by Emseal Corporation. Manufacturer's recommended primer and top coat are to be used.

E17.5.24 Low Density Styrofoam

- (a) Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B6, "Substitutes".

E17.5.25 Backup Rod

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

E17.5.26 Screed Bases and Chairs

- (a) Screed bases shall be Hilti HAS 304 stainless steel threaded rods, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".
- (b) Screed chairs shall be Mega Screed as supplied by Brock White Canada Company, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".

E17.5.27 Dampproofing

- (a) Dampproofing materials shall be applied to all buried concrete 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. 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, "Substitutes".
- (b) All damaged concrete, including tie holes to be filled with non-shrink grout prior to application of dampproofing.
- (c) 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, "Substitutes".

E17.5.28 Anchor Units for Aluminum Pedestrian Handrail

- (a) Anchor units for the aluminum pedestrian handrail shall be National Concrete Accessories Type DGR-1, stainless steel or equal as accepted by the Contract Administrator, in accordance with B6 "Substitutes".

E17.5.29 Miscellaneous Materials

E17.5.30 Benchmark Plugs

- (a) Benchmark plugs shall be supplied by the City. Installation by the Contractor shall be considered incidental to these Works. Installation locations shall be shown on all Drawings.

## E17.6 Equipment

### E17.6.1 General

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

### E17.6.2 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 and stainless steel reinforcing, 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.

### E17.6.3 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 Structural Deck Concrete
  - (i) The Contractor may choose to use a mechanical or non-mechanical screed to strike the surface of the structural deck 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 structural deck 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) The mechanical screed on guides or rails shall be supported so that they are completely clear of the finished surface.
  - (v) Internal vibration of the concrete will be required with mechanical screeding. Care shall be taken not to overwork the concrete surface.
  - (vi) 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.
  - (vii) Screed surface touching concrete shall not be made of aluminum (magnesium acceptable).
  - (viii) The supply, setup, operation, and takedown of the screed for structural deck concrete shall be considered incidental to the placement of the structural deck concrete. No separate measurement or payment shall be made for this Work.
- (c) Moveable Work Bridges for Structural Deck Concrete
  - (i) At least two moveable Work Bridges will be required (one for finishing operations and one for curing operations), independent of the screeding and finishing machines for the structural deck concrete.
  - (ii) These moveable Work Bridges shall travel guided on rails supported clear of the finished structural 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.
    - (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.
  - (d) Moveable Deck Hoarding
    - (i) The moveable deck 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 can be the same rail system used for the screed and the Work Bridges, subject to the approval of the Contract Administrator.
    - (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 structural deck without first obtaining permission from the Contract Administrator.

#### E17.6.4 Placing and Finishing Equipment for Sidewalk Slab Concrete

- (a) Sidewalk Slab Hoarding
  - (i) The sidewalk slab hoarding shall consist of opaque panels which shall be placed over the sidewalk slab following finishing operations to protect concrete until curing blankets can be applied without marring the surface of the concrete.
  - (ii) The supply, setup, and takedown of the sidewalk slab hoarding shall be considered incidental to the placement of the sidewalk slab concrete. No separate measurement or payment shall be made for this Work.

#### E17.6.5 Placing and Finishing Equipment for Approach Slab Concrete

- (a) Mechanical Screed for Approach Slab Concrete
- (b) The mechanical screed shall be:
  - (i) Constructed to span the full width of the approach slab 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
  - (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.
- (c) Movable Work Bridge for Approach Slab Concrete Works
  - (i) The Contractor shall provide a movable Work Bridge, spanning the approach slab at right angles 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.

- (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.

## E17.7 Construction Methods

### E17.7.1 General

- (a) It is intended that this Section cover all construction Work associated with Structural Concreting operations.
- (b) Rate of application shall be the rate required to meet the requirements of ASTM C309 for the texture of concrete the curing compound is being applied to.

### E17.7.2 Temporary False Work, Formwork, and Shoring

#### (a) Construction Requirements

- (i) Temporary false work, formwork, and shoring shall satisfy all requirements of the Navigable Waters Protection Program.
- (ii) The Contractor shall construct false work, formwork and shoring for the new structural deck concrete overhangs strictly in accordance with the accepted Shop Drawings.
- (iii) All forms shall be of wood, metal or other materials as approved by the Contract Administrator. No formwork shall extend beneath the underside of the girders.
- (iv) The false work, formwork, and shoring for these Works shall be released prior to placement of the HPC overlay.
- (v) The false work, formwork, and shoring for these Works shall be erected, and braced, as designed, and maintained to safely support all vertical and lateral loads until such loads can be supported by the concrete. All proposed fastening shall be as shown on the accepted Shop Drawings.
- (vi) Forms shall be constructed and maintained so that the completed Work is within minus 3 mm or plus 6 mm of the dimensions shown on the Drawings.
- (vii) Formwork shall be cambered, where necessary to maintain the specified tolerance to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete, due to construction loads.
- (viii) Slots, recesses, chases, sleeves, inserts, bolts, hangers, and other items shall be formed or set in coordination and cooperation with the trade concerned. No openings shall be made in structural members that are not shown on the Shop Drawings without the prior written approval of the Contract Administrator.
- (ix) Shores shall be provided with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.
- (x) Mud sills of suitable size shall be provided beneath shores, bedded in sand or stone, where they would otherwise bear on soil. The soil below shores must be adequately prepared to avoid settlement during or after concreting. Shores must not be placed on frozen ground.
- (xi) Shores shall be braced horizontally in two directions and diagonally in the same two vertical planes so that they can safely withstand all dead and moving loads to which they will be subjected.
- (xii) All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.
- (xiii) Formwork shall have sufficient strength and rigidity so that the resultant finished concrete conforms to the shapes, lines, and dimensions of the members shown on the Drawings.
- (xiv) Forms shall be constructed so as to be sufficiently tight to prevent leakage of grout or cement paste.

- (b) Form panels shall be constructed so that the contact edges are kept flush and aligned.
- (c) Forms for the concrete barriers shall be accordingly aligned to each other and to the geometry shown on the Drawings so as to provide a smooth, continuous barrier. Any misalignments in the barrier shall be cause for rejection and removal of same. No snap ties within the barriers shall be placed below 250 mm above the top of the upper lift elevation.
- (d) Forms shall be clean before use. Plywood and other wood surfaces shall be sealed against absorption of moisture from the concrete by a field applied form coating or a factory applied liner as accepted by the Contract Administrator.
- (e) Where prefabricated panels are used, care shall be taken to ensure that adjacent panels remain flush. Where metal forms are used, all bolts and rivets shall be counter sunk and well ground to provide a smooth, plane surface.
- (f) Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be commercially manufactured types. The portion remaining within the concrete shall leave no metal within 50 mm of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed 30 mm in diameter. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest possible size. Torch cutting of steel hangers and ties will not be permitted. Formwork hangers for exterior surfaces of decks and curbs shall be an acceptable break-back type with surface cone, or removable threaded type. Cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in colour.
- (g) Formwork shall be constructed to permit easy dismantling and stripping and such that removal will not damage the concrete. Provision shall be made in the formwork for shores to remain undisturbed during stripping where required.
- (h) It shall be permissible to use the forms over again where possible to a maximum of three uses, provided they are thoroughly cleaned and in good condition after being removed from the former portions of the 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 forty-eight (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, incidental to the Work of this Specification, and the entire site shall be left in a neat and clean condition.

#### E17.7.3 Concrete Construction Joints

- (a) Concrete construction joints shall be located only where shown on the Drawings or as otherwise directed in writing by the Contract Administrator. Concrete construction joints shall be formed at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints.
- (b) Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.
- (c) After the forms are stripped off the construction joint, the entire face of the joint, including the reinforcing steel, shall be thoroughly cleaned down to sound concrete and the surface roughened.
- (d) Refer to, E17.7.11, "Preparation for Concreting Against Hardened Concrete", for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

#### E17.7.4 Bridge Deck Screeds

##### (a) Setting Deck Screeds

- (i) The Contractor shall adjust screeds to maintain uniform slab thickness. Adjust screed heights to plan elevations or to such other elevation as may be determined by the Contract Administrator in the field. Screed bases shall be permitted to be drilled and grouted into existing concrete and shall be adjustable to achieve the required elevations.
- (ii) The screed chairs and screed rail supports shall be spaced to prevent deflections of the screed bars or screed rails during screeding operations.

#### E17.7.5 Concrete Bridge Traffic Barrier Joints

##### (a) Finishing of Concrete Barrier Joints

- (i) The installation of the fibre joint filler, the backup rod, and the flexible joint sealant shall be undertaken as shown on the Drawings.
- (ii) Furnish fibre joint filler for each joint in a single piece for the required depth and width for each joint, unless otherwise approved by the Contract Administrator. If permitted, multiple pieces shall be fastened together for a given joint by butting ends and securing in place by stapling or other positive fastening methods. Polyethylene bond breaker tape shall be installed between joint fillers and sealants. Expansion board caps shall be adhered to fibre joint filler prior to closing barrier formwork. These caps shall be used to position and secure backup rod in place prior to flexible joint sealing operations.
- (iii) The flexible joint sealant at the barrier joints shall be installed as per the Manufacturer's recommendations and shall be tooled smooth, after installation, to provide a clean, uniform finish and a properly sealed joint.
- (iv) All joint sealing of Bridge traffic barriers shall take place prior to casting the HPC overlay and sidewalk concrete.
- (v) 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.

#### E17.7.6 Anchor Units for Aluminum Pedestrian Handrail

- (a) All anchor units shall be installed as shown on the Drawings.
- (b) All anchor units shall be held securely in place so as not to become displaced during concrete placement operations.
- (c) The Contractor shall coordinate the installation of aluminum pedestrian handrail posts as described in E21, "Aluminum Pedestrian Handrail".

#### E17.7.7 Permeable Formwork Liner

- (a) Permeable formwork liner shall be used on all exposed surfaces, except on soffit surfaces, or surfaces where a normal architectural 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 or payment shall be made for this Work.

#### E17.7.8 Benchmarks

- (a) The Contractor shall install benchmark plugs supplied by the Contract Administrator at such locations on the structure as may be directed by the Contract Administrator.

#### E17.7.9 Structure Identification Date

- (a) The Contractor shall indent into the exposed concrete a structure identification date at such location at the west 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.

E17.7.10 Supply of Structural Concrete

- (a) All structural 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 CAN/CSA A23.1, 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 E17.1, "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 CAN/CSA A23.1 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 of Concrete
  - (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 re-handling, and without damage to the structure or the concrete.
- (e) Concrete Placement Schedule
  - (i) The Contractor shall submit to the Contract Administrator the proposed concrete placement schedule for all concrete placements for review and approval. 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);
  - (ii) Augment his facilities and Plant in order to complete the proposed placement;
  - (iii) In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting; and
- (ii) The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

#### E17.7.11 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 shall be removed to sound concrete or to the limits as shown on the Drawings, whichever is greater. The resulting surface shall be roughened to remove latent cement and miscellaneous debris.
  - (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, bonding grout shall be thoroughly brushed onto the entire surface of the existing hardened concrete in a thin and even coating that will not run or puddle.
  - (iv) For the Bridge traffic and median barriers, during concreting of the structural deck, the top surface of the concrete shall be roughened using a small rake running longitudinally between barrier dowels.

#### E17.7.12 Placing Structural Concrete

- (a) General
- (i) The Contractor shall notify the Contract Administrator at least one (1) Working day prior to concrete placement so that an adequate inspection may be made of formwork, shoring, reinforcement, deck joints, mechanical screed setup, movable hoarding, and related Works. No concrete pour shall be scheduled without the prior written approval of the Contract Administrator.
  - (ii) The Contractor shall conduct a dry run of the screed machine in the presence of the Contract Administrator to verify that the screed supporting rails are properly set to ensure compliance with the specified longitudinal and transverse deck grades. 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 at least one (1) Working Day prior to the proposed pour. The Contract Administrator will verify that the screed machine and screed rails have been adjusted so that the height of the screed above the existing concrete at each point meets the requirements. To confirm the Contractor's adjustments of the machine and screed rails, the screed 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.
- (b) Placing Structural Concrete
- (i) Placement of deck concrete shall not be permitted when the surface moisture evaporation exceeds 0.75 kg/m<sup>2</sup>/h. Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator.

- (ii) The nomograph, Figure D1, Appendix D of CAN/CSA A23.1 shall be used to estimate surface moisture evaporation rates.
- (iii) 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. All equipment and processes are subject to acceptance by the Contract Administrator.
- (iv) 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.
- (v) Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.
- (vi) 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.
- (vii) Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.
- (viii) 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.
- (ix) When the Contractor chooses to pump the concrete, the operation of the pump shall produce a continuous flow of concrete without air pockets. The equipment shall be arranged such that vibration is not transmitted to freshly placed concrete that may damage the concrete. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients.
- (x) Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.
- (xi) 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.
- (xii) 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.
- (xiii) 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.
- (xiv) Concrete shall not be placed during rain or snow unless adequate protection is provided for formwork and concrete surfaces, to the satisfaction of the Contract Administrator.
- (xv) Before any concrete is placed for the approach slabs the Bridge structural deck or the sidewalk slab, 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.

#### E17.7.13 Finishing of Concrete Surfaces

##### (a) Finishing Operations for Unformed Surfaces

- (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 minimized. 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 delay, while the finishing operations catch up, shall be rejected.

##### (b) Type 1 Finish – Exposed Formed Surfaces

- (i) A permeable 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, but excluding soffit surfaces where an architectural form finish is specified.
- (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 an approved permeable formwork liner.
- (iv) The surfaces shall be patched as specified in this Specification.

##### (c) Type 2 Finish – Unformed Surfaces

- (i) All unformed concrete surfaces, with the exception of the approach slab and deck concrete 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. Concrete surfaces after floating shall have a uniform, smooth, granular texture.

##### (d) Type 3 Finish – Approach Slab and Deck Concrete

- (i) For final concrete finish see the requirements within E20, "High Performance Concrete (HPC) Overlay."

##### (e) 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 the requirements of Sections E17.5.20 "Patching Mortar", E17.5.16 "Bonding Agents", and E17.7.16 "Patching of Formed Surfaces" of this Specification.
- (ii) All surfaces below 300 mm below finish grade shall receive dampproofing in accordance with E17.5.27, "Dampproofing" of this Specification.

##### (f) Working Base Concrete Finish

- (i) During placing, concrete working base shall be vibrated, screeded and floated.
- (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.



#### E17.7.14 General Curing Requirements

- (a) Refer to E17.7.17, "Cold Weather Concreting" for cold weather curing requirements and E17.7.18, "Hot Weather Concreting" of this Specification for hot weather curing requirements.
- (b) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, running water, vibration, and mechanical shock. No machinery shall travel in the vicinity of freshly placed concrete for a period of 24 hours. Concrete shall be protected from freezing until at least 24 hours after the end of the curing period.
- (c) 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.
- (d) The use of curing compound shall not be allowed on concrete areas that are to receive additional concrete, dampproofing, a waterproofing membrane, or an asphalt or concrete overlay.
- (e) Freshly finished concrete shall have either a curing compound applied, or shall be moist cured by immediately applying wet curing blankets to the exposed concrete surface immediately following finishing operations for at least seven (7) consecutive days thereafter. Construction joints shall be cured by means of wet curing blankets only. Water shall be applied as necessary to keep the concrete and curing blankets saturated. The Contractor must ensure the concrete and curing blankets are kept saturated with water for the entire seven (7) days.
- (f) Immediately following finishing of the structural deck and approach slab concrete, apply fog misting until the concrete has enough strength to support the placement of the pre-dampened curing 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 by the misting device. There should be no standing water. Failure to apply wet curing blankets within 40 minutes after the structural deck concrete has been deposited shall be cause for rejecting the Works so affected. Concrete in the rejected area shall be removed and replaced at no additional cost to the City.
- (g) 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. Formed surfaces shall receive, immediately after stripping and patching, the same curing as finished surfaces, with the exception of the Bridge deck overhang surfaces.
- (h) For curing of barriers, formwork shall remain in place for six (6) consecutive days following concreting. The top surface of the concrete surface shall be moist cured during this timeframe.
- (i) The sidewalk slab, pier cap, abutment and sleeper footing concrete shall be moist cured in accordance with E17.7.14(e).
- (j) Curing compound shall be applied at the rate specified by the Manufacturer for the accepted product. The compound must be applied uniformly.
- (k) Where curing compound is permitted, and following the completion of finishing operations, the surface shall be sprayed with an initial coating of curing compound, as per the Manufacturer's recommendations. As soon as initial set has occurred, the surface shall receive a second roller-applied application of curing compound, to the satisfaction of the Contract Administrator.

#### E17.7.15 Form Removal

- (a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to form removal. The Contractor shall not commence any form removal operations without the prior written acceptance of the Contract Administrator.

- (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 authorized by the Contract Administrator in writing.
- (c) Notwithstanding the above, the minimum strength of in-place concrete prior to removal of vertical forms shall be 70% percent of the 28 day strength, with the added provision that the member shall be of sufficient strength to safely carry its own weight, together with super-imposed construction loads..
- (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.

E17.7.16 Patching of Formed Surfaces

- (a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to removal of forms. Immediately after forms have been removed and before the Contractor commences any surface finishing or concrete patching operations, all newly exposed concrete surfaces shall be inspected by the Contract Administrator.
- (b) Any repair or surface finishing started before this inspection may be rejected and required to be removed.
- (c) Patching of formed surfaces shall take place within 24 hours of formwork removal.
- (d) 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.
- (e) 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, then applying bonding grout followed by patching mortar. Bonding grout shall be well brushed onto the area immediately prior to patching. When the bonding grout begins to lose the water sheen, the patching mortar shall be thoroughly trowelled into the repair area to fill all voids. It shall be struck off slightly higher than the adjacent concrete surface and left for one hour before final finishing to facilitate 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.
- (f) Concrete shall be cast against forms which will produce plane surfaces with no bulges, indentations, or protuberances other than those shown on the Drawings. All objectionable fins, projections, offsets, streaks, or other surface imperfections on the concrete surface shall be removed by means acceptable to the Contract Administrator. Cement washes of any kind shall not be used.
- (g) 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.

E17.7.17 Cold Weather Concreting

- (a) The requirements of CAN/CSA A23.1 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.

E17.7.18 Hot Weather Concreting

- (a) General
  - (i) The requirements of this section shall be applied during hot weather, i.e., air temperatures forecast to go higher than 27°C during placing.
  - (ii) Concrete at discharge shall be at as low a temperature as possible, preferably as low as 15°C, but not above 25°C. Concrete containing silica fume shall be between 10°C minimum and 18°C maximum at discharge. Aggregate stockpiles should 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 appear in the Mix Design Statement submitted to the Contract Administrator.
- (viii) Hot weather 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. Note that fog misting is mandatory for all structural deck and median slab pours 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 forecast to rise to 25°C or higher during the placing period, provisions shall be made by the Contractor 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, to the satisfaction of the Contract Administrator.
- (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 E17.2, "Acceptable Concrete Temperatures", for the indicated size of the concrete section.

TABLE E17.2: ACCEPTABLE CONCRETE TEMPERATURES		
THICKNESS OF SECTION, M	TEMPERATURES °C	
	MINIMUM	MAXIMUM
Less than:		
1	10	27
1.2	5	25

#### E17.7.19 Cleanup

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

#### E17.8 Concrete Quality

##### E17.8.1 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.

- (b) 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.
- (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

#### E17.8.2 Access

- (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

#### E17.8.3 Materials

- (a) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Quality Assurance 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 the latest edition and all subsequent revisions of CAN/CSA A23.1.
- (c) All testing of materials shall conform to the latest edition and all subsequent revisions of CAN/CSA A23.2.
- (d) All materials shall be submitted to the Contract Administrator for acceptance at least twenty (20) Business Days prior to its scheduled incorporation into any construction. 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.

#### E17.8.4 Quality Assurance and Quality Control

- (a) The Contract Administrator shall be afforded full access for the inspection and control and assurance 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.
- (b) The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.
- (c) The Contractor shall provide, without charge, the samples of concrete and the constituent materials required for Quality Assurance tests and provide such assistance and use of tools and construction equipment as is required.
- (d) Quality Assurance and Control tests will be used to determine the acceptability of the concrete supplied by the Contractor.
- (e) 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.
- (f) The frequency and number of concrete Quality Control tests shall be in accordance with the requirements of CAN/CSA A23.1. An outline of the quality tests is indicated below.

#### E17.8.5 Concrete Testing

- (a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits in E17.4.2, "Concrete Mix Design Requirements" 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.

- (b) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E17.4.2, "Concrete Mix Design Requirements" 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.
- (c) The air-void system shall be proven satisfactory by data from tests performed in accordance with the latest edition and all subsequent revisions of ASTM Standard Test Method C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C, 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.
- (d) Rapid chloride permeability testing shall be performed in accordance with ASTM C1202.
- (e) Testing for post-cracking residual strength index ( $R_i$ ) of 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 C1609-10. 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 C1399-07. The average of the peak loads during the reloading is the post cracking load of the concrete ( $P_{pcr}$ ). The  $R_i$  is equal to the ratio of  $P_{pcr}$  over  $P_{cr}$ . The Contractor shall submit a summary of the results of all post-cracking residual strength index tests, including all load deflection curves. Tests conducted in accordance to ASTM C1399- 07 will be considered invalid by the Contract Administrator if the initial crack in the specimen has occurred after 0.5mm deflection. Specimens shall be sampled in accordance with E17.8.5(f).
- (f) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method A23.2-1C, "Sampling Plastic Concrete".
- (g) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C, "Making and Curing Concrete Compression and Flexure Test Specimens".
- (h) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) 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, "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.
- (i) 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 E17.1 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, "Compressive Strength of

Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

**E17.8.6 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.

**E17.9 Measurement and Payment**

**E17.9.1 Structural Concrete**

Structural concrete will not be measured and will be paid for at the Contract Lump Sum Price for the "Items of Work" listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Items of Work:

Structural concrete:

- (i) Pier Caps
- (ii) Abutment Bearing Seats
- (iii) Abutment Wingwalls
- (iv) Approach Slabs
- (v) Structural Roadway Slab
- (vi) Deck and Backwalls
- (vii) Sidewalks
- (viii) Traffic Barriers

**E17.9.2 Moveable Deck and Approach Slab Hoarding**

Supplying, setting up, operating, and removing of the moveable deck hoarding will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Moveable Hoarding for Deck and Approach Slab Concrete", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E17.9.3 Anchor Units for Pedestrian Handrail**

Supplying and installing anchor units for the pedestrian handrails will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Anchor Units for Pedestrian Handrail", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E18. EXPANSION JOINTS**

**E18.1 Description**

- (a) This Specification shall cover the supply and installation of expansion joints and miscellaneous steel items, as specified herein and shown on the Drawings.
- (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 other things necessary for and incidental to the satisfactory performance and completion of all Work hereinafter specified.

## E18.2 Referenced Specifications and Drawings

- (a) The latest edition and subsequent revisions of the following:
  - (i) ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished;
  - (ii) ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings;
  - (iii) ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension;
  - (iv) ASTM D471 – Standard Test Method for Rubber Property – Effect of Liquids;
  - (v) ASTM D573 – Standard Test Method for Rubber – Deterioration in an Air Oven;
  - (vi) ASTM D1149 – Standard Test Methods for Rubber Deterioration – Cracking in an Ozone Controlled Environment;
  - (vii) ASTM D2240 – Standard Test Method for Rubber Property – Durometer Hardness;
  - (viii) CAN/CSA G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel;
  - (ix) CAN/CSA W59 – Welded Steel Construction (Metal Arc Welding);
  - (x) CAN/CSA G164-M92 – Hot Dip Galvanizing of Irregularly Shaped Articles; and
  - (xi) Ontario Provincial Standard Specification OPSS 1210 – Material Specification for Deck Joint Assemblies.

## E18.3 Scope of Work

- (a) The Work under this Specification shall involve:
  - (i) Supplying and installing the expansion joints;
  - (ii) Supplying and installing the expansion joint seals;
  - (iii) Completing a watertight verification of the expansion joint seals;

## E18.4 Submittals

- (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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) 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 proposed approved materials to be used.

## E18.5 Materials

### E18.5.1 General

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- (b) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

### E18.5.2 Handling and Storage of Materials

- (a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the latest edition and all subsequent revisions of CAN/CSA-A23.1.
- (b) Store materials under cover in a dry and clean location off the ground.

E18.5.3 Compression Seal

- (a) Expansion joints shall be of a compression seals where and as shown on the Drawings.
- (b) The compressions seal joints shall be an equivalent to Wabo Compression Seal WA-350, as specified in the Drawings, and supplied by D.S. Brown, Goodco, or Watson Bowman Acme Corp., or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".
- (c) The compression seals shall be installed as per the manufacturer's requirements.

E18.5.4 Epoxy Adhesive

- (a) Epoxy adhesive for concrete to steel bonding shall be one of the following approved products: 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, "Substitutes".

E18.5.5 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, Duralcrete, Dural 103 Gel, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".

E18.5.6 Cementitious Grout

- (a) Cementitious grout shall be nonshrink and non-metallic. Approved products are 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, "Substitutes". The minimum compressive strength of the grout at 28 days shall be 45 MPa

E18.6 Equipment

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.

E18.7 Construction Methods

E18.7.1 Installation

- (a) The Contractor shall install expansion joints as shown on the Drawings.

E18.7.2 Placement of Concrete at Expansion Joints

- (a) The expansion joints shall be set in position as per the Drawings and the manufacturer's requirements.

E18.7.3 Watertight Verification of Joint Seal

- (a) Prior to installing the expansion joint and sidewalk cover plates, the Contractor shall dyke off the approach slab expansion joints and maintain a minimum of 75 mm of water over all areas of the seal for a period of not less than four (4) hours, with no leakage. Any and all leaks shall be corrected, using mechanical or other adjustment of the bridge deck expansion joints to the satisfaction of the Contract Administrator. In no case shall caulk or other temporary devices or materials be used to seal leaks in the expansion joints. The Contract Administrator's decision in this regard shall be final.
- (b) Prior to commencing the test, the Contractor shall remove all expansion joints forming materials and debris from the deck and from the substructure units below. The Contractor shall provide safe access, acceptable to the Contract Administrator, to the pier tops for inspection of the expansion joints during the testing.

E18.8 Fabrication Warranty

- (a) Before final acceptance of the expansion joints by the Contract Administrator, the approach slab expansion joints supplier shall provide the City with a written warranty



stating that they will perform satisfactorily within the design range of movement and under the design loads for a period of five (5) years from the date of issuance of the Certificate of Acceptance (Certificate of Acceptance is issued after the successful completion by the Contractor of the Project's standard warranty period), provided that the expansion joints have been properly installed, acceptable to the Contract Administrator. The Supplier shall state that they have observed the installation and found it to be in accordance with their recommended procedure. The Supplier shall warranty the replacement of the expansion joints, including removal of the defective expansion joint assemblies and supply and installation of the replacement expansion joint, at no cost to the City, in the event that the joint does not perform satisfactorily within the design range of movement and under the design loads for a period of five (5) years from the date of issuance of the Certificate of Acceptance.

E18.8.2 Installation Warranty

- (a) The Contractor shall ensure that the expansion joints are installed in such a manner that will not void the fabrication warranty.
- (b) Similar to the expansion joint Supplier, and before final acceptance by the Contract Administrator, the Contractor shall warranty, in writing, the performance of the expansion joints for a period of five (5) years from the date of issuance of the Certificate of Acceptance (Certificate of Acceptance is issued after the successful completion by the Contractor of the Project's standard warranty period). Provide in the warranty for the replacement of the expansion joints at no cost to the City, including all direct and indirect costs in the event that the expansion joints do not perform satisfactorily in the range of design movement and under the design loads for a period of five (5) years from the date of issuance of the Certificate of Acceptance.

E18.9 Quality Control

E18.9.1 General

- (a) All workmanship and all materials furnished and supplied under this Specification are subject to the 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 Work.
- (b) 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.

E18.9.2 Access

- (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E18.9.3 Expansion Joint Seal Markings

- (a) All expansion joint seals shall be identified as to the Manufacturer by means of a continuous permanent mould mark. The mould marks shall be registered with the Contract Administrator and shall be used on all seals produced by the respective Manufacturer. The seal shall also be permanently marked, on the side of the seal, with the date of production and the batch/lot, at intervals of not more than 1.2 m.
- (b) The Contractor shall supply to the Contract Administrator a summary of the seals identifying the date of manufacture, the batch/lot, and the proposed installation location.

E18.10 Measurement and Payment

- E18.10.1 Expansion joints will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Supply and Install Expansion Joints", which price shall be

payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## **E19. BEARINGS**

### **E19.1 Description**

This Specification shall cover the supply and installation of the bearings, steel plates and retaining angles for the proposed bridge.

The work to be done 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.

### **E19.2 Scope of Work**

#### **E19.2.1 The Work under this Specification shall involve the following:**

- (a) Supply and installation of bearing pads at the abutments and piers

### **E19.3 Material**

#### **E19.3.1 General**

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator and shall be subject to inspection and testing by the Contract Administrator.
- (b) The contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

#### **E19.3.2 Materials**

##### **(a) Bearing Pads**

The bridge bearing pads shall be supplied and installed by the Contractor as shown on the Drawings.

##### **(i) Pier Bearing Pads**

Bearing pads shall be Goodco Laminated Elastomeric pads as shown on the Drawings or approved equivalent. Bearing pads shall have Shore A hardness of 60 Durometer.

##### **(ii) Abutment Bearing Pads**

Bearing pads shall be Goodco Natural Elastomeric pads as shown on the Drawings or approved equivalent. Bearing pads shall have Shore A hardness of 60 Durometer.

##### **(b) Grout**

Grout shall be non-metallic, non-shrink grout of a type approved by the Contract Administrator.

##### **(c) Elastomeric Shims**

Elastomeric shims shall be neoprene, with a Shore A hardness of 60 Durometer and be 2mm and 3mm thick

##### **(d) Adhesive**

The adhesive for bonding the shims shall be a long lasting, high strength, cold applied, air cured, water and heat resistant material specifically formulated for bonding neoprene and shall meet the following requirements:

Property	Requirement	ASTM Test Procedure
Adhesion	5.25 kN/m	D429, Method B
Hardness	50±5 Shore A points	D2240
Tensile Strength, min.	12.4 MPa	D412
Elongation before breaking, min.	750%	D412

#### E19.4 Equipment

- (a) All equipment shall be of a type approved by the Contract Administrator and shall be kept in good working order.

#### E19.5 Fabrication

- (a) Shop drawings showing details of bearings, completed with laminated and non-laminated bearing pads and steel bearing plates shall be provided to the Contract Administrator for approval. Submission of shop drawings to the Contract Administrator in no way relieves the Contractor of his responsibility for the fabrication quality and accuracy and proper installation of the bearing pads as indicated herein this Specification and on the Drawings.

#### E19.6 Guarantee

##### E19.6.1 Fabrication Guarantee

- (a) The bearing supplier shall provide a written guarantee stating that they will perform satisfactorily within the design range of movement and under the design loads for a period of five (5) years from the issuance of the Final Certificate, provided that the bearings have been properly installed. The supplier shall state that they have reviewed the installation procedures and find it in accordance with their recommendations. The supplier shall guarantee the replacement of the bearings at no cost to the City in the event that the bearings do not perform satisfactorily within the design range of movement and under the design loads.

##### E19.6.2 Installation Guarantee

- (a) The Contractor shall ensure that the bearings are installed in such a manner that will not void the fabrication guarantee.
- (b) The Contractor shall guarantee in writing, the performance of the bearings for a period of five (5) years from the date of issuance of the Final Certificate. Provided in the guarantee for the replacement of the bearings at no cost to the City in the event that the bearings do not perform satisfactorily in the range of design movement and under the design loads.

#### E19.7 Construction Methods

##### E19.7.1 Bearings

- (a) The bearings, complete with bearing retainer assemblies shall be installed by the Contractor prior to placing the girders.
- (b) Before erection of the bearings, the Contractor shall satisfy himself that the location of substructure units and elevations of bridge seats are in accordance with the plans and specifications. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.
- (c) Workmanship and finish shall be in accordance with plans and specifications and shall conform to the best practices of bridge construction. The parts shall be assembled as shown on the plans and all match marks shall be observed. The material shall be handled carefully so that no parts will be bent, broken or otherwise damaged.

- (d) The elastomeric bearings shall bear uniformly on all surfaces under full dead load. If uniform bearing is not present, the gaps beneath the bearing shall be filled with elastomeric shims. The Contractor, in the presence of the Contract Administrator, shall measure the gaps to determine the limits of the areas requiring shims.
- (e) The Contractor shall raise the superstructure and install shims as required to provide uniform bearing of the bearings. The individual shims shall be bonded to the elastomer portion of the bearing with adhesive applied over the entire shim interface. The surface preparation, application and curing of the adhesive shall be in accordance with the manufacturers recommendations. If shims in excess of 3mm are required, multiple shims shall be bonded together. Shimming of areas that vary in thickness shall be done by stepping the shims.

#### E19.8 Quality Control

- (a) All workmanship and all materials furnished and supplied under this Specification are subject to the close and systematic inspection by the Contract Administrator. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval 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 the specification.

#### E19.9 Measurement and Payment

- E19.9.1 Supply and place bearings will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for the "Items of Work" listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Items of Work:

Supply and place bearings:

- (a) Supply and Place Pier Bearings
- (b) Supply and Place Abutment Bearings

### **E20. HIGH PERFORMANCE CONCRETE (HPC) OVERLAY**

#### E20.1 Description

- (a) This Specification shall cover all operations relating to the preparation of Portland Cement structural concrete for, and all concreting operations related to, the construction of High Performance Concrete (HPC) Overlay Works, as specified herein and as shown on the Drawings.
- (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.

#### E20.2 Referenced Specifications and Drawings

- (a) The latest edition and subsequent revisions of the following:
  - (i) ASTM C157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete;
  - (ii) ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete;
  - (iii) ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete;
  - (iv) ASTM C494 – Standard Specification for Chemical Admixtures for Concrete;

- (v) ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete;
- (vi) ASTM C1202 – Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration;
- (vii) ASTM C1399 – Standard Test Method for Obtaining Average Residual- Strength of Fiber-Reinforced Concrete;
- (viii) ASTM C1609 – Standard Test Method for Flexural Performance of Fiber- Reinforced Concrete (Using Beam with Third Pont Loading);
- (ix) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
- (x) CAN/CSA A3001 – Cementitious Materials for Use in Concrete;
- (xi) CAN/CSA-S6 – Canadian Highway Bridge Design Code;
- (xii) City of Winnipeg By-Law No. 7070/97 Part 5 – Control of Discharge into Sewers;
- (xiii) ICRI Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers, and Polymer Overlays;
- (xiv) Ministry of Transportation Ontario MTO Lab Test Method LS 609 – Petrographic Analysis of Coarse Aggregate; and
- (xv) Ontario Provincial Standard Specification OPSS 1010 – Material Specification for Aggregates – Base, Sub-base, Select Subgrade, and Backfill Material.

#### E20.3 Scope of Work

- (a) The Work under this Specification shall involve the HPC overlay Works, placed on top of deck concrete.

#### E20.4 Submittals

##### E20.4.1 General

- (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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) 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 proposed materials to be used.

##### E20.4.2 Concrete Mix Design Requirements

- (a) The Contractor shall submit a concrete mix design statement to the Contract Administrator for the HPC overlay 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](http://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 ten (10) Business Days prior to the scheduled commencement of concrete placement for each of the concrete types. The concrete mix designs must be received by the City of Winnipeg a minimum of five (5) Business Days prior to the scheduled commencement of concrete placement for each 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 with CAN/CSA A23.1 Clause 4.3.2.3.2.
- (e) Any change in the constituent materials of the approved mix design shall require submission of a new concrete mix design statement, mix design, and 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 any necessary adjustments.

#### E20.4.3 Concrete Mix Design Test Data

- (a) Concrete
- (i) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, test data showing that the concrete to be supplied will meet the performance criteria stated in this Specification for each concrete type.
  - (ii) The Contractor shall submit at a minimum, the test data to prove that the minimum compressive strength, flexural strength for Fibre Reinforced Concrete (FRC) only, air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. In addition, test data shall be submitted to support requirements for post-cracking residual strength index ( $R_i$ ) and fibre dispersion in accordance with the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6, Section 16, Fibre Reinforced Structures, Clause 16.6. Testing for  $R_i$  of concrete shall be completed in accordance with E17.8.5(e).
  - (iii) Testing for air void system shall be completed in accordance with E17.8.5(c).
  - (iv) Testing for rapid chloride permeability shall be completed in accordance with E17.8.5(d).
  - (v) Testing for shrinkage strain shall be completed in accordance with E17.8.5(f).
  - (vi) 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 line should the Contractor choose to pump the concrete into place.
- (b) Aggregates
- (i) The Contractor shall furnish, in writing to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled

commencement of concrete placement, 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 A23.2-2A.
  - (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 Method 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 Method 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 A23.2-27A.
- (c) The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

#### E20.4.4 Notification of Ready Mix Supplier

- (a) The Contractor shall submit to the Contract Administrator the name and qualifications of the Ready Mix Concrete Supplier that he is proposing to use, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement. 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.

#### E20.4.5 Moveable Deck Hoarding

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of the HPC overlay 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 the HPC 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 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 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.

#### E20.4.6 HPC Overlay Pour Sequence and Schedule

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of the HPC overlay placement:
  - (i) The proposed sequence of construction for the placement of the HPC overlay.
- (b) The Contractor shall submit to the Contract Administrator for review, at least ten (10) Business Days prior to the placement of concrete, details of any proposed construction joints.
- (c) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the scheduled commencement of concrete placement, the proposed placement schedule for the HPC overlay.

### E20.5 Materials

#### E20.5.1 General

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- (b) The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

#### E20.5.2 Handling and Storage of Materials

- (a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the latest edition and all subsequent revisions of CAN/CSA A23.1.

#### E20.5.3 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 E20.1.



TABLE E20.1 REQUIREMENTS FOR HARDENED CONCRETE							
Type of Concrete	Location	Nominal Compressive Strength MPa	Class of Exposure	Air Content Category	Max Aggregate Size	Special Requirements	Minimum Post Residual Cracking Index
Type 5	High Performance Concrete (HPC) Overlay	50 @ 56 Days	C-XL	1	14 mm	Crushed Granite Aggregate; Synthetic Fibers; maximum Shrinkage Strain of 450 microstrains @ 56 Days;	0.15

#### E20.5.4 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 CAN/CSA Standard Test Method A23.2-27A. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA Standard Test Method A23.2-14A or A23.2-25A 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 CAN/CSA A23.1, 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 CAN/CSA A23.1, Table 12.

##### (c) Coarse Aggregate – Granite

- (i) Only coarse crushed granite aggregate shall be used for the HPC overlay.
- (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%.

E20.5.5      Admixtures

- (a) Air-entraining admixtures shall conform to the requirements of ASTM C260.
- (b) Chemical admixtures shall conform to the requirements of 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.

E20.5.6      Cementitious Materials

- (a) Cementitious materials shall conform to the requirements of CAN/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 CI or F and the substitution shall not exceed 30% 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.

E20.5.7      Water

- (a) Water to be used for all operations in the Specification, including the mixing and curing of concrete or grout, surface texturing operations, and saturating the substrate shall conform to the requirements of CAN/CSA A23.1 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.

E20.5.8      Synthetic Fibres

- (a) The synthetic fibres shall consist of 100% virgin polypropylene as accepted by the Contract Administrator. 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 with the Canadian Highway Bridge Design Code, CAN/CSA-S6, Section 16, Fibre-Reinforced Structures, Clause 16.6.

E20.5.9      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, "Substitutes".

E20.5.10     Bonding Agents

- (a) Latex Bonding Agent
  - (i) Latex bonding agent shall be Acryl-Stix, SikaCem 810, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes". Polyvinyl acetate-based latexes will not be permitted.
- (b) Bonding Grout
  - (i) grout for bonding the HPC overlay to the new concrete structural deck shall be mixed in an agitating hopper slurry pump and shall consist of the following constituents, by weight:
    - i. 1 part Water;
    - ii. 1 part latex bonding agent; and
    - iii. 1 ½ parts Type GUSF Portland Cement.

- (ii) The consistency of the bonding grout shall be such that it can be brushed onto the existing concrete surface in a thin, even coating that will not run or puddle in low spots.

E20.5.11 Miscellaneous Materials

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

E20.6 Equipment

E20.6.1 General

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E20.6.2 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.

E20.6.3 Finishing Machine for the HPC Overlay

- (a) Unless otherwise specified, an approved finishing machine complying with the following requirements shall be used.
- (b) A mechanical strike-off shall be required to provide a uniform thickness of concrete in front of the screed.
- (c) Design of the finishing machine, together with appurtenant equipment, shall be such that positive machine screeding to the plastic concrete will be obtained with 25 mm of at least 150 mm 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 150 mm.
- (d) Finishing machines that are approved for use for placing the HPC overlay are Bidwell Bridge Pavers and Gomaco Bridge Pavers.
- (e) The finishing machine shall have a paving carriage with strike-off auger, rotating cylinders, and a finishing pan.
- (f) 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.
- (g) 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.
- (h) 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.
- (i) Vehicles for transporting fresh concrete from the truck to the mechanical screed shall not travel directly on the surface of the new concrete structural deck.
- (j) The supply, set up, operation, and takedown of the finishing machine shall be considered incidental to the placement of the HPC overlay and no separate measurement or payment shall be made for this Work.

#### E20.6.4 Moveable Deck Hoarding

- (a) The moveable deck 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.
- (b) The rail system for the movable deck hoarding can be the same rail system used for the finishing machine and the Work Bridges, subject to the approval of the Contract Administrator.
- (c) 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.
- (d) The hoarding shall not be removed from overtop of a newly completed HPC overlay without first obtaining permission from the Contract Administrator.

#### E20.6.5 Moveable Work Bridges for HPC Overlay

- (a) At least two moveable Work Bridges will be required (one for finishing operations and one for curing operations), independent of the finishing machine, for the HPC overlay Works.
- (b) These moveable Work Bridges shall travel guided on rails supported clear of the finished Bridge deck.
- (c) 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.
- (d) 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.

### E20.7 Construction

#### E20.7.1 HPC Overlay

- (a) General
  - (i) The HPC overlay shall be constructed in accordance with the requirements of this Specification.
  - (ii) The new deck concrete, and any patching repairs thereto, shall reach a minimum compressive strength of 35 MPa, as determined by field-cured test cylinders, before the HPC overlay is placed.
- (b) Surface Preparation
  - (i) Following the completion of the deck and approach slab concrete, the Contractor shall conduct a final screed survey on the top of the concrete and submit elevations to the Contract Administrator.
  - (ii) The Contract Administrator shall finalize and provide elevations for the top of the HPC overlay. The Contract Administrator shall provide these elevations for the Contractor within five (5) Business Days from receipt of the final screed survey.
  - (iii) The new concrete deck and approach slab surface, onto which the HPC overlay concrete is to be placed shall be roughened as per ICRI Guideline No. 03732 CSP 6 (Medium Scarification).
  - (iv) It is permissible that the concrete surface may be prepared by rotomilling, as approved by the Contract Administrator. The entire rotomilled surface shall receive a high-pressure water blast to remove all surface microfractures to the satisfaction of the Contract Administrator.
  - (v) The time interval between the surface preparation and the placing of the HPC overlay concrete shall be kept to a minimum, and utmost care shall be taken to keep the prepared surfaces clean during the interval.

- (vi) Immediately before proceeding with each HPC overlay concrete 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.
- (vii) Placement of the HPC overlay concrete shall not be permitted when the surface moisture evaporation exceeds 0.75 kg/m<sup>2</sup>/h. Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator. The nomograph, Figure D1, Appendix D of CAN/CSA A23.1 shall be used to estimate surface moisture evaporation rates.
- (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:
    - i. 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; and
    - ii. 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 HPC 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 overlay previously placed shall be saw cut full depth to a minimum of 50 mm horizontally back from the formed joint location, to a straight and vertical edge against which the adjacent HPC overlay is to be placed, as approved by the Contract Administrator.
  - (ii) Immediately before placing the HPC overlay concrete, a thin coating of bonding grout shall be scrubbed into the clean, dry surface of the joint and Bridge deck. Care shall be exercised to ensure that all surfaces 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 fresh HPC overlay concrete.
  - (iii) The Contractor shall take every precaution necessary to secure a smooth-riding HPC overlay surface, within the tolerances indicated in E20.8.7 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 E20.2, "Minimum Requirement for Placing High Performance Concrete (HPC) Overlay", except when noted otherwise on the Drawings.

TABLE E20.2 MINIMUM REQUIREMENT FOR PLACING HIGH PERFORMANCE CONCRETE (HPC) 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 30 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 full depth a minimum 50 mm horizontally back from the discontinued joint location, and then shall be chipped out and thoroughly cleaned before placing further HPC 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 in writing 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 HPC overlay shall have a minimum thickness of 50 mm. Actual HPC overlay thickness may be greater. This would be to accommodate field adjustments for camber and deflection, and to accommodate variances in grade of the underlying structural deck.

- (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 HPC overlay 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 of the HPC Overlay
- (i) Immediately following finishing of the HPC overlay surface, apply fog misting until the concrete has enough strength to support the placement of the predampened curing 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 by 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, curing blanket.
  - (iii) Care shall be exercised to ensure that the 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 curing blankets does not run into areas where concrete placement and finishing operations are underway. If this occurs, the Contractor shall stop concrete placement operations until the problem is corrected to the satisfaction of the Contract Administrator.
  - (iv) The predampened curing blankets shall be a temperature of 20°C,  $\pm$  5°C, when applied to the deck.
  - (v) Failure to apply wet curing blankets within 40 minutes after the HPC overlay has been deposited shall be cause for rejecting the Works so affected. 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 curing blanket cure for at least seven (7) days. Water shall be applied as necessary to keep the concrete and curing blankets saturated. The Contractor must ensure the concrete and curing blankets are kept saturated with water for the entire seven (7) days.
  - (vii) As soon as the HPC overlay surface can be walked on without damaging the surface, as approved by the Contract Administrator, the 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 the HPC Overlay Surface

- (i) Grooves are to be parallel (within 2 mm) and cut perpendicular to traffic flow. Grooves shall only be cut into the HPC overlay surface following the curing.
- (ii) Saw cuts shall be 2.5 mm wide,  $6 \pm 2$  mm deep, and spaced 25 mm on centre.
- (iii) The area 600 mm from the low side of traffic barriers, and the area 600 mm from the high side of traffic barriers are not to be grooved and the grooves shall all end in a straight line parallel to the face of the traffic barrier.
- (iv) Saw cuts shall extend no closer than 200 mm to expansion joints and to any deck drains.
- (v) The Contractor shall supply all water for surface texturing operations strictly in accordance with Section E20.5.7 of this Specification. All run-off from grooving operations and suspended solids shall be collected at either end of the Bridge off the Bridge approach slabs, 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 to the HPC overlay Works specified herein, 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 (summer placement only) and the surface moisture evaporation rate is less than 0.75 kg/square metre per hour as determined by CAN/CSA A23.1, 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.

E20.7.2 Opening to Traffic

- (a) In no case shall traffic or construction equipment be allowed on the HPC overlay until it has reached a minimum of 60% of its design strength, as determined by concrete cylinders.
- (b) The Contract Administrator's decision as to when the concrete shall be opened to traffic shall be final. Prior to opening to traffic the HPC overlay shall be swept clean.

E20.8 Concrete Quality

E20.8.1 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.
- (b) 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.
- (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E20.8.2 Access

- (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.



### E20.8.3 Materials

- (a) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Quality Assurance 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 the latest edition and all subsequent revisions of CAN/CSA A23.1.
- (c) All testing of materials shall conform to the latest edition and all subsequent revisions of CSA A23.2.
- (d) All materials shall be submitted to the Contract Administrator for acceptance at least twenty (20) Business Days prior to its scheduled incorporation into any construction. 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.

### E20.8.4 Quality Assurance and Quality Control

- (a) The Contract Administrator shall be afforded full access for the inspection and control and assurance 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.
- (b) The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.
- (c) The Contractor shall provide, without charge, the samples of concrete and the constituent materials required for Quality Assurance tests and provide such assistance and use of tools and construction equipment as is required.
- (d) Quality Assurance and Control tests will be used to determine the acceptability of the concrete supplied by the Contractor.
- (e) 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.
- (f) The frequency and number of concrete Quality Control tests shall be in accordance with CSA A23.1. An outline of the quality tests is indicated below.

### E20.8.5 Concrete Testing

- (i) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits in E20.4.2, "Concrete Mix Design Requirements" 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.
- (ii) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E20.4.2, "Concrete Mix Design Requirements" 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.
- (iii) The air-void system shall be proven satisfactory by data from tests performed in accordance with the test method of the latest edition and all subsequent revisions of ASTM C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C, 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.

- (iv) Rapid chloride permeability testing shall be performed in accordance with ASTM C1202.
- (v) Testing for post-cracking residual strength index ( $R_i$ ) of 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 C1609-10. 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 C1399-07. The average of the peak loads during the reloading is the post cracking load of the concrete ( $P_{pcr}$ ). The  $R_i$  is equal to the ratio of  $P_{pcr}$  over  $P_{cr}$ . The Contractor shall submit a summary of the results of all post-cracking residual strength index tests, including all load deflection curves. Tests conducted in accordance to ASTM C1399-07 will be considered invalid by the Contract Administrator if the initial crack in the specimen has occurred after 0.5mm deflection.
- (vi) Testing for shrinkage strain shall take place for HPC overlay in accordance with ASTM C157.
- (vii) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C, "Sampling Plastic Concrete".
- (viii) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C, "Making and Curing Concrete Compression and Flexure Test Specimens".
- (ix) Compressive strength tests at fifty-six (56) days shall be the basis for acceptance of all concrete supplied by the contractor. For each 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, "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.
- (x) 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 E17.1, "Requirements for Hardened Concrete" 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, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.
- (xi) Notwithstanding CSA A23.2, cores taken from the HPC overlay must achieve at a minimum 85% of the specified concrete design strength.

#### E20.8.6

##### 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.

## E20.8.7 Surface Flatness Requirements

- (a) The surface of the HPC overlay 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 prior to the opening of the Bridge. The Contractor shall remove and replace the curing blankets, if required by the Contract Administrator, to undertake the necessary flatness testing and shall restore same immediately upon completion of the testing in each area, so as not to significantly disturb concrete curing, to the satisfaction of the Contract Administrator. The Contractor shall clear all materials and equipment from the deck surface during the testing.

## E20.9 Measurement and Payment

### E20.9.1 High Performance Concrete (HPC) Overlay

Supplying and placing the High Performance Concrete (HPC) will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Place High Performance Concrete (HPC) Overlay", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

### E20.9.2 Moveable Deck Hoarding

Supplying, setting up, operating, and removal of the moveable deck hoarding will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Moveable Deck Hoarding for High Performance Concrete (HPC) Overlay", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E21. SUPPLY, FABRICATION AND ERECTION OF MISCELLANEOUS METAL

### E21.1 Description

- (a) This specification shall cover all operations relating to the supply, fabrication, and erection of miscellaneous metal as shown or described on the Drawings and in this Specification. Miscellaneous metal includes, but is not limited to; retaining angles, bearing retaining plate assembly, prefabricated and pre-set anchors, galvanized steel

anchor bolts, fasteners washers and nuts, retaining plates, perforated stainless steel plate, stainless steel angles, and stainless steel bolts and anchors.

- (b) Quality control of materials and fabrication, including magnetic particle testing of welds.
- (c) Galvanizing of miscellaneous metal.
- (d) 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 other things necessary for and incidental to the satisfactory completion of all Work as hereinafter specified.

## E21.2 References and Related Specifications

- (a) All related specifications shall be current issued or latest revision at the first date of tender advertisement.

### E21.2.1 References

- 1) CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- 2) CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding
- 3) CSA W59, Welded Steel Construction (Metal Arc Welding)
- 4) CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles
- 5) CSA W47.1, Certification of Companies for Fusion Welding of Steel
- 6) ASTM A36, Standard Specification for Carbon Structural Steel
- 7) ASTM A53, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
- 8) ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- 9) ASTM A123, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
- 10) ASTM A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- 11) ASTM A276, Standard Specification for Standard Specification for Stainless Steel Bars and Shapes
- 12) A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- 13) ASTM A320, Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
- 14) ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- 15) ASTM A404, Standard Specification for General Requirements for Stainless Steel Bars, Billets and Forgings
- 16) ASTM A449, Standard Specification for Quenched and Tempered Steel Bolts and Studs
- 17) ASTM A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
- 18) ASTM A500, Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- 19) ASTM A514, Standard Specification for High- Yield- Strength, Clenched and Tempered Alloy Steel Plate, Suitable for Welding

- 20) ASTM A516, Standard Specification for Pressure Vessel Plates, Carbon Steel, For Moderate and Low Temperature Service
- 21) ASTM A517, Standard Specification for Pressure Vessel Plates, Alloy Steel, High Strength, Quenched and Tempered
- 22) ASTM A615, Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement
- 23) ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- 24) ASTM B22, Standard Specification for Bronze Castings for Bridges and Turntables
- 25) ASTM B29, Standard Specification for Refined Lead
- 26) ASTM B100, Standard Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use
- 27) ANSI B46.1, Surface Texture (Surface Roughness, Waviness, and Lay)
- 28) AASHTO/AWS D1.5M/D1.5, Bridge Welding Code
- 29) AWS D1.1, Structural Welding Code – Steel
- 30) AWS D1.6, Structural Welding Code – Stainless Steel

#### E21.3 Scope of Work

- (a) Supply and install galvanized retaining angles attached to the piers and the underside of the girders.
- (b) Supply and install galvanized pre-set, pre-fabricated retaining angle mounting plate and anchorage units into the pier to the retaining angles complete with galvanized bolts, nuts and washers.
- (c) Supply and install galvanized pier bearing retaining plate assemblies.
- (d) Supply and install ferrule anchors for the galvanized pier bearing retaining plate assemblies complete with galvanized anchor bolts, nuts and washers.
- (e) Supply and install perforated stainless steel plates, angles and anchors at the piers as shown on the Drawings.

#### E21.4 Submittals

##### E21.4.1 The Contractor shall submit the following to the Contract Administrator:

- (a) Copies of Mill Test Certificates showing chemical analysis and physical tests of all miscellaneous metal prior to commencement of fabrication. Miscellaneous metal without this certification will be rejected.
- (b) Certification of chemical analysis and physical tests for all materials.
- (c) A complete set of Shop Drawings prior to commencement of fabrication. The Contractor shall indicate on the Shop Drawings all the necessary material specifications for the materials to be used and identify the components in accordance with the Drawings and Specifications. Applicable welding procedures, stamped as approved by the Canadian Welding Bureau, shall be attached to the Shop Drawings. In no case will the Contractor be relieved of responsibility for errors or omissions in the Shop Drawings.
- (d) Manufacturer's test reports of mechanical tests on high strength bolts, if requested by the Contract Administrator.

## E21.5 Materials

### E21.5.1 General

- (a) The Contractor shall mark all materials to identify its material specification and grade. This shall be done by suitable marking or by a recognized colour coding.

### E21.5.2 Miscellaneous Metals

- (a) Miscellaneous metals shall conform to the material grades specified on the Drawings, and meet the requirements and satisfy the testing procedures of CSA G40.21.

### E21.5.3 Welded Steel Construction

- (a) Welded steel construction (Metal Arc Welding) shall conform to the requirements and satisfy the testing procedures of CSA W59 and Welded Highway & Railway Bridges - AWS D1.1 of The American Welding Society & Addendum.

### E21.5.4 Zinc

- (a) Zinc for hot dipped, galvanized coatings shall conform to the requirements of ASTM A123.

### E21.5.5 Stainless Steel

- (a) Stainless steel bolts, nuts, washers, inserts, and the like as shown on the Drawings shall conform to the requirements of ASTM A320, Grade B8, Class 2.
- (b) Stainless steel plates and perforated plates as shown on the Drawings shall be Type 316 or Type 316L, UNS S31600 or UNS S31603 and conform to the requirement for ASTM A240 and ASTM A666.
- (c) Stainless steel shapes, such as angles, shall be Type 316 or Type 316L, UNS S31600 or UNS S31603 and conform to the requirements of ASTM A276
- (d) Stainless steel pipe or tubing, not electrical conduit, shall be Type 316 or Type 316L, UNS S31600 or UNS S31603 and conform to the requirements of ASTM A312

### E21.5.6 Structural Inserts for Pier Bearing Retainer Assemblies

- (a) Structural inserts shall be Dayton Superior Type F-57 expanded coil ferrule insert, galvanized. Insert to come as a unit with 25mm diameter, 50mm long, A307 bolts, with lock washers, galvanized. Galvanizing to be in accordance with CSA G164.

## E21.6 Construction Methods

### E21.6.1 Fabrication

#### (a) General

- (i) The workmanship shall meet established practice in modern shops. Special emphasis shall be placed in prevention of cracks, notch-like flaws and bruises that may lower the structure's resistance to fatigue and brittle fracture.
- (ii) The punching of identification marks on members will not be allowed unless authorized in writing by the Contract Administrator.
- (iii) If damage occurs to the miscellaneous metal during fabrication, the Contract Administrator shall be notified immediately to facilitate the implementation of remedial measures. Remedial repair measures are subject to the approval of the Contract Administrator.
- (iv) Dimensions and fabrication that control field matching of parts shall receive careful attention in order to avoid field adjustments.
- (v) Field high-tensile bolted connections shall have all holes drilled or sub-punched and reamed using steel templates. Templates shall be located with utmost care as to position and angle and firmly bolted in place.
- (vi) Cutting shall be in accordance with AWS D1.1, D1.6 and CSA W59.

(b) Clean Material

- (i) The material shall be clean, free from rust, mill scale, and other foreign matter before being worked in the shop. Material shall be cleaned by wheelabrating, sandblasting or other methods subject to the Contract Administrator's approval.

(c) Finish

- (i) All portions of the Work shall be neatly finished. Shearing, cutting, chipping and machining shall be done neatly and accurately. Finished members shall be true to line and free from twists, bends, open joints, and sharp corners and edges.

(d) Bending

- (i) When bending is necessary in order to meet the requirements of the design, it shall be done with care and by methods subject to the approval of the Contract Administrator. The bend line shall be at right angles to the direction of rolling. The internal radius of bend of load carrying sections shall not be less than twice the thickness of the bend section when bent cold, and if a smaller radius of bend is essential, the material shall be bent hot and later annealed. Before bending, the edges of the section in the region of the bend shall be smoothed and rounded to a radius of 2 mm.

(e) Holes

- (i) General - Except where a specific method of holing materials is shown on the Drawings or required in the Special Provisions, all holes shall be either drilled or sub-punched and reamed with the exception of the holes and slots in the rectangular steel guardrail which may be punched. Poor matching holes will be cause for rejection.
- (ii) Punched Holes and Slots - For holes and slots punched full size, the diameter or size of the die shall not exceed that of the punch by more than 2 mm. All holes and slots which are punched shall have burrs and sharp edges removed. All holes shall be clean-cut without torn or ragged edges. The punching shall not distort the structural member. If required by the Contract Administrator, a sample of the punching operation shall be carried out to the satisfaction of the Contract Administrator prior to the start of fabrication.
- (iii) Drilled Holes - Drilling shall be done with twist drills or core drills, and all burrs and sharp edges shall be removed carefully. Care shall be taken to centre the drill accurately and to ensure that the hole is perpendicular to the member. Holes shall be clean-cut, without torn or ragged edges.
- (iv) Sub-Punched and Reamed Holes - All holes shall be sub-punched or sub-drilled to a diameter 5 mm smaller than the nominal hole diameter, and enlarged by reaming to the correct diameter. The diameter of the die shall not exceed the diameter of the punch by more than 2 mm. Holes shall be clean-cut without torn or ragged edges. Reamed holes shall be truly cylindrical and perpendicular to the member and all burrs shall be removed carefully. All reaming shall be done with twist reamers which shall be directed by mechanical means.
- (v) Allowable Tolerance for Holes - All matching holes for bolts shall register with each other so that a gauge 2 mm less in diameter than the hole shall pass freely through the assembled members in a direction at right angles to such members. Finished holes shall be not more than 2 mm in diameter larger than the diameter of the bolt passing through them unless otherwise specified by the Contract Administrator. The centre-to-centre distance between any two holes of a group of holes shall not vary by more than 1 mm from the dimensioned distance between such holes. Mispunched or misdrilled members shall not be corrected by welding.

(f) Welding

(i) Specifications

Welding shall conform to the requirements of the Structural Welding Code - Steel of the American Welding Society AWS D1.1 and addendum and CSA W59 Welded Steel Construction.

Welding of stainless steel shall conform to the requirement of the American Welding Society AWS D1.6.

(ii) Welding Operator Qualification

Welding operators shall be qualified in accordance with the requirements of C.W.B. at the time of fabrication for the processes that will be required as part of the Work.

Qualification shall have been issued within 2 years of commencement of fabrication. The reports of the results of the qualification tests shall bear the welding operator's name, the identification mark he will use and all pertinent data of the tests. Evidence that the welding operators have been executing satisfactory welding in the required processes within the six (6) month period immediately prior to commencement of fabrication shall also be provided to the Contract Administrator. The Contractor shall bear the whole cost and be fully responsible for the qualification of all welding operators.

(iii) Welding Procedures, Specifications and Qualification

Welding procedures that conform in all respects to the approved procedures of AWS D1.1, D1.6 and CSA W59 shall be deemed as pre-qualified and are exempt from tests or qualifications.

Welding procedures that do not conform to approved procedures in AWS D1.1, D1.6 and CSA W59 shall be qualified by tests carried out in accordance with AWS D1.1 or D1.6. The Contract Administrator may accept previous qualifications of the welding procedure.

(iv) Welding Materials

All electrodes for manual shielded metal arc welding shall conform to the low hydrogen classification requirements of the latest edition of the American Welding Society's Filler Metal Specification AWS A5.1 or AWS A5.5 and the CAN/CSA W48 Specification and be capable of producing weld metal having an impact strength of at least 27 J (Charpy V-Notch) at -18°C. All bare electrodes and flux used in combination for submerged arc welding, the electrode and gas shielding used in combination for gas metal-arc welding, or the electrode and shielding medium used in combination for flux cored arc welding of steels shall conform to the requirements in the latest edition of the American Welding Society AWS A5.17, A5.18 or A5.20 and CAN/CSA W48 and be capable of producing weld metal having a minimum impact strength of 27 J (Charpy V Notch) at -18°C or shall be capable of producing low alloy weld metal having the mechanical properties listed in Table 4.1.1 of AWS D1.1.

Low alloy weld properties shall be determined from a multiple pass weld made in accordance with the requirements of the latest edition of the applicable Specification (AWS A5.17, A5.18, or A5.20) or the welding procedure specification. Every user shall demonstrate that each combination of electrode and shielding medium will produce weld metal having the above mechanical properties until the applicable AWS Filler Metal Specification is issued. At that time, the AWS Filler Metal Specification will control. The test assembly for Grades E100XX and E110XX shall be made using CAN/CSA G40.21M 700Q or ASTM A514/A517 steel. The Contract Administrator may accept evidence of record of a combination that has been satisfactory tested in lieu of the test required, provided the same welding procedure is used.

Electrodes conforming to AWS A5.1 shall be purchased & delivered in hermetically sealed containers or shall be dried for at least two (2) hours between 230°C and 260°C before they are used. Electrodes conforming to



AWS A5.5 shall be purchased & delivered in hermetically sealed containers or shall be dried 1 hour + 15 min. at a temperature of  $425^{\circ}\text{C} + 15^{\circ}\text{C}$  before being used. All electrodes for use in welding ASTM A514/A517 and CSA 700 Q. steel having a strength lower than that of the E100XX classification shall be dried for 1 hour + 15 min. at a temperature of  $425^{\circ}\text{C} + 15^{\circ}\text{C}$  before being used.

Electrodes shall be dried prior to use if the hermetically sealed container shows evidence of damage. Immediately after removal from hermetically sealed containers or from drying ovens, electrodes shall be stored in ovens held at a temperature of at least  $120^{\circ}\text{C}$ . E70XX electrodes that are not used within four (4) hours, E80XX within 2 hours, E90XX within one (1) hour, and E100XX and E110XX within 0.5 hours after removal from hermetically sealed containers or removal from a drying or storage oven shall be re-dried before use. In humid atmospheres, these time limits will be reduced as directed by the Contract Administrator. Electrodes that have been wet shall not be used. Electrodes shall be re-dried no more than once.

Flux used for submerged arc welding shall be non-hygroscopic, dry and free of contamination from dirt, mill-scale, or other foreign material. All flux shall be purchased in moisture-proof packages capable of being stored under normal conditions for at least six (6) months without such storage affecting its welding characteristics or weld properties.

Flux from packages damaged in transit or handling shall be discarded or shall be dried before use at a minimum temperature of  $120^{\circ}\text{C}$  for 1 hour. Flux shall be placed in the dispensing system immediately upon opening a package. If flux is used from an open package or an open hopper that has been inoperative for four (4) hours or more, the top 25 mm shall be discarded. Flux that has been wet shall not be used. Flux fused in welding shall not be reused.

(v) Preheat and Interpass Temperature

The minimum preheat and interpass temperatures for welding miscellaneous metal shall conform to AWS D1.1, D1.6 and CSA W59.

(vi) Welding Processes

Welding processes which do not conform to the provisions of AWS D1.1, D1.6 or CSA W59 shall not be used without the written approval of the Contract Administrator.

(vii) Distortion and Shrinkage Stresses

Distortion and shrinkage stresses shall be kept to a minimum by the use of jigs and fixtures, utilizing heat distribution and a welding sequence. Areas contiguous to welding operations shall be preheated to a maximum temperature of  $120^{\circ}\text{C}$ , if necessary in the estimation of the Contract Administrator to prevent distortion or weld cracking.

The provisions of AWS D1.1, D1.6 and CSA W59 shall be followed in the control of distortion and shrinkage stresses.

(viii) Tack Welding

All tack welds shall be a minimum of 10 mm in length and made with low hydrogen electrodes and shall not be incorporated in the final structure without specific written authorization by the Contract Administrator.

(ix) Hot-Dip Galvanizing

Galvanizing, when called for on the Drawings, shall be done in accordance with CAN/CSA G164.

All metal surfaces to be galvanized shall be cleaned thoroughly of rust, rust scale, mill scale, dirt, paint and other foreign material by commercial sand, grit or shop blasting or pickling prior to galvanizing. Heavy deposits of oil and grease shall be removed with solvents prior to blasting or pickling.

#### E21.6.2 Handling, Delivery and Storage of Materials

- (a) Precautionary measures shall be taken to avoid damage to miscellaneous metal during handling, transit, stockpiling and erecting. Pinholes, or other field connection holes shall not be used for lifting purposes. Special attention is directed to the shipping and storing of miscellaneous metal.
- (b) Damaged parts shall not be installed in the structure and may be rejected at the discretion of the Contract Administrator.
- (c) (a) Materials that are not placed directly in the structure shall be stored above probable high water, on skids, platforms or in bins in a manner that will prevent distortion or the accumulation of water or dirt on the miscellaneous metal. The materials shall be kept separate and stored properly for ease of inspection, checking and handling and shall be drained and protected from corrosion.

#### E21.6.3 Erection

Layout Before erection of miscellaneous metal, the Contractor shall satisfy himself that the installation locations are in accordance with the Drawings and specifications. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.

- (a) Workmanship
  - (i) The parts shall be assembled as shown on the Drawings and all match marks shall be observed. The material shall be handled carefully so that no parts will be bent, broken or otherwise damaged. Hammering which will injure or distort the member is not permitted.
- (b) Misfits and Field Fitting
  - (i) Misfits of any part or parts to be erected under this Specification may be cause for rejection. No field fitting shall be undertaken by the Contractor until the cause for misfit of parts has been determined and the Contract Administrator, so informed, has given direct approval to accept the Contractor's proposed corrective measures. The Contract Administrator's decision as to the quantity of such work to be performed at the Contractor's expense will be final and binding.
- (c) Field Welding
  - (i) All field welding shall be electric arc welding, and shall be carried out in accordance with the Drawings, AWS D1.1 and CSA W59.
- (d) Final Cleaning
  - (i) All metal surfaces shall be left free of dirt, dried concrete, debris or foreign matter to the satisfaction of the Contract Administrator.

#### E21.7 Quality Control / Quality Assurance

##### E21.7.1 Quality Control

The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Work. All miscellaneous metal shall be free of surface imperfections, pipes, porosity, laps, laminations and other defects.

- (a) Welding
  - (i) All welding may be subject to inspection by Non-Destructive Testing. This inspection shall be carried out in a manner approved of the Contract Administrator. The Contractor shall provide sufficient access and shop area to permit the performance of the tests. The Contractor shall give the Contract Administrator not less than 24 hours notice of when work will be ready for testing and shall advise the Contract Administrator of the type and quantity of work that will be ready for testing.
  - (ii) All defects revealed shall be repaired by the Contractor at his own expense and to the approval of the Contract Administrator.

#### E21.7.2 Quality Assurance

- (a) All materials will be subject to physical inspection by the Contract Administrator and will be subject to rejection during the course of the Work and for the length of time as specified in the General Conditions, if, in the opinion of the Contract Administrator, the materials involved do not meet the requirements of the Drawings and this Specification.
- (b) All materials shall be subject to testing by the Contract Administrator and will be approved only if the requirements of the Drawings, standards and this Specification are met. The Contractor shall supply the specimens for testing in accordance with the requests of the Contract Administrator.
- (c) The Contractor shall furnish facilities for the inspection of material and workmanship in the mill, shop and field, and the Contract Administrator shall be allowed free access to the necessary parts of the works.

#### E21.8 Measurement and Payment

- E21.8.1 Supply, fabrication and erection of miscellaneous metal will not be measured and will be paid for at the Contract Lump Sum Price for "Miscellaneous Metal", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

### **E22. ALUMINUM PEDESTRIAN HANDRAIL**

#### E22.1 Description

- (a) This Specification shall cover all operations relating to the supply and installation of the aluminum pedestrian handrail and artwork as specified herein and as shown on the Drawings.
- (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 other things necessary for and incidental to the satisfactory completion of all Work as hereinafter specified.

#### E22.2 Referenced Specifications and Drawings

- (a) The latest edition and subsequent revisions of the following:
  - (i) ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate;
  - (ii) ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes;
  - (iii) ASTM B276 – Standard Specification for Stainless Steel Bars and Shapes;
  - (iv) ASTM D1187 – Standard Specification for Asphalt-Base Emulsions for use as Protective Coatings and Metal;
  - (v) CAN/CSA W47.2 – Certification of Companies for Fusion Welding of Aluminum;
  - (vi) CAN/CSA W59.2 – Welded Aluminum Construction; and
  - (vii) CAN/CSA S157 – Strength Design in Aluminum.

#### E22.3 Scope of Work

- (a) The Work under this Specification shall involve:
  - (i) Supplying and installing the aluminum pedestrian handrail;
  - (ii) Supplying and installing aluminum art along the length of the aluminum pedestrian handrail;
  - (iii) Supplying and installing miscellaneous steel items and other items associated with the Work.

#### E22.4 Submittals

- (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 scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of any fabrication, the proposed Shop Drawings showing all fabrication details of the aluminum pedestrian handrail and artwork. Fabrication shall take place as shown on the Drawings.
- (c) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the scheduled commencement of any fabrication, the operator's qualifications detailed in E22.8, "Quality Control" and mill certificates.
- (d) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of any fabrication, the proposed welding procedures and welding consumable certificates. The Contractor shall submit copies of the welding procedures which he intends to use, for examination and acceptance by the Contract Administrator.
  - (i) The Contractor shall submit copies of the welding procedures which he intends to use, for examination and acceptance by the Contract Administrator.
  - (ii) Such procedures shall be accompanied by documentary proof that they have been qualified previously by the Canadian Welding Bureau at the plant where the Work is to be carried out.
  - (iii) The procedures shall include the following information: joint type, welding process, welding position, base metal specification, welding consumable specification and size, preheat requirements, amperage and voltage requirements, speed, polarity, and welding equipment, including a description of travel for automatic welding.

#### E22.5 Materials

##### E22.5.1 General

- (a) This Specification shall cover all operations relating to the repair of miscellaneous areas of abutment Bridge deck and precast concrete girder concrete, as specified herein and as shown on the Drawings.
- (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.

##### E22.5.2 Handling and Storage of Materials

- (a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

##### E22.5.3 Material for the Aluminum Pedestrian Handrail and Art

- (a) Extruded Shapes or Drawn Tubing for Rails and Posts: shall conform to the latest edition and all subsequent revisions of CAN/CSA Aluminum Alloy and Temper HA.5 SG 11 R-T6 (ASTM B221 Alloy 6351-T6), or HA.7 GA 11 M-T6 (ASTM B221 Alloy 6061-T6).
- (b) Aluminum sheet, bar, support pin, angle, and plate shall conform to the latest edition and all subsequent revisions of ASTM B221- Alloy 5083, ASTM B209 Alloy 6061-T6 or Alloy 6351-T6.
- (c) Aluminum plates for the artwork shall conform to the requirements of the latest edition and all subsequent revisions of ASTM B221 Alloy 5083.
- (d) Bolts and cap screws, nylon lock nuts, and washers - stainless steel conforming to ASTM A276, Type 316.

E22.5.4 Bituminous Paint

- (a) Bituminous paint shall be an alkali-resistant coating and conform to the requirements of ASTM D1187. Supply of bituminous paint shall be considered incidental to the supply of aluminum pedestrian handrail.

E22.5.5 Handrail Anchorage System

- (a) The pre-set handrail anchorage units are specified, measured and paid for in accordance with E17, "Structural Concrete".
- (b) The anchor bolts drilled in to the coping of the retaining wall between the proposed bridge structures are to be Hilti Hit HY 150 Max adhesive and HAS 316 SS Rods with stainless steel nut and washer.

E22.5.6 Aluminum Shims

- (a) Aluminum shims shall conform to ASTM Standard B221, Alloy 6061-T6, and shall be supplied as required to facilitate the installation of the rail posts as shown on the Drawings. Supply of shims will be considered incidental to the supply of aluminum pedestrian handrail.

E22.5.7 Aluminum Filler Alloys for Welded Construction

- (a) Aluminum filler alloys for welded construction shall be one of the following: ER4043, ER5183, ER5356, ER5554, ER5556, or ER5654.

E22.6 Equipment

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be in good working order.

E22.7 Construction Methods

E22.7.1 Layout

- (a) Before fabrication and/or installation of the aluminum pedestrian handrail, art gateway panels, and art balusters, the Contractor shall satisfy himself of all required aluminum rail and enclosure section dimensions, by field measurements.

E22.7.2 Fabrication

(a) General

- (i) No fabrication shall commence until permission to do so has been received from the Contract Administrator.
- (ii) All fabrication shall be carried out in accordance with this Specification and the Drawings.
- (iii) The Contractor shall fabricate the entire aluminum pedestrian handrail in sections, to permit the installation of the rail sections onto the concrete.
- (iv) The punching of identification marks on the members will not be allowed.
- (v) Any damage to members during fabrication shall be drawn to the attention of the Contract Administrator in order that the Contract Administrator may accept remedial measures.
- (vi) Dimensions and fabrication details which control the field matching of parts shall receive very careful attention in order to avoid field adjustment.
- (vii) Components of the railings and enclosures shall be joined by means of bolt, cap screws, and welds as called for on the Drawings.

(b) Sample Panel

- (i) The Contractor shall be required to supply one completely fabricated handrail sample panel, including at least two posts and one art piece to the Contract Administrator and receive acceptance of the sample panel from the Contract Administrator prior to proceeding with the fabrication of the remainder. The sample, once accepted, shall be identifiable for the duration of the Project, but

may be incorporated into the rail system. It shall become the standard for acceptance of all aluminum pedestrian handrail panels.

(c) Cutting

- (i) Material 13 mm thick or less may be sheared, sawn, or cut with a router. Materials more than 13 mm thick shall be sawn or routed. Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided whenever possible. If used, they shall be filleted by drilling prior to cutting. Flame cutting of aluminum alloys is not permitted.

(d) Welding

- (i) Welded construction shall conform to the requirements of the latest edition and all subsequent revisions of CAN/CSA W59.2, Welded Aluminum Construction and W47.2, Certification of Companies for Fusion Welding of Aluminum.
- (ii) Welding will be done by qualified welders using the Metal Inert Gas (MIG) process. All areas to be welded should be thoroughly cleaned with a suitable solvent followed by wire brushing if surfaces are heavily oxidized. The size of fillet for equal leg fillet welds is defined as the leg length of the largest isosceles right angle triangle which can be inscribed within the fillet weld section. Welds must penetrate into the root corner. All butt welds should have full penetration to ensure maximum strength. Defective welds should be repaired by chipping out the defective area and re-welding. Particular care must be paid to the elimination of craters and cold starts.
- (iii) Welders and procedure should be qualified as agreed between the Contract Administrator and the Contractor. The minimum requirements for mechanical test results of joints butt welded with Alcan 56S filler alloy shall be 259 MPa for Alcan D45S-H1 1A and 165 MPa for Alcan B51S-T4 alloy. In addition to the mechanical tests, soundness tests should be made as follows:
  - a. Guided Bend Test: All bend tests should be fully guided through an angle of 180°. Root, face, and side bend tests in Alcan D54S parent alloy welded in Alcan 56S filler wire require a bend radius of 2T where T is the thickness of the material. For Alcan B51S parent alloy welded with 56S filler wire, a bend radius of 4T is required. Root bend and face bend specimens on material 10 mm thick and less should be 305 mm long and a minimum of 25 mm in width and cut from a plate having a minimum butt weld length of 450 mm. No test piece should be taken within 25 mm of the ends of the weld. Side bend tests should be carried out on material over 10 mm in thickness.
  - b. Specimens should be 10 mm in width. Longitudinal edges should be given in 2mm radius. There should be no crack greater than 3 mm in length. If a crack starts from an edge, the specimen should be disregarded.
  - c. Fracture Test: The butt-welded joint shall have a notch not exceeding 2 mm in depth sawn on the four sides of the weld bend and the weld broken. Inspection of the fracture should reveal no gas pockets or inclusions greater than 2 mm in diameter and the area lost due to scattered gas, porosity or voids should not exceed 3% of the area under inspection.

(e) Bolting

- (i) Bolt holes in 10 mm or thinner material may be drilled or punched to finished size. In material thicker than 10 mm, the holes shall be drilled to finished size or subpunched smaller than the normal diameter of the fastener and reamed to size.
- (ii) The finished diameter of the holes shall be not more than 7 percent greater than the nominal diameter of the fastener, except:

- a. Slotted holes for expansion purposes shall be provided as required on the Drawings
  - b. Holes for anchor bolts may be up to 50 percent greater than the nominal bolt diameter with a maximum of 13 mm greater than the nominal bolt diameter.
  - c. Holes shall not be drilled in such a manner as to distort the metal, but holes only slightly misaligned may be reamed to render a reasonable fit.
- (iii) In all bolts, the finished shank shall be long enough to provide full bearing, and washers shall be used under the nuts to give full grip when the nuts are tightened.

E22.7.3 Aluminum Art

- (a) The aluminum art shall be fabricated as shown on the Drawings.

E22.7.4 Installation of Aluminum Pedestrian Handrail

- (a) The aluminum pedestrian handrail shall be brought on-site and accurately installed as shown on the Drawings.
- (b) The rails shall be set true to the line and grade as shown on the Drawings or as required by the Contract Administrator.
- (c) The material shall be carefully handled so that no parts will be bent, broken or otherwise damaged. Hammering which will injure or distort the member is not permitted. The Contractor shall report to the Contract Administrator any corrective measures.
- (d) Except where shown on the Drawings, field welding shall not be permitted unless acceptable to the Contract Administrator. The rail posts shall be set on aluminum shims, as required, to achieve the correct elevation and grade. Additional aluminum shims shall be installed as required to achieve the correct elevation and grade. A minimum 3 mm aluminum shim shall be installed under each post.

E22.7.5 Installation of Aluminum Art

- (a) The aluminum art shall be accurately installed as shown on the Drawings.
- (b) The aluminum art panels shall be shop installed as shown on the Drawings prior to delivery to the Site.
- (c) Except where shown on the Drawings, field welding shall not be permitted unless acceptable to the Contract Administrator.

E22.8 Quality Control

- (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 Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspecting 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.
- (b) 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.

E22.8.1 Access

- (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator

or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

**E22.8.2 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 for any materials taken by the Contract Administrator for testing purposes.

**E22.9 Measurement and Payment**

**E22.9.1 Aluminum Pedestrian Handrail**

**E22.9.2** Supplying and Installing the aluminum pedestrian handrail will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Supply and Install Aluminum Pedestrian Handrail", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E22.9.3 Aluminum Art**

**E22.9.4** Supplying and Installing the aluminum art gateway panels will be measured on unit basis and will be paid for at the Contract Unit Price per unit for "Supply and Install Aluminum Art", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E23. BRIDGE ALUMINUM BALANCED BARRIER**

**E23.1 Description**

- (a) The specification shall amend and supplement City of Winnipeg specification CW 3650.

**E23.2 Scope of Work**

- (a) The Work under this Specification shall involve:
  - (i) Supply and installation of the bridge aluminum balanced barriers on the concrete traffic barriers and along Sturgeon Road.
  - (ii) Supply and installation of the anchors for the bridge aluminum balance barriers on the concrete traffic barriers.

**E23.3 Submissions**

- (a) At least fourteen (14) days prior to the scheduled commencement of any fabrication, the qualifications of Contractor, the qualifications of operator, the shop drawings, mill certificates, welding procedures, and welding consumable certificates shall be submitted to the Contract Administrator for his acceptance.
- (b) The shop drawings shall consist of three (3) sets of full size prints and one (1) reproducible sepia set.
- (c) The shop drawings shall clearly show shapes, dimensions, detail, connection (including proper CSA welding identification), bolt holes, and accessories.

**E23.4 Materials**

- (a) Rail posts for the aluminum balance barrier on the concrete traffic barriers shall be fabricated in accordance with the Drawings and E21, "Supply, Fabrication and Erection of Miscellaneous Metals."
- (b) The anchors for the aluminum balance barrier on the concrete traffic barriers shall be in accordance with the Drawings and E21, "Supply, Fabrication and Erection of Miscellaneous Metals."



## **E23.5 Measurement and Payment**

- E23.5.1 Supplying and installing the bridge aluminum balanced barrier will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Bridge Aluminum Balance Barrier", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## **E24. SILT FENCE BARRIER**

### **E24.1 Description**

- E24.1.1 This Specification shall cover all operations relating to the work necessary for the supply, installation and maintenance of silt fence barriers, as herein specified.
- E24.1.2 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 works as hereinafter specified.

### **E24.2 Materials**

- E24.2.1 The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.
- E24.2.2 The silt fence fabric shall be proposed by the Contractor and approved by the Contract Administrator.
- E24.2.3 The stakes shall be of sufficient strength to satisfy silt fence barrier performance and maintenance requirements. The stakes shall be a minimum of 1.2 metres in length with a maximum spacing of 2.5 metres between stakes.

### **E24.3 Construction Methods**

- E24.3.1 The locations of the reinforced silt fence barriers are shown on the Plans, but the final locations of the silt fence barriers will be dependent on site conditions, the Contractor's activities and methods of construction and on direction of the Contract Administrator.
- E24.3.2 The different types of reinforced silt fence barriers are required under the following conditions:
- (a) The sandbag reinforced silt barrier (frozen ground conditions) is required to isolate all works at or near the waterway during freezing/ice conditions.
  - (b) The chained reinforced silt barrier.
- E24.3.3 Sandbag Reinforced Silt Barrier
- (a) Sandbags shall be filled with a type of sand as recommended by the sandbag supplier. When lying flat the filled sandbags shall measure not less than 250mm (width) by 450mm (length) by 180mm (height).
- E24.3.4 Chained reinforced silt barrier
- (a) Posts shall be spaced a maximum of 2.5 m apart, and shall be driven vertically into the ground to a minimum depth of 600 mm.
  - (b) A trench measuring approximately 200 mm wide by 200 mm deep shall be excavated along the entire line of stakes. The trench shall be on the side of the stakes where grading work is to be conducted.
  - (c) The geotextile from the silt fence shall extend into the trench a minimum of 300 mm. The prefabricated silt fence shall be installed without sags and have an overlap of 450 mm wherever its length is extended.

- (d) The trench shall be backfilled and tamped to existing grade so as to hold the base of the geotextile firmly in place. The completed silt fence barrier shall have a minimum height of 600 mm above the ground surface.

#### E24.4 Maintenance

- E24.4.1 All silt fences shall be inspected immediately after runoff event and at least daily during prolonged rainfall or runoff. Any required repairs shall be made immediately. The silt fence barriers shall be maintained in place, without gaps, and without undermining, so as to prevent sediment passage through or under the barrier. Silt fence barriers shall be maintained vertical without tears and without sagging and maintain a 450 mm overlap on seams.
- E24.4.2 Accumulated sediment shall be removed at the direction of the Contract Administrator in a manner that avoids escape to the downstream side of the barriers. Sediment shall be removed to the level of the grade existing at the time of barrier installation and shall conform to the following:
  - (a) accumulated sediment shall be removed when it reaches a depth of one-half the height of the silt fence barrier;
  - (b) accumulated sediment shall be removed as necessary to perform maintenance repairs;
  - (c) accumulated sediment shall be removed immediately prior to the removal of the silt fence.

#### E24.5 Measurement and Payment

- E24.5.1 Supplying and placing silt fence barrier will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Silt Fence Barrier", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

### E25. MODULAR BLOCK RETAINING WALL

#### E25.1 Description

- (a) This specification shall cover all operations related to the supply and installation of modular block retaining walls, as herein specified.
- (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 other things necessary for and incidental to the satisfactory performance and completion of all work hereinafter specified.

#### E25.2 Scope of Work

- E25.2.1 The Work under this Specification shall involve:
  - (a) Design, supply and installation of all materials required for the modular block retaining wall.
  - (b) Material Limits
    - (i) The material limits pertaining to the modular block retaining wall are as per the Drawings. All materials within the limits shown on the Drawings shall be considered incidental to the payment item for the modular block retaining wall.
- E25.2.2 Contractor shall design and implement the required connections or details between the modular block retaining wall and the temporary grade separation wall to facilitate the phasing and construction of the Work as described, measured and paid in E11 "Temporary Grade Separation Wall".

#### E25.3 Materials

##### E25.3.1 Modular Blocks

- (a) Concrete blocks to be DuraHold 305 mm (H) x 610 mm (D) x 1830 mm (L), natural concrete, by RisiStone Retaining Wall Systems available through Barkman Concrete, or as approved by the Contract Administrator.

E25.3.2 Granular Base Material

- (a) Base material to consist of sound, hard, crushed rock in accordance with CW 3110 Base Course Material.

E25.3.3 Granular Free Draining Material

- (a) The draining material shall be Coarse Aggregate in accordance with the requirements of E17, "Structural Concrete."

E25.3.4 Granular Fill Material

- (a) The granular fill material shall be base material in accordance with E25.3.2.

E25.4 Submittals

E25.4.1 Contractor to submit design drawings and calculations, sealed by a Professional Engineer Registered in Manitoba experienced in the design of modular block retaining walls, to Contract Administrator for review no later than twenty (20) days prior to wall installation. Details to include:

- (a) Plan of entire length of wall;
- (b) Elevation of wall indicating top and bottom of wall elevations;
- (c) Sections through walls;
- (d) All vertical and horizontal break points and running dimensions to break points;
- (e) Designation of type and size of blocks including caps;
- (f) Limits and extent of reinforced fill volume;
- (g) Length, size, type and elevation of every layer of geogrid reinforcement;
- (h) Running dimension to changes in length of the geogrid reinforcement;
- (i) The original and final ground elevations;
- (j) Location of drain lines within geogrid reinforcement;
- (k) Without written consent from the Contract Administrator the modular block wall material shall be as noted in this Specification and on the Drawings. All other materials, type of materials, dimensions of materials and configurations shall be confirmed and determined by the Contractor. This information shown on the Drawings was determined through a preliminary design and shall not be considered final.
- (l) The Geotechnical Report will be supplied to Contractor such that the modular block wall design can be completed.
- (m) The top of wall elevations are to be as shown on the Drawings unless approved, in writing, by the Contract Administrator.
- (n) Construction methods required for the construction of the modular block wall.
- (o) General notes required for construction.

Samples of modular concrete blocks and soil reinforcing materials to be submitted twenty (20) days prior to wall installation.

E25.5 Construction Methods

- (a) Construction methods to be confirmed by the Contractor.
- (b) Compact subgrade to minimum 98% of standard proctor density prior to placement of wall foundation/base course material.

- (c) Granular base to be compacted to thicknesses and dimensions indicated on the Drawings in layers not exceeding 150 mm. Compact Granular Base to 98% of standard proctor density.
- (d) Moisture content of backfill material before and during compaction shall be uniformly distributed throughout each layer and shall be within about 3% of optimum.
- (e) Only lightweight, hand operated compaction equipment shall be allowed within 600 mm of the face of the concrete units.
- (f) Tracked construction equipment shall not be operated directly upon geogrid reinforcing on within 1 m of concrete units. Minimum fill thickness of 150 mm is required prior to operation of tracked vehicles over geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing fill and damaging the geogrid.
- (g) Any damage to the geogrid reinforcing or other components of the wall caused the Contractor shall be repaired at the Contractor's expense.
- (h) Minimize cutting block. Cut exposed block with power driven abrasive cutting disc or diamond cutting wheel for flush-mounted electrical outlets, grilles, pipes, conduit, leaving 3.0 mm maximum clearance.
- (i) Caps to be positively secured, with landscaping block adhesive.

#### E25.6 Measurement and Payment

- E25.6.1 Supplying and placing the modular block retaining wall will not be measured and will be paid for at the Contract Lump Sum Price for "Modular Block Retaining Wall", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

### **E26. ROCK SOCKETED CAISSONS**

#### E26.1 Description

- (a) This Specification shall cover all operations relating to the supply and installation of rock-socketed caissons for the piers.
- (b) The Work to be done by the Contractor under this Section 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.

#### E26.2 Elevations on Drawings

- (a) The elevations indicated on the rock socketed caisson Drawings are approximate only. The geotechnical report shall be referred for accurate soil conditions and elevations. The soil profile elevations stated on the drawings are only a guide.

#### E26.3 Scope of Work

- (a) Construction of rock socket sockets
- (b) Supply and Installation of steel casing
- (c) Supply and placement of reinforcing steel
- (d) Supply and placement of structural concrete for the caissons

#### E26.4 Materials

##### E26.4.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.

##### E26.4.2 Handling and Storage

- (a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA A23.1. Materials damaged by careless or negligent handling or storage by the Contractor shall be replaced at the Contractor's expense.

#### E26.4.3 Testing

- (a) All materials supplied under this Specification shall be subject to inspection by the Contract Administrator and testing by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.
- (b) All materials shall be approved by the Contract Administrator at least twenty (20) 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 specification 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.

#### E26.4.4 Steel Casings

Steel casings shall be as follows:

- (a) 914 mm outside diameter x 9.5 mm thick permanent casing as indicated on the Drawings, conforming to CSA G 40.21, Grade 300W. Steel casing shall be hot dip galvanized to the limits shown on the Drawings.
- (b) The steel casing shall be seamless.
- (c) The lengths of the caissons shall be as shown on the Drawings. The length may be increased, based on the rock quality determined at the time of construction.
- (d) Galvanizing shall be in accordance with CSA G164.

#### E26.4.5 Concrete

- (a) The concrete shall conform to E17, "Structural Concrete" of this Specification.
- (b) The concrete shall be placed by the tremie method if dewatering is not successful.

#### E26.4.6 Reinforcing Steel

- (a) The reinforcing steel shall conform to E16, "Reinforcing Steel" of this Specification for black reinforcing steel.

#### E26.5 Equipment

- (a) All equipment shall be of a type accepted by the Contract Administrator and shall be kept in good working order.

##### E26.5.1 Tremie Equipment

- (a) The tremie pipe shall consist of a tube, having a diameter of not less than 250mm, constructed with sections having flange couplings fitted with gaskets. The discharge end shall have a proper seal so that water will not enter the tube at any time. Tremie concrete may also be deposited by means of a bottom dump tremie bucket equipped with a closing top. The tremie bucket shall be of a type approved by the Contract Administrator.

#### E26.6 Construction Methods

##### E26.6.1 Location and Alignment of Caissons

- (a) The Caissons shall be installed in the positions shown on the Drawings or as directed by the Contract Administrator. The Contractor will be required to remove obstructions in order to achieve the proper pile alignments.

##### E26.6.2 Cut-off of Steel Casings

- (a) The casings shall be set to the elevations shown on the Contract Drawings. All costs associated with the casing cut-offs shall be incidental to the appropriate Contract Lump Sum Price for "Supply and Install Rock-Socketed Caissons".

#### E26.6.3 Dewatering

- (a) Any water present within the caisson holes shall be pumped out and removed from site.
- (b) The caisson hole safe and dewatered to facilitate inspection by the Contract Administrator.
- (c) All costs associated with the dewatering shall be incidental to the appropriate Contract Lump Sum Price for "Supply and Install Rock-Socketed Caissons".

#### E26.6.4 Rock-Socketed Caisson Installation

- (a) The Contractor shall drill holes, or use a down hole hammer, at each caisson location down to bedrock. Steel casings shall be advanced into the bedrock.
- (b) The Contractor shall construct sockets into bedrock using a down-hole hammer powered by compressed air, or by coring. The sockets shall be advanced a minimum of 4500 mm into sound bedrock as determined by the Contract Administrator. The Contract Administrator may require extension of the rock sockets if, in the opinion of the Contract Administrator, it is necessary in order to reach a suitable layer of bedrock.
- (c) Sockets shall be de-watered, and loose and broken rock removed using compressed air.
- (d) After de-watering, the caisson hole shall be inspected by the Contract Administrator. Upon approval of the caisson hole by the Contract Administrator the Contractor shall place the reinforcing steel as indicated on the Drawings and fill the entire length of the caissons with concrete to the top elevation of the permanent 914 mm diameter steel casing as indicated on the Drawings Install reinforcing steel and place concrete as indicated on the Drawings.

#### E26.6.5 Tremie Concrete Procedure

- (a) Where tremie concrete is to be used, sufficient additional cement shall be added to the mix to compensate for dilution due to the depositing of concrete in the water.
- (b) Tremie concrete shall be deposited in a manner approved by the Contract Administrator. Tremie concrete shall not be placed without the Contract Administrator's approval.
- (c) To prevent segregation, concrete deposited underwater shall be carefully deposited in a compact mass in its final position by means of a tremie pipe, or other approved method, and shall not be disturbed after being deposited. Still water shall be maintained at the point of deposit. The water level shall be regulated so that there is no fluctuation of water pressure that may be injurious to the concrete.
- (d) The minimum rate of depositing tremie concrete shall be 15 m<sup>3</sup>/hr. Continuous soundings shall be taken during the concrete pour and all irregularities in the concrete profile shall be corrected. If a tremie pipe is used, it shall be supported so as to permit
  - (i) free movement of the discharge end over the entire top surface of the work, and
  - (ii) rapid lowering when necessary to retard or stop the flow of concrete.
- (e) The discharge end shall be closed at the start of the work in order to prevent water from entering the tube and it shall be sealed at all times when not within the deposited concrete.
- (f) The tremie tube shall be kept full up to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it within the deposited concrete.

- (g) If a bottom dump tremie bucket is used, the rate of lowering and raising shall be such that the bucket does not create undue turbulence in the rock socket. The bucket shall always be within the deposited concrete when the bottom is opened.
- (h) Where tremie concrete is used, in addition to the heating and hoarding requirements in E17.7.17, the Contractor shall heat the water inside the temporary sleeves and rock sockets to a minimum temperature of 5 °C, and after the concrete has been deposited and shall maintain the water above the rock socket at this temperature for a period of at least 7 days.
- (i) If tremie concrete methods are used, the associated cost shall be incidental to the Contract Unit Price for "Supply and Install Rock-Socketed Caissons".

**E26.6.6 Heating and Hoarding**

- (a) The Contractor shall make provisions for heating the concrete, the permanent and casings to a minimum of 5 °C prior to placing any concrete. The deposited concrete shall be heated and protected against freezing in accordance with E17.7.17. All costs associated with heating and hoarding shall be incidental to the Contract Unit Price for "Supply and Install Rock-Socketed Caissons".

**E26.7 Measurement and Payment**

**E26.7.1 Rock Socket Caissons**

Supplying and installing rock-socketed caissons will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Rock-Socketed Caissons", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E26.7.2 Provisional Items**

(a) Increase Caisson Length

(i) 914 dia. Caisson Length Increase

914 dia. caisson length increase is a provisional item and will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "914 dia. Caisson Length Increase," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification for each additional metre of length of 900 dia. caisson length increase as approved and deemed required, in writing, by the Contract Administrator.

(ii) 762 dia. Rock-Socket Length Increase

762 dia. caisson length increase is a provisional item and will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "762 dia. Caisson Length Increase," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification for each additional metre of length of 850 dia. caisson length increase as approved and deemed required, in writing, by the Contract Administrator.

**E27. EROSION CONTROL BLANKET (ECB)**

**E27.1 Description**

**E27.1.1** This Specification covers the supply, installation, and maintenance of erosion control blanket to be installed on areas disturbed during construction and as directed by the Contract Administrator.

**E27.2 Materials**

**E27.2.1 Erosion Control Blanket(ECB)**

- (a) Erosion Control Blanket shall be a machine-produced mat of 70% agricultural straw and 30% coconut blanket with a functional longevity of up to 24 months. Suitable products include SC 150 Extended Term manufactured by North American Green, or approved equivalent.
- (b) The blanket shall be of consistent thickness with the straw and coconut evenly distributed over the entire area of the mat. The blanket shall be covered on the topside with heavyweight photodegradable polypropylene netting having ultraviolet additives to delay breakdown and a maximum 159mm x 159mm mesh and on the bottom side with a lightweight photodegradable polypropylene netting with a maximum 127mm x 127mm mesh. The blanket shall be sewn together on 381mm centres (maximum) with degradable thread.



- (c) ECB shall have the following properties:
  - (i) Matrix 70% Straw Fibre (0.19kg/m<sup>2</sup>) and 30% Coconut Fibre (0.08kg/ m<sup>2</sup>).
  - (ii) Netting top side heavyweight photodegradable with UV additives (1.47kg/100m<sup>2</sup>).
  - (iii) Bottom side lightweight photodegradable minimum netting weight (0.73 kg/100m<sup>2</sup>).
  - (iv) Degradable thread.

### E27.3 Submittals

- E27.3.1 The Contractor shall submit all manufacturers' product specifications and recommended installation methods for the proposed erosion control blankets and associated materials to the contract administrator a minimum of 14 days before construction.

### E27.4 Construction Methods

- E27.4.1 The Contractor shall supply all ECB materials required and store them on site. The installation and maintenance of all ECM will be as directed by the Contract Administrator. The installation will be required only if the outer coffer dam upstream of the culvert is going to be over topped.
- E27.4.2 Actual alignment and location of the ECB may be adjusted in the field by the Contract Administrator.
- E27.4.3 Erosion Control Blanket – Drainage Channel Installation
  - (a) In general excavate a trench 150mm deep by 150mm wide at the upstream end of the drainage channel and leave 300mm of ECB beyond the upslope portion of the trench. Anchor blanket with 200mm long staples in trench as shown on the Drawings. Staples shall be a minimum of 300mm apart. Backfill trench with soil and compact. Apply seed to compacted soil. Fold remaining portion of blanket over sodded soil and secure with staples spaced 300mm (minimum) apart across width of blanket. Starting with the blanket on bottom of drainage channel, roll blanket out in direction of water flow. Securely fasten blanket against soil surface with staples. There shall be a minimum of 0.8 staples per square metre. Place blankets end over end in the downstream direction and secure overlaps with a double row of staples, staggered 10cm (minimum) apart. There shall be a minimum 10cm to 15cm overlap between blankets in the downstream direction.
  - (b) Repeat with blankets along the side slopes of the drainage channel. The overlap between adjacent blankets in the channel side slope direction shall be 50mm to 125mm (depending of blanket type). At the top of the side slope the full length edge of the blanket shall be anchored into a 150mm deep by 150mm wide anchor trench with staples spaced 300mm apart (minimum). The anchor trench shall be backfilled and compacted upon completion of stapling.
  - (c) Secure downstream edges of ECB as per manufacturer's specifications and detail drawings.

### E27.5 Maintenance

- E27.5.1 The areas covered with ECB shall be regularly inspected especially after severe rainfall or storm events, to check for blanket separation or breakage.
- E27.5.2 Any damaged or poorly performing areas as the result of storm events shall be replaced/repared immediately. Re-grading of the slope by hand methods may be required in the event of rill or gully erosion.
- E27.5.3 Should the Contract Administrator determine that the Contractor has not maintained the erosion control blankets properly or has damaged the blankets from construction activities resulting in sediment releases beyond the work area, the Contractor shall retrieve all sediment that has left the construction area, to the fullest extent possible, at his own cost. As a minimum, the Contractor shall remove all deltas and sediment deposited in drainage

ways and re-grade and/or reseed the areas where sediment removal results in exposed soil. The removal and restoration shall take place within 5 working days of discovery unless precluded by legal, regulatory, or physical access restraints. If precluded, removal and restoration must take place within 5 working days of obtaining access. The Contractor is responsible for contacting all local, regional, provincial, and federal authorities before working in surface waters and for obtaining applicable permits. The Contractor's restoration work to restore property outside of the designated work area shall be at his own cost.

#### E27.6 Measurement and Payment

- E27.6.1 Supplying and placing Erosion Control Blanket will be measured on an area basis and will be paid for at the Contract Unit Price per square metre for "Supply and Install Erosion Control Blanket", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

### **E28. CHAIN LINK FENCE**

#### E28.1 Description

- E28.1.1 The specification shall amend and supplement City of Winnipeg specification CW 3550.

#### E28.2 Scope of Work

- E28.2.1 The Work under this Specification shall involve:
- (a) Supply and installation of chain link fence attached to the modular block retaining wall.

#### E28.3 Submissions

- E28.3.1 At least fourteen (14) days prior to the scheduled commencement of any fabrication, the qualifications of Contractor, the qualifications of operator, the shop drawings, mill certificates, welding procedures, and welding consumable certificates shall be submitted to the Contract Administrator for his acceptance.
- E28.3.2 The shop drawings shall consist of three (3) sets of full size prints and one (1) reproducible sepia set.
- E28.3.3 The shop drawings shall clearly show shapes, dimensions, detail, connection (including proper CSA welding identification), bolt holes, and accessories.

#### E28.4 Materials

- (a) Steel plates to be attached to the posts of the chain link fence are to be in accordance with E21, "Supply, Fabrication and Erection of Miscellaneous Metal."
- (b) Anchor bolts are to be Hilti HAS SS 316 rods with Hilti HIT HY-150 adhesive.

#### E28.5 Construction Methods

- E28.6 The welding of the plates to the posts shall be in accordance with E21, "Supply, Fabrication and Erection of Miscellaneous Metal."

- E28.7 Anchor bolts to be installed in accordance with the Manufacturers recommendations and requirements.

#### E28.8 Measurement and Payment

- E28.8.1 Supplying and Installing the aluminum balanced barrier will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Chain Link Fence", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## **E29. RIPRAP**

### **E29.1 General**

E29.1.1 Riprap shall be random stone riprap and supplied and installed in accordance with Specification CW 3615, except as specified herein.

### **E29.2 Materials**

#### **E29.2.1 Rock**

- (a) The Contractor shall supply quarried rock, or quarried limestone which is dense, durable, sound, resistant to the action of water and frost, and suitable in all respects for the purpose intended. Stone rip-rap shall be free from sod, roots, organic material and debris prior to placement. Individual pieces of stone shall be free of defects such as seams or cracks that would cause rapid or excessive deterioration or degradation. The Contract Administrator shall approve the rock for riprap prior to placing.
- (b) Quarried limestone shall have a maximum Los Angeles Abrasion Loss of 32% (ASTM C535) and a maximum Magnesium Sulphate Soundness Loss of 13% (ASTM C88).
- (c) The stone rip-rap shall be well graded having a full range and even distribution of sizes and shall conform to the following gradation:

Size (mm)	
450	100%
250	15-50%
150	0-15%

#### **E29.2.2 Geotextile Fabric**

- (a) Geotextile fabric shall be non-woven and conform to the requirements of CW 3130 Clause 2.5.

### **E29.3 Construction Methods**

E29.3.1 Place a layer of the geotextile fabric under the riprap and anchor the upstream and downstream end of rock filled trenches as shown on the Drawings. The inlet and outlet proposed riprap are to blend into the existing riprap.

E29.3.2 Place the rock riprap carefully on the geotextile fabric so that it does not tear.

### **E29.4 Measurement and Payment**

E29.4.1 Supply and placement of riprap and geotextile fabric will be measured on a volume basis and will be paid for at the Contract Unit Price per cubic metre for "Random Stone Riprap and Geotextile", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E29.4.2 Supply and placement of riprap and geotextile fabric will be measured by surface area of riprap placed and accepted by the Contract Administrator multiplied by the specified depth as indicated on the Drawings.

## **E30. PRE-CAST CONCRETE TRAFFIC BARRIERS**

### **E30.1 Description**

E30.1.1 This Specification covers the pick-up, installation, maintenance, and return of pre-cast concrete traffic barriers as indicated on the Drawings.

## E30.2 Materials

E30.2.1 Precast Concrete Traffic Barriers will be available for use by the Contractor at the City of Winnipeg Bridge Yard.

E30.2.2 Work zone crash cushions to be Energy Absorption Systems Inc. "Energite III Crash Cushion" system to be supplied, placed, and removed by the Contractor.

## E30.3 Construction Methods

E30.3.1 The Contractor shall arrange to pick up, load, deliver and unload the precast concrete barriers to the Site from the City of Winnipeg Bridge Yard at 849 Ravelstone Avenue West and pick-up, load, deliver and unload the precast concrete barriers to the City of Winnipeg Bridge Yard at 849 Ravelstone Avenue West from the Site by contacting Mike Terleski at 794-8510.

E30.3.2 The Contract is to supply all necessary equipment for loading, unloading, placing, maintenance and all items related thereto that are not identified under a separate item of work at both the City Yard and the Site.

E30.3.3 The Contractor shall be responsible for maintenance of the barriers during construction.

E30.3.4 The Contractor shall be responsible for loading the precast units from the City Yard, hauling, unloading, placing, as well as storing of the precast concrete barriers once they have been received. The Contractor shall supply all necessary equipment and materials for loading, hauling, unloading and storing of the barriers.

E30.3.5 Precast concrete barrier shall be installed at location shown on the Drawings. The barriers shall be properly aligned, seated firmly to the sub-surface and pinned together to the satisfaction of the Contract Administrator.

E30.3.6 The Energite III Crash Cushion array, configuration, and sizing shall be in accordance with the manufacturer's requirements for a TL-2. The supply, placement, and removal of the crash cushions shall be considered incidental to the supply and placement of the temporary traffic barriers and no separate measurement or payment shall be made for these items.

## E30.4 Measurement and Payment

E30.4.1 Placing precast concrete traffic barriers will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for "Place Precast Concrete Traffic Barriers", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E30.4.2 Payment for the pre-cast concrete traffic barriers will be 50% of the unit price for each unit being placed and maintained to the satisfaction for the duration of construction as accepted by the Contract Administrator and 50% of the unit price for each unit returned to the yard as accepted by the Contract Administrator.

## E31. EARTHWORK AND GRADING

### E31.1 Description

E31.1.1 Further to CW 3170, this specification shall amend phrases for materials, and construction methods stated in CW 3170.

### E31.2 Materials

#### E31.2.1 Fill Material

(a) Clause 5.4 of CW 3170, Fill Material, shall read:

Fill material for embankment construction shall be obtained from site excavation, from borrow sites as specified in the Specifications for the Work or shall be imported material, of a type approved by the Contract Administrator.

Approved clay fill material shall consist of low to high plastic clays or of mixtures of sand and clay, or sand material, uniform in texture and suitable for compaction.

### E31.3 Construction Methods

#### E31.3.1 Preparation of Existing Ground Surface

- (a) Clause 9.5 of CW 3170, Preparation of Existing Ground Surface, shall read:

Before any embankment is placed on original ground having a smooth firm surface, the existing ground shall be scarified or ploughed so as to permit bonding with the new material.

Where the existing ground surface is sloped sufficiently (steeper than 6H:1V) to affect the bond between the old and new materials the original ground on which the embankment is to be placed shall be ploughed deeply or stepped before embankment construction is commenced, as directed by the Contract Administrator.

When embankment is being placed on an existing roadbed, the side slopes of the existing roadbed shall have vegetation removed and then be scarified or ploughed, as directed by the Contract Administrator, to ensure adequate bonding between the new embankment and the existing material.

Following the excavation and disposal of unsuitable material and the preparation of the side slopes, as described above, the surface of the existing roadbed shall be scarified to a depth of 150 mm, and compacted to the proper density, at the optimum moisture content.

Where existing roadbeds are being widened and existing embankments extended, the existing slopes shall be denuded of all vegetation and either stepped or ploughed so as to form a medium of contact with the new embankment. Vertical cuts for the full depths of embankment shall not be permitted.

- (b) Clause 9.7 of CW 3170, Compaction, shall read:
- (c) All material placed in embankments shall be spread and bladed smooth in successive layers not exceeding 150 mm in compacted thickness to the full width of the cross-section, unless otherwise directed by the Contract Administrator.
- (d) Each layer, including the existing sub-grade, shall be compacted to a minimum of ninety-five (95%) percent of Standard Proctor Density. The material shall be compacted within four (4%) percent of optimum moisture content for clay fill, and within two (2%) percent of optimum moisture content for granular fill, as directed by the Contract Administrator.
- (e) Where the grade line is in cut, the sub-grade shall be excavated to a minimum depth of 500 mm below the sub-grade line, or as directed by the Contract Administrator. The sub-grade shall then be reconstructed in layers as specified and compacted to ninety-five (95%) percent of Standard Proctor Density.
- (f) Where the moisture content of the embankment material is too high, the material shall be thoroughly worked until the optimum moisture content is achieved.
- (g) Where the moisture content of the embankment material is too low, the material shall be thoroughly disced and broken down, water added as required and the material thoroughly worked to mix the water throughout the material, prior to commencing compaction operations.

### E31.4 Measurement and Payment

#### E31.4.1 Earthworks and grading will be measured and paid for as described in Sections 12 and 13 of CW 3170.

## **E32. CLEARING AND GRUBBING**

### **E32.1 References**

- E32.1.1 Section E3, "Environmental Protection Plan".
- E32.1.2 D39.1.1 U.S. Environmental Protection Agency (EPA)/Office of Water
  - (a) EPA 832, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### **E32.2 Definitions**

- E32.2.1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- E32.2.2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- E32.2.3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- E32.2.4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- E32.2.5 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

### **E32.3 Quality Assurance**

- E32.3.1 Safety Requirements: worker protection.
  - (a) Workers must wear gloves, eye protection and protective clothing when applying herbicide materials.
  - (b) Workers must not eat, drink, or smoke while applying herbicide material.
  - (c) Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

### **E32.4 Submittals**

- E32.4.1 Samples:
  - (a) Submit a sample of each material listed below for approval prior to delivery of materials to project site.
  - (b) Tree wound paint: one litre can with manufacturer's label.
  - (c) Herbicide: one litre can with manufacturer's label.
- E32.4.2 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- E32.4.3 Submit manufacturer's installation instructions.

### **E32.5 Storage and Protection**

- E32.5.1 Prevent damage to fencing, trees, natural features, bench marks, existing buildings existing pavement, utility lines, site appurtenances, water courses, root systems of trees which are to remain.
- E32.5.2 Repair damaged items to approval of Contract Administrator. Replace trees designated to remain, if damaged, as directed by Contract Administrator.
- E32.5.3 The Contractor shall not remove any trees or perform any clearing and grubbing that has not been clearly marked by the Contract Administrator. If the Contractor removes any tree,

regardless of size or species, that was not approved by the Contract Administrator, the Contractor shall supply and install five (5) trees of a species and calliper equal to or greater than that which was removed. The replaced trees shall be installed at a location determined by the Contract Administrator, which may be in or near the Site.

E32.5.4 Protect existing trees to remain on-site with snow fencing as indicated by the Contract Administrator.

E32.5.5 Limit site disturbance including earthwork and clearing of vegetation to

- (a) 12 m beyond the building perimeter.
- (b) 1.5m beyond road way, walkways, ditches and main utility trenches.
- (c) 5m beyond sports fields and parking.

E32.5.6 Maintain access roads to prevent accumulation of construction related debris on roads.

#### E32.6 Waste Management and Disposal

E32.6.1 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.

- (a) Trim limbs and tops, and saw into saleable lengths for pulpwood, for poles, for ties, and for fuel wood.
- (b) Stockpile adjacent to site.
- (c) Owner to have first right of refusal for saleable timber.

#### E32.7 Materials

E32.7.1 Herbicide: effective for killing annual and perennial weeds, by being absorbed through roots and foliage.

E32.7.2 Soil Material for Fill:

- (a) Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
- (b) Remove and store soil material for reuse.

#### E32.8 Temporary Erosion and Sedimentation Control

E32.8.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to engineering controls such as silt fence, silt traps and filter cloth placement during construction.

E32.8.2 Excavation and reuse of soil must not create fugitive dust. Contractor to cover or dampen soil to prevent blowing dust or debris under dry conditions. All stockpiled materials must be covered with 6mm poly at the end of each day.

E32.8.3 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

E32.8.4 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

#### E32.9 Preparation

E32.9.1 Inspect site and verify with Contract Administrator items designated to remain.

E32.9.2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.

E32.9.3 Notify Contract Administrator immediately of damage to or when unknown existing utility lines are encountered.

E32.9.4 Keep roads and walks free of dirt and debris.

E32.9.5 Supply and install protective strapping as per E6.1(b) and / or snow fencing around existing trees to remain as directed by the Contract Administrator.

E32.10 Application

E32.10.1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

E32.11 Clearing

E32.11.1 Clearing includes cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush and rubbish occurring within cleared areas.

E32.11.2 Clear as directed by Consultant, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

E32.11.3 Cut off unsound branches on trees designated to remain as directed by Consultant.

E32.11.4 Apply herbicide in accordance with manufacturer's label to top surface of stumps designated to be removed.

E32.12 Close Cut Clearing

E32.12.1 Close cut clearing to ground level for gravel pathway areas as indicated

E32.13 Underbrush Clearing

E32.13.1 Clear underbrush from areas as indicated at ground level.

E32.14 Grubbing

E32.14.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas except gravel pathway areas.

E32.14.2 Grub out stumps and roots to not less than 100 mm below ground surface.

E32.14.3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.

E32.14.4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

E32.15 Removal and Disposal

E32.15.1 Remove cleared and grubbed materials off site.

E32.15.2 Dispose of cleared and grubbed materials by burning, burying or mulching.

E32.15.3 Burn only in area designated by Consultant. Burn under constant care of competent watchmen, at such times and so that surrounding vegetation, adjacent property or anything to remain will not be jeopardized.

E32.15.4 Bury to approval of Consultant by:

(a) Consolidating.

(b) Covering with minimum 500 mm of mineral soil.

(c) Finishing surface.

E32.15.5 Chip or mulch and spread cleared and grubbed vegetative material on site as directed by Consultant.



#### E32.16 Finished Surface

E32.16.1 Leave ground surface in condition suitable for immediate grading operations to approval of Consultant.

#### E32.17 Cleaning

E32.17.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

#### E32.18 Measurement and Payment

E32.18.1 Clearing and grubbing will be measured and paid for as described in Section 13 of CW 3110.

### **E33. ROUGH GRADING**

#### E33.1 References

E33.1.1 American Society for Testing and Materials (ASTM)  
(a) ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m).

#### E33.2 Existing Conditions

E33.2.1 Examine geotechnical report.

E33.2.2 Known underground and surface utility lines and buried objects are as indicated on survey.

#### E33.3 Protection

E33.3.1 Protect existing trees, natural features and drainage courses which are to remain as directed by Consultant. If damaged, restore to original or better condition unless directed otherwise.

E33.3.2 Protect existing trees to remain on-site

E33.3.3 Maintain access roads to prevent accumulation of construction related debris on roads.

#### E33.4 Materials

E33.4.1 Fill material shall be suitable site material, as approved by the Contract Administrator.

E33.4.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Consultant.

#### E33.5 Stripping of Topsoil

E33.5.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Consultant.

E33.5.2 Commence topsoil stripping of areas as indicated and relocate off site.

E33.5.3 Strip topsoil to depths as directed by Consultant. Avoid mixing topsoil with subsoil.

E33.5.4 Stockpile in locations as directed by Consultant. Stockpile height not to exceed 2 m. All stockpiled materials must be covered with 6 mm poly at the end of each day.

E33.5.5 Dispose of unused topsoil as directed by Consultant.

#### E33.6 Grading

E33.6.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

E33.6.2 Rough grade to depths appropriate to accommodate finish grades of seeded areas.

- E33.6.3 Slope rough grades as indicated.
- E33.6.4 Grade ditches to depth as indicated.
- E33.6.5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- E33.6.6 Compact filled and disturbed areas to Standard Proxy Density to ASTM D698, as follows:
- (a) 86% under landscaped areas.
  - (b) 95% under paved and walk areas.
- E33.6.7 Do not disturb soil within branch spread of trees or shrubs to remain.
- E33.7 Testing
- E33.7.1 Inspection and testing of soil compaction will be carried out by designated testing laboratory designated by ULC.
- E33.7.2 Submit testing procedure and frequency of tests to Consultant for approval.
- E33.7.3 Remove surplus material and material unsuitable for fill, grading or as directed by Consultant.
- E33.8 Measurement and Payment
- E33.8.1 Rough grading will be considered incidental to CW 3510, "Sodding" or CW 3520, "Seeding." No measurement and payment will be made within this section.

#### **E34. MATCHING EXISTING GRADES**

- E34.1 Whenever the proposed paving or sod meets existing building edge, doorway, or property line, the Contractor shall construct the proposed element to an acceptable grade, as directed by the Contract Administrator, to ensure that proper drainage and accessibility are maintained.

#### **E35. PLANTING BED PREPARATION AND MULCH**

- E35.1 Description
- E35.1.1 The Work to be done by the Contractor under this Specification shall cover planting bed preparation, include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all Work as shown on the Drawings and herein specified.
- E35.2 Materials
- E35.2.1 Planting Soil
- Planting Soil shall consist of black top soil, a fertile friable natural loam containing by volume not less than 4% and no more than 25% of organic matter for clay loams, and not less than 2% and no more than 25% for sandy loams, with an acidity value ranging from pH 6.0 to 8.0 and capable of sustaining vigorous plant growth. Topsoil is to be free of any mixture of subsoil, clay lumps and free of stones and other extraneous matter. It is not to contain couch or crab grass rhizomes.
- E35.2.2 Mulch
- Mulch shall be locally available clean bark or wood chip mulch free of leaves, branches and other extraneous matter. The recommended mulch shall consist of chips not less than 15mm not larger than 75mm in size and not more than 20mm thick.
- E35.2.3 Water
- Water shall be potable and free of minerals which may be detrimental to plant growth.

E35.2.4 Fertilizer

Fertilizer shall be complete synthetic slow release fertilizer with maximum 35% water-soluble nitrogen.

E35.3 Construction Methods

E35.3.1 General

Contractor shall visit the Site and verify all data and dimensions and report any errors, omissions or discrepancies to the Contract Administrator prior to any installation.

E35.3.2 Planting Bed Preparation

Contractor shall co-ordinate Site excavation Works with landscaping to ensure minimal additional excavation for shrub beds. All remaining areas to be excavated shall be to the shape shown on the Drawings. Planting Beds shall be excavated with vertical sides and material removed to a minimum depth of 450mm in areas as shown on Drawings.

Upon excavation of the planting bed, the excavation shall be backfilled with a topsoil mixture to a depth to permit adequate installation and stabilization of the plant material. Topsoil shall be placed in accordance with City of Winnipeg Standard Construction Specification CW 3540 to a 450mm depth.

E35.3.3 All areas and locations provided for planting shall be staked according to layout shown on the Drawings. Excavation shall not proceed until the layout has been inspected and approved by the Contract Administrator. Excavation shall not be undertaken until all underground utilities have been located and protected.

E35.3.4 Supply and Installation of Mulch

Contractor to supply and install bark mulch in planting bed. Mulch supplied shall cover entire planting area to a consistent depth of 100mm.

E35.4 Measurement and Payment

E35.4.1 Protection of existing trees will considered incidental to E36, "Trees, Shrubs and Perennials Planting." No measurement and payment will be made within this section.

**E36. TREES, SHRUBS AND PERENNIALS PLANTING**

E36.1 Description

E36.1.1 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 other things necessary for and incidental to the satisfactory performance and completion of all Work as shown on the Drawings and as hereinafter specified, including, but not necessarily confined to the following:

- (a) Supply and Installation of trees.
- (b) Supply and Installation of shrubs and perennials.

E36.2 Reference

- (a) Install trees, shrubs and perennials work in accordance with the Canadian Standards for Nursery Stock Current Edition, published by the Canadian Nursery Trades Association, except where specified otherwise.

E36.3 Source Quality Control

- (a) All plant material shall be randomly inspected at the source upon request of the Contract Administrator.
- (b) Trees are to be grown in nurseries under proper cultural practices as recommended by the Canadian Nursery Trades Association.

- (c) Only those trees that have been grown for at least the four (4) previous years in local Manitoba nurseries located in an Agriculture Canada Plant Hardiness Zone designation of 2(a or b) or 3(a or b) and within a 250 kilometre radius of Winnipeg, will be accepted. Trees that have grown in plant hardiness zones 1 and 4 or greater will be rejected.

#### E36.4 Maintenance

- (a) The Contractor shall be responsible for the maintenance of the trees for a period of one (1) year from the date of Substantial Performance. Any areas planted after September 15th, the maintenance period will commence on May 15th of the following year or such date as mutually agreed upon by all parties.
- (b) The Contractor shall be responsible for the maintenance of the shrubs and perennials for a period of one (1) year from the date of Substantial Performance. Any areas planted after September 15th, the maintenance period will commence on May 15th of the following year or such date as mutually agreed upon by all parties.
- (c) Water to ensure soil moisture conditions for optimum growth and health of plant material. Ensure watering techniques do not cause erosion.
- (d) Reform damaged watering saucers.
- (e) Remove weeds bi-monthly.
- (f) Replace or re-spread damaged, missing or disturbed mulch.
- (g) For non-mulched areas, cultivate monthly to keep top layer of soil friable.
- (h) If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Contract Administrator prior to application.
- (i) Apply fertilizer as directed by manufacturer's specifications.
- (j) Remove dead, broken or hazardous branches from plant material.
- (k) Keep trunk protection and tree supports in proper repair and adjustment.
- (l) Remove trunk protection, tree supports and level watering saucers at end of warranty period.
- (m) Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
- (n) Submit monthly written reports to Contract Administrator identifying:
  - (i) Maintenance work carried out.
  - (ii) Development and condition of plant material.
  - (iii) Preventative or corrective measures required which are outside Contractor's responsibility.

#### E36.5 Warranty

- (a) The Contractor shall, at his/her expense, warrant the Work against any and all defects or deficiencies resulting from insect infestation, disease and mechanical damage due to improper handling, installation or maintenance, for a period of two (2) years for trees and two (2) years for shrubs and perennials from the date of the Total Performance. Nursery stock damaged by vandalism or reasons beyond the control of the Contractor shall be replaced by the client.
- (b) End-of-Warranty inspection will be conducted by the Contract Administrator.
- (c) The Contract Administrator reserves the right to request material replacement or extend the Contractor's Maintenance responsibilities for an additional one (1) year if, at the end of the Warranty Period, leaf development and growth are not sufficient to ensure future survival of the plant material.

#### E36.6 Replacements

- (a) During the Maintenance Period, the Contractor shall remove from Site any plant material that has died or failed to grow satisfactorily as determined by the Contract Administrator and replace as per Specifications within a maximum ten (10) day period from notification.
- (b) Defective plants shall be replaced within three (3) days of notification to the Contractor.
- (c) The Contractor shall extend Maintenance and Warranty on replacement tree for a period equal to the original Maintenance and Warranty Periods.
- (d) The Contractor shall continue such replacement, Maintenance and Warranty until tree is acceptable.

## E36.7 Materials

### E36.7.1 Miscellaneous Materials

- (a) Water shall be potable and free of minerals which may be detrimental to plant growth.
- (b) Stakes shall be metal T-Bar, steel, 40x40x5x2440mm.
- (c) Guying Wire shall be 3mm diameter multi-strand galvanized steel cable.
- (d) Guying Collar shall be plastic tube, 13mm diameter, nylon reinforced.
- (e) Trunk Protection shall be plastic perforated spiraled strip.
- (f) Fertilizer shall be a slow release formulation of low nitrogen and high phosphorus e.g. 10-50-12. Apply quantities at rates stated by product manufacturer.
- (g) Planting Soil shall be as per specification E35, "Planting Bed Preparation and Mulch."
- (h) Root Ball Burlap shall be 150 g Hessian burlap, biodegradable.
- (i) Wire Baskets shall be horticultural accepted product designed to carry the weight and to contain a burlap-covered root ball. Minimum diameter basket size is to conform to the same minimum diameter of the tree root ball for the respective minimum tree caliper sizes.

### E36.7.2 Plant Material

- (a) Nomenclature of specified trees is to conform to the International Code of Nomenclature for Cultivated Plants and is to be in accordance with the approved scientific names given in the latest edition of the Standardized Plant Names.
- (b) Trees are to be characteristically developed for their species and structurally sound, well branched, healthy and vigorous and densely foliated when in leaf. The tree is to have a healthy, well developed, fibrous root system which may be verified through a testing procedure that destructively samples one or more randomly selected root balls.
- (c) Trees are to have been root pruned regularly, but not later than one growing season prior to arrival on Site. The Contractor may be required to furnish documentation to the client on their root-pruning program. Trees in excess of 75mm caliper are to have been half root pruned during each of two successive growing seasons, the latter at least, one growing season prior to arrival on Site.
- (d) All parts of the trees, especially the lower branches, are to be moist and show live, green cambium tissue when cut.
- (e) Trees are to have only one, sturdy, reasonably straight and vertical trunk, and a well-balanced crown with fully developed leader.
- (f) Trees are to be free of disease, insect infestation, rodent damage, sun scald, frost cracks, abrasions, unhealed scars, scars exceeding 5cm in diameter, major forks or crooks in the trunk, broken branches, or angled leaders. Trees having the above defects will not be accepted by the Contract Administrator.
- (g) Trees having a leader which has developed at a sharp angle to the trunk as a result of pruning or trunk damage will not be accepted.

- (h) Trees exhibiting suppressed, weakly developed branches due to competition from other closely spaced trees in the nursery will not be accepted. Trees exhibiting dead branches will not be accepted.
- (i) Any tree that has come out of dormant stage and is too far advanced will not be accepted unless prior approval obtained. Approval is required for any tree which has been held in cold storage.
- (j) Balled and burlapped trees in excess of a 3m height must have been dug with large firm ball. Roots in root balls must be comprised of 75% fibrous and feeder root systems. Secure root balls with burlap, heavy twine and rope. For trees 75mm or more in caliper, wrap ball in double layer of burlap and drum lace with minimum 10mm diameter rope. Protect root balls against sudden changes in temperature and exposure to heavy rainfall.
- (k) Tree spade dug trees are to be dug with mechanized digging equipment with hydraulic spade. Lift root ball from hole, place in wire basket designed for purpose and lined with burlap. Tie basket to ball with heavy rope. Take care not to injure trunk of tree with wire basket ties or rope.
- (l) Use of collected or native trees is not permitted.

#### E36.7.3 Tree Quantity and Size

- (a) Trees are to be planted at the quantities and caliper listed on the Plant Lists which are shown on the drawings. Any variation from the specified quantity is to be clearly identified on the Schedule of Prices. Any variations to species, size or caliper of specified trees will require a request for approval from the Contract Administrator.
- (b) Any changes in planting locations will be determined on-site by the Contract Administrator.
- (c) The Contractor shall supply trees as indicated in the Schedule of Prices and PLANT LISTS.
- (d) Trees are to conform to the measurements specified in the on drawing PLANT LISTS, except that trees larger than specified may be used if approved by the Contract Administrator.
- (e) Trees are to be measured when the branches are in their normal position. Height dimensions specified are to refer to the main body of the tree and not from branch tip to root base. Where trees have been measured by caliper or diameter, reference is to be made to the diameter of the trunk measured 15cm above the ground as the tree stands in the nursery prior to lifting. Caliper of tree shall be appropriately designed on a permanently fixed tag on one of the branches.

#### E36.7.4 Shipment and Pre-Planting Care

- (a) Coordinate shipping of trees and excavation of holes to ensure minimum time lapse between digging and planting.
- (b) Tie branches of trees securely, and protect trees against abrasion, exposure and extreme temperature change during transit. Avoid binding of trees with rope or wire which would damage bark, break branches or destroy natural shape of tree. Give full support to root ball of trees during lifting.
- (c) Cover tree foliage with tarpaulin, and protect bare roots by means of dampened straw, peat moss, saw dust or other acceptable material to prevent loss of moisture during transit and storage.
- (d) Remove broken and damaged roots with sharp pruning shears. Make clean cuts, and cover cuts over 10mm diameter with a tree wound dressing.
- (e) Keep roots moist and protected from sun and wind. Heel-in trees which cannot be planted immediately in shaded areas and water well.

#### E36.8 Construction Methods

E36.8.1 Workmanship

- (a) Location of trees will be staked out or painted on Site by the Contractor. Locations shall be approved by the Contract Administrator prior to installation.
- (b) Coordinate operations. Keep Site clean and planting holes drained. Immediately remove soil or debris spilled onto street pavement, grass or sidewalk.

E36.8.2 Planting Time

- (a) Plant deciduous trees during dormant period before buds have broken. Trees noted for spring planting only, must be planted in dormant period.
- (b) Plant only under conditions that are conducive to health and physical conditions of trees.
- (c) Provide planting schedule to Contract Administrator. Extending planting operations over long period using limited crew will not be accepted.
- (d) The Contractor must obtain all above and below ground clearances from all the utilities as well as the appropriate District Operations Branch in a timely manner so as not to jeopardize the schedule of the complete tree planting Contract.

E36.8.3 Excavation

- (a) Refer to specification E35 - Planting Bed Preparation and Mulch for preparation of planting beds.
- (b) Excavate planting pits as indicated by stakes or paint marks.
- (c) Protect bottom of excavations against freezing.
- (d) Remove water which enters excavations prior to planting. Ensure source of water is not ground water and notify Contract Administrator.

E36.8.4 Installation

- (a) Planting shall be done during periods of suitable weather conditions and in accordance with locally accepted practice.
- (b) Trees are to be planted within forty eight (48) hours of excavation from the nursery.
- (c) No tree pit is to be left open at the end of the Contractor's Work Day. Planting program is to be planned to ensure that all approved trees delivered to the Site at designated planting locations are installed and thoroughly watered the same day as delivery.
- (d) With balled and burlapped root balls and root balls in wire baskets, burlap shall be loosened and cut away from the top 1/3 without disturbing root ball. Wire shall be cut away and removed from the top 1/3 of the root ball. Burlap or rope shall not be pulled from under root ball. Non-biodegradable wrapping shall be removed.
- (e) After inserting the tree and tamping the root system with topsoil in layer of 150mm, water shall be poured in until the pit is thoroughly soaked. Filling of the hole shall then be completed and the fill-in soil shall be packed firmly around the roots, leaving a concave surface for convenient watering. After filling, the planting shall be watered at frequent intervals.
- (f) Each tree is to have an earth saucer at its base having a diameter as large as the excavation with a 10cm lip formed at the perimeter of the saucer to retain water.
- (g) All nursery stock shall be set plumb in the centre of pits and at levels as shown on the planting details after settlement has taken place.
- (h) Nursery stock shall be faced to give the best appearance or relationship to adjacent structure and to the approval of the The City of his representative. Trees shall be placed equal to depth they were originally growing in nursery.

**E36.8.5 Fertilizing**

- (a) When planting is completed, give surface of planting saucer dressing of fertilizer meeting the requirements of Specification. Mix fertilizer thoroughly with top layer of planting soil and water in well.

**E36.8.6 Trunk Protection**

- (a) Install trunk protection on trees as indicated.
- (b) Install trunk protection prior to installation of tree supports when used.

**E36.8.7 Pruning**

- (a) The Contractor shall provide a licensed Manitoba Certified Arborist for each work crew or work site.
- (b) Employ clean sharp tools and make cuts flush with branch collars. Remove dead and injured branches.

**E36.8.8 Watering**

- (a) Trees are to be watered during the planting procedure as described previously, and once a week thereafter, or more frequently if required, during the growing season.
- (b) A complete record is to be kept of each series of watering for all planted trees noting: 1) location, and 2) date of watering. This record shall be sent bi-weekly to Scatliff+Miller+Murray Inc. - Fax: (204) 927-3443.
- (c) Apply 40 litres of water per 25mm caliper per application using deep root feeder or low/pressure nozzle and hose. The water stream must not gouge out a hole in the soil and mulch.

**E36.9 Measurement and Payment**

**E36.10** Installation of shrubs and perennials will not be measured and will be paid for at the Contract Lump Sum Price for the "Shrubs and Perennials (c/w warranty)," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E36.11** Installation of trees will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for "Deciduous Tree (c/w warranty), Populous Deltoid," which price shall be payment in full for performing all the operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E37. TOPSOIL AND SOD**

**E37.1 Description**

**E37.1.1** The specification shall amend and supplement City of Winnipeg specification CW 3510 and CW 3540.

**E37.1.2** 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 other things necessary for and incidental to the satisfactory performance and completion of all Work as shown on the Drawings and as hereinafter specified, including, but not necessarily confined to the following:

- (a) Supply and Installation of imported topsoil, to a minimum 75mm compacted thickness, for areas to be sodded.
- (b) Supply and Installation of mineral sod as required.



## **E37.2 Materials and Construction Methods**

- E37.2.1 The Contractor shall install topsoil and sod in any existing play areas where material is removed and not re-established as play area, or where play surfacing is not proposed.
- E37.2.2 The Contractor shall install topsoil and sod around the perimeter of the newly constructed area to clean up turf disturbed by the Work. Sod and topsoil shall be installed as shown on Drawings a distance of a minimum of 1000mm from the concrete walkway as per Detail Drawings.
- E37.2.3 The Contractor shall install topsoil and sod in any existing pathway area where material is removed and not re-established as pathway.
- E37.2.4 Damaged areas: Restoration of damaged areas other than as outlined above shall be incidental to the Work. No separate payment shall be made. Restoration shall be achieved using sod and topsoil unless otherwise directed by the Contract Administrator.

## **E37.3 Measurement and Payment**

- E37.3.1 Topsoil and sod will be measured and paid for as described in Section 13 of CW 3510.

## **E38. SITE CLEAN UP**

- E38.1 The Contractor shall upon the completion of Work each day, load and dispose of all excess asphalt cuttings, spoiled concrete, reinforcing steel, granular and other material associated with the Works from the Work Site. The Contractor shall secure or remove all of his machinery and equipment at the end of each day from the immediate work site. The Contractor will not be permitted to store machinery, equipment, or materials on public roads overnight. Any costs in connection with the above mentioned Works are incidental.
- E38.2 Unless otherwise specified the Contractor shall restore all areas which have been disturbed by his operations to as good as or better than original condition including removal of all construction debris, repair all vegetation, sod, concrete pavement, concrete curbs, concrete sidewalk and asphalt paving to remain etc. to the satisfaction of the Contract Administrator. Any costs incurred in connection with the above mentioned Work are incidental to unit prices bid under this contract.
- E38.3 Total Performance of the Work shall not be attained until the Contractor has cleaned up the Site and has removed all tools, equipment, waste, debris and surplus foundation earth to the satisfaction of the Contract Administrator. Unless otherwise specified, the Contractor shall restore all areas of the Site beyond the established limit of Work, which have been disturbed by the Contractor's operations to as good as or better than the original condition to the satisfaction of the Contract Administrator. The Contractor shall pay all costs associated with this Work.
- E38.4 Sod and Topsoil (repair to damaged areas). The Contractor shall install mineral sod and a minimum 75mm compacted thickness of topsoil, as required, and in accordance with CW 3510 and CW 3540.

## **E39. SOFT EXCAVATION TO EXPOSE UNDERGROUND UTILITIES**

### **E39.1 Description**

- E39.1.1 This specification covers the soft excavation to expose underground utilities to determine the depth of the underground utility and whether it will interfere with the installation of proposed Works on site.
- E39.1.2 These underground utilities include, but are not limited to, Manitoba Hydro cables, MTS cables, existing sewers, and existing watermain.

## **E39.2 Materials**

### **E39.2.1 Backfill Material**

- (a) Backfill material for backfill of shafts after hydro-excavation has been completed shall consist of sand as per City of Winnipeg Standard Construction Specification CW 2030.

## **E39.3 Construction Methods**

E39.3.1 Prior to commencement of any construction works adjacent to underground utilities, the Contractor shall use soft digging or hand excavation to expose the underground utilities.

E39.3.2 Once the elevation of the top of the pipe or duct has been determined the resulting excavation shall be backfilled with bedding sand to the elevation of the existing ground.

## **E39.4 Measurement and Payment**

E39.4.1 Soft excavation to expose underground utilities will be considered incidental to the Work. No measurement and payment will be made within this section.

## **E40. SAWCUTTING PAVEMENT**

E40.1 At the limits of excavation as directed by the Contract Administrator, the Contractor shall saw cut the existing pavement to produce a clean straight edge when excavated. The edge must be clean and straight prior to pouring new concrete pavement.

## **E40.2 Measurement and Payment**

E40.2.1 Sawcutting pavement and disposal of surplus material will be considered incidental to Clause 4.1 of CW 3110 "Pavement Removal." No measurement and payment will be made within this section.

## **E41. SODDING**

E41.1 Further to CW 3510 – Sodding

E41.1.1 The maintenance and warranty period will be one year.

E41.1.2 Payment Method: The unit price for sodding to include the maintenance and warranty period of one year. The 10% of the cost of sodding will be held as a maintenance contract value.

## **E42. SALT TOLERANT GRASS SEEDING**

### **E42.1 Description**

E42.1.1 Further to CW 3520 and CW 3540, this specification shall cover sub-grade preparation and the supply and placement of Salt Tolerant Grass Seed.

### **E42.2 Materials**

#### **E42.2.1 Salt Tolerant Grass Seed**

- (a) Salt Tolerant Grass Seed for regional and collector boulevards, medians and interchange areas shall be a mixture composed of:
- (b) Seventy percent (70%) Fults or Nuttalls Alkaligrass (*Puccinellia* spp.), twenty percent (20%) Audubon or Aberdeen Creeping Red Fescue and ten percent (10%) Perennial Ryegrass.

### E42.3 Equipment

- E42.3.1 Scarification equipment shall be suitable for the area being scarified, shall be capable of scarifying the sub-grade to the specified depth and shall be accepted by the Contract Administrator. For confined areas a toothed bucket may be acceptable. For larger areas tilling equipment may be required.

### E42.4 Construction Methods

#### E42.4.1 Preparation of Existing Grade

- (a) Prior to placing topsoil, in areas to be seeded greater in width than 600mm, prepare the existing sub-grade by scarifying to a minimum depth of 75mm and to a maximum depth of 100mm to the satisfaction of the Contract Administrator.
- (b) Scarification shall consist of breaking up and loosening the sub-grade. No scarification shall occur within the edge of a tree canopy (or drip line).

#### E42.4.2 Salt Tolerant Grass Seeding

- (a) Salt Tolerant Grass Seed shall be sown at a rate of 2.2 kilograms per 100 square metres.

### E42.5 Measurement and Payment

- E42.5.1 Salt Tolerant Grass Seed will be measured on an area basis and will be paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

Items of Work:

- (a) Salt Tolerant Grass Seed:
  - (i) Sixty five (65%) percent of quantity following supply and placement.
  - (ii) Remaining thirty five (35%) percent of quantity following termination of the Maintenance Period

## E43. SEEDING

### E43.1 Further to CW 3520 – Seeding

- E43.1.1 The maintenance and warranty period will be one year.
- E43.1.2 Payment Method: The unit price for seeding to include the maintenance and warranty period of one year. The 10% of the cost of seeding will be held as a maintenance contract value.

## E44. UNDER BRIDGE LIGHTING AND UTILITY CONDUITS

### E44.1 Description

- (a) This Specification shall cover the supply and installation of the, lighting fixtures, fixture support arms, fixture vandal guards, circuit breakers, contactors, conductors, conduits, pull boxes, and junction boxes and all required appurtenances and incidental components.
- (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 other things necessary for and incidental to the satisfactory completion of all Work as hereinafter specified

#### E44.1.1 Scope of Work

The works involved with lighting fixtures and conduit shall include:

- (a) The supply and installation of metering enclosure, circuit breakers, contactors, conduit, wiring and related materials.
- (b) The supply and installation of lighting fixtures, ballasts and mounting hardware.
- (c) Testing of feeds and all modes of contactor operation.
- (d) Supply and place conduits
- (e) Supply and place splice pit

#### E44.2 Materials

##### E44.2.1 FRE Conduits

- (b) Conduits within bridge structure shall be FRE ID Series Standard Wall. Expansion / deflection joints for conduit within the bridge structure shall be FRD ID SW Expansion / Deflection joints.
- (c) Other concrete embedded and below ground conduits shall be PVC. Exposed conduit accessible to public shall be stainless steel.

##### E44.2.2 Pull Box

- (d) Pull boxes shall be 432x762x305mm Synertech with SCTE Tier 15 performance load rating or approved equal in accordance with B6.

##### E44.2.3 Metering

- (e) Metering enclosure to be stainless steel CSA 4 enclosure for utility revenue metering.

##### E44.2.4 Contactor

- (f) 120V 15A single pole breaker and 120V 20A single pole contactor complete with 120V coil

##### E44.2.5 Wiring

- (g) All wiring to be via Teck cable sizes as per Drawings.

##### E44.2.6 Lighting Fixtures

- (h) Lighting fixture shall be outdoor American Electric Lighting ATB 30LED E70 120 R2 NR complete with custom support arm and custom vandal guard. Contractor to confirm fixture voltage with utility.

##### E44.2.7 Custom Support Arm

- (a) The support arm shall be constructed as described on the Drawings and in accordance with E23.

##### E44.2.8 Custom Vandal Guard

- (a) The custom vandal guard shall be constructed as described on the Drawings and in accordance with E23.

##### E44.2.9 Anchor Bolts for Lighting Assemblies

- (a) The anchor bolts for the lighting assemblies are to be Hilti Hit HY 150 Max adhesive and HAS 316 SS Rods with stainless steel nut and washer.

#### E44.3 Construction Methods

##### E44.3.1 General

- (b) Manufacturers and CSA labels to be visible and legible, after equipment installation.
- (c) Install permanently mounted mechanically fastened warning signs on equipment in accordance with requirements of the electrical inspection department and CEC.

- (d) Contractor to confirm voltage with utility prior to ordering any materials.

E44.3.2 Handling and Storage of Materials

- (e) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.
- (f) All materials shall be handled and stored in a careful and workmanship like manner.

E44.3.3 Pull Boxes

- (g) Supply and place pull boxes at the locations shown on the Drawings with the conduits connected to the pull boxes as per manufacturer's recommendations and requirements.

E44.3.4 Metering

- (h) Contractor shall supply and install stainless steel CSA 4 enclosure for utility revenue metering. Contractor to coordinate additional enclosure requirements with utility

E44.3.5 Contactor

- (i) Contractor shall supply and install 120V 15A single pole breaker and 120V 20A single pole contactor complete with 120V coil in surface mounted stainless steel CSA 4 enclosure. Contactor coil to be wired to a rugged photocell mounted on top of the cabinet, facing North. Photocell to be complete with an override

E44.3.6 Grounding

- (j) 19mm diameter by 3m long copper clad steel rod electrodes, connected to the equipment by soft annealed bare strand copper wire via copper accessories. Buried connections to be made in accordance with ANSI/IEEE 837. Soldered joints not permitted.

E44.3.7 Inspection and Approvals

- (k) All materials and assemblies supplied under this Specification and Drawings shall be CSA approved and subject to inspection. If a special approval is required for an assembly, the contractor is responsible to obtain the approval from the authority having jurisdiction. A copy of the written approval obtained by the Contractor shall be given to the Contract Administrator prior the installation the assembly.

E44.3.8 Conductors for Lighting Fixtures

- (l) All conductors and terminations required for the lighting and associated controls to be supplied and installed under this contract.

E44.3.9 Conduits and Related Materials

- (m) All conduit shall be sized as shown on the Drawings or otherwise accepted by the Contract Administrator in accordance with the Canadian Electrical Code, unless otherwise specified.
- (n) Supply and install conduit expansion joints in accordance with Drawings and these Specifications.

E44.3.10 Installation of Lighting Fixtures

- (o) Lighting fixtures shall be mounted on the support arm in accordance with manufacturer's recommendations and the Drawings and Specifications.

E44.3.11 Placing Conduits, Pull Boxes, and Junction Boxes

- (p) All conduits, pull boxes and junction boxes shall be placed as shown on the Drawings, and in accordance with manufacturer's recommendations.
- (q) The conduit to be placed in concrete shall be firmly anchored in place to prevent movement during pouring of the concrete. Care shall be exercised when pouring concrete to prevent damage to any conduit. The open ends of the conduits shall be

suitably capped, to protect the conduit from damage. The conduit system shall be watertight.

- (r) Fish wire shall be placed in all conduits and shall be firmly anchored at the open ends of the conduits. The Contractor shall drill a small hole in the conduit cap for passage of the fish wire.
- (s) Upon completion of the conduit system, the Contractor shall ascertain that no obstructions are blocking any conduit.

#### E44.3.12 Underground Conductors

- (t) Bedding for underground conductors shall consist of a 150 mm layer of well compacted, dry sand.
- (u) Dry sand shall be backfilled to a minimum depth of 150 mm above the conduit.
- (v) The remainder of the trench shall be filled with selected material free from stones larger than 100 mm in any one dimension. Backfill shall be compacted throughout the length of the installation to avoid subsequent settlement. Contractor is responsible for additional backfill in case of any subsequent settlement. Provide marking tape above the entire length of buried conductors.
- (w) Except where otherwise specified, buried conductors shall be minimum of 900 mm below final grade.

#### E44.3.13 Power Supply

- (x) Coordinate the location of the incoming feed to the metering enclosure for the lighting with the utility. Contractor to coordinate the supply and installation of incoming feed with utility as required. Contractor shall provide a new metering enclosure and a new breaker / contactor enclosure complete with photocell control. See Drawings for details.

#### E44.4 Permits, Codes, and Regulations

- (a) The Contractor shall be responsible to obtain and pay for all electrical permits, inspections, etc., required by the authorities having jurisdiction over this work, and shall keep a copy of each permit at the project site.
- (b) The work shall be carried out in accordance with the latest regulations of the Canadian Electrical Code (CEC) and all applicable municipal and Provincial Codes and Regulations. In case of a conflict between the CEC and the specification, contractor to ensure that the installation meets the CEC requirements. In no instance, however, shall the standard established by the Drawings and Specifications be reduced by any of the Codes referred to above.

#### E44.5 Measurement and Payment

##### E44.5.1 FRE Conduits

FRE conduits will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for the "Items of Work" listed here below, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator:

Items of Work:

FRE Conduits:

- (a) 100mm FRE Conduit
- (b) 125mm FRE Conduit

##### E44.5.2 Pull Boxes

Pull boxes will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for "Supply and Place Pull Boxes", which price shall be payment in full for

performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E44.5.3 Bridge Lighting**

**E44.5.4** Bridge lighting will not be measured and will be paid for at the Contract Lump Sum Price for "Bridge Lighting", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E45. ROCKFILL TRENCH SHEAR KEY**

**E45.1 Description**

This Specification shall cover the installation of the rockfill trench shear key, including excavation, removal of excavated material, supply and placement of rockfill and clay cap backfill, and incidental provisions for handling groundwater infiltration.

The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, and all things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

**E45.2 Materials**

**E45.2.1 General**

The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.

**E45.2.2 Rockfill Backfill**

Rockfill for backfilling the trench shear key shall consist of blasted or crushed rockfill material, free from organics, roots, sand, silt, clay, snow, ice or any other material that would detract from the strength and drainage characteristics of rockfill. The rockfill for the rockfill trench shear key shall conform to the following specifications:

- (a) minimum bulk gravity of 2.6 (ASTM C127)
- (b) maximum Los Angeles abrasion loss of 30% (ASTM C131)
- (c) maximum soundness of loss 13% (ASTM C88)
- (d) gradation requirements

Canadian Metric Sieve Size (millimetres)	Percent Total Dry Weight Passing Each Sieve
500	100%
300	35-80%
100	20-60%
50	15-45%
5	0-10%

The rockfill shall be durable, comprised of either limestone, granite, or other quality dense rock. Should the contractor choose to use limestone, it shall be durable while crystalline limestone. Softer buff to yellow dolomite or dolostone will not be acceptable. Rock samples shall either be submitted to the Contract Administrator for approval ten (10) days prior to their use, or the contract Administrator shall visit the quarry for inspection a minimum ten (10) days prior to use. No rockfill will be permitted without providing the source and supplier. Inspection of the source will be performed by the Contract Administrator prior to written acceptance.

The rockfill will be a crushed material. Smooth, rounded, rock or field stones will not be accepted.

### E45.2.3 Clay Cap

The impervious clay cap at the top of the rockfill trench shear key shall consist of a high plasticity clay material with a liquid limit in excess of 60%. The clay shall be free of deleterious material such as roots, organic material, ice, snow or other unsuitable materials and may be salvaged from the on-site excavation, as approved by the Contract Administrator. Frozen material will not be accepted. The supply and placement of the impervious clay cap shall be considered incidental to the rockfill trench shear key installation, and no separate measurement or payment will be made.

### E45.3 Equipment

All equipment, implements, tools and facilities used shall be of size and type as required to complete the work in a reasonable time, approved by the Contractor Administrator. The Contractor shall keep all equipment in good working order, and have sufficient equipment available at all times, as required.

### E45.4 Construction Methods

#### E45.4.1 General

The excavation shall be supervised at all times, and open excavations shall be adequately guarded or covered to protect work safety.

#### E45.4.2 Shear Key Construction

The shear key excavation shall be excavated to the depths and widths, and in the locations shown on the Drawings. An adequate volume of rockfill for backfilling shall be on-site prior to excavation of each incremental length of the trench shear key. The excavation shall proceed in a timely manner and rockfill must be placed as soon as excavation takes place. Stockpiling of excavated material on the riverbank will not be permitted. The maximum open length of the shear key shall be 2 metres along the bottom of the excavation. The Contractor shall be required to prevent surface water from entering the excavation.

In no case shall the shear key be left at the end of the day. The shear key must be filled with rockfill at the end of each day.

After placement of the rockfill to the required dimensions shown on the Drawings, the impervious clay cap shall be placed in layers not exceeding 200 millimetres, and compacted to a minimum of 95% of the Standard Proctor maximum dry density. The clay cap shall be located within undisturbed native material surrounding the trench. Care shall be taken to ensure that an effective seal results between the wall of the excavation and the clay material placed to protect against water infiltration into the trench, as approved by the Contract Administrator.

Water infiltration and bottom blow out may occur as the bottom of the trench approaches the till. The top elevation of the trench excavation shall be located to minimize the risk of river water entering the excavation. Discharge of water contained within the trench excavation from displacement of the rockfill during backfill will be acceptable. The Contractor shall be responsible to contain and direct any displaced water such that it will not affect other construction work or cause excessive erosion of the native riverbank soils. The control of the water shall be the responsibility of the Contractor and shall be considered incidental work.

As outlined within other areas of this Specification, the existing bridge removal and new bridge construction will be performed in two Phases. Upon the Phase 1 removal of the existing bridge, all rockfill trench shear key shown on the drawings located east of the west limit of Phase 1 construction shall be installed prior to approach slab fill placement or segmental block wall fill placement as part of Sturgeon Road northbound lanes bridge replacement.



For the Phase 2 construction, all rockfill trench shear key construction at the limits shown on the drawings shall be completed prior to Sturgeon Road Southbound Lanes approach slab fill placement or any fill placement for segmental block retaining wall construction.

**E45.4.3 Supply of Rockfill**

The Contractor shall monitor the supply rate of rockfill material to ensure backfilling operations are not delayed.

**E45.4.4 Stockpiling of Rockfill Material**

The stockpiling material on the lower bank will not be permitted at locations where the trench shear key has not been installed. The methodology for the stockpiling of rockfill at the lower bank area at locations where the trench shear key has been installed shall be subject to the approval of the Contract Administrator. The approvals shall be considered incidental to the cost of E46 Rockfill Trench Shear Key. Stockpiles of rockfill for the rock columns and trench shear key shall be kept separate.

**E45.4.5 Contaminated Rockfill Material**

Where crushed limestone has been contaminated with silt, clay or other deleterious material, the materials shall be classified as rejected backfill and shall be weighed prior to disposal, for deduction from the total weight of crushed limestone measured for payment.

**E45.5 Quality Control**

**E45.5.1 Inspection**

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 the final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.

The Contract Administrator shall be afforded full access for inspection of the work and testing of materials at the site to determine whether the material is being supplied and placed in accordance with this Specification.

**E45.6 Measurement and Payment**

**(i) Shear Key Excavation**

Shear key excavation will be measured on a volume basis and will be paid for at the Contract Unit Price per cubic metre for "Common Excavation – Suitable Site Material", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**(ii) Rockfill**

Rockfill will be measured on a mass basis and will be paid for at the Contract Unit Price per metric tonne for "Rockfill", which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

The Contractor shall provide the weight tickets to the Contract Administrator for the material supplied to the site at the time of delivery. No payment will be made for any weight tickets which are not supplied at the time of delivery, or which are lost.

**E46. ROCKFILL COLUMNS**

**E46.1 Description**

This Specification shall cover the installation of the rockfill columns, including the auger drilling, cuttings removal, sleeving, supply and placement of rockfill and clay cap backfill, and incidental provisions for handling groundwater infiltration.

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.

## E46.2 Materials

### E46.2.1 General

The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.

### E46.2.2 Rockfill Backfill

Rockfill for backfilling the columns shall consist of a blasted or crushed rockfill material, free from organics, roots, sand, silt, clay, snow, ice or any other material that would detract from the strength and drainage characteristics of rockfill. The rockfill for the rockfill columns shall conform to the following specifications:

- (a) minimum bulk specific gravity of 2.6 (ASTM C127)
- (b) maximum Los Angeles abrasion loss of 30% (ASTM C 131 )
- (c) maximum soundness of loss of 13% (ASTM C88)
- (d) gradation requirements

Canadian Metric Sieve Size (millimetres)	Percent Total Dry Weight Passing Each Sieve
500	100%
300	35-80%
100	20-60%
50	15-45%
5	0-10%

E46.2.3 The rockfill shall be durable, comprised of either limestone, granite, or other quality dense rock. Should the contractor choose to use limestone, it shall be durable white crystalline limestone. Softer buff to yellow dolomite or dolostone will not be acceptable. Rock samples shall either be submitted to the Contract Administrator for approval ten (10) days prior to their use, or the Contract Administrator shall visit the quarry for inspection a minimum of ten (10) days prior to use. No rockfill will be permitted without providing the source and supplier. Inspection of the source will be performed by the Contract Administrator prior to written acceptance.

### E46.2.4 Clay Cap

The impervious clay cap at the top of the rockfill column shall consist of a high plasticity clay material with a liquid limit in excess of 60%. The clay shall be free of deleterious material such as roots, organic material, ice, snow or other unsuitable materials and may be salvaged from the on-site excavation, as approved by the Contract Administrator. Frozen material will not be accepted. The supply and placement of the impervious clay cap shall be considered incidental to the rockfill column installation, and no separate measurement or payment will be made.

### E46.2.5 Rock Column Sleeves

E46.2.6 During auguring of the rockfill columns, it may be necessary to use steel sleeves to prevent the sidewalls of the columns from caving in during auguring. The sleeves shall be a minimum of 2.1 m in diameter (inside diameter) and be of a length suitable to extend from ground surface down to a minimum of 0.3 m into the underlying till material. The Contract Administrator will determine if sleeving is required at each rockfill column.

### E46.3 Equipment

All equipment, implements, tools and facilities used shall be of a size and type as required to complete the work in a reasonable time, approved by the Contract Administrator. The Contractor shall keep all equipment in good working order, and have sufficient standby equipment available at all times, as required.

### E46.4 Construction Methods

#### E46.4.1 General

The excavation shall be supervised at all times, and open shafts shall be adequately guarded or covered to protect for worker safety.

#### E46.4.2 Construction Timing and Sequence

- (a) The Contractor shall submit their rock column installation sequence to the Contract Administrator for review a minimum of one (1) week prior to the start of construction. The Contractor will not start to install rockfill columns until the Contract Administrator has reviewed the construction sequence and has provided written approval.
- (b) As outlined within other areas of this Specification, the existing bridge removal and new bridge construction will be performed in two Phases. Upon the Phase 1 removal of the existing bridge, all rockfill columns shown on the drawings located east of the west limit of Phase 1 construction shall be installed prior to approach slab fill placement or segmental block wall fill placement as part of Sturgeon Road northbound lanes bridge replacement.
- (c) For the Phase 2 construction, all rockfill columns shown on the drawings shall be completed prior to Sturgeon Road southbound lanes approach slab backfill placement, or any fill placement for segmental block retaining wall construction.

#### E46.4.3 Excavation

- (a) The rock column shafts shall be excavated by drill rig augers to the depth as shown on the drawings to achieve a minimum of 0.3 m penetration into competent glacial till. Note that the glacial till contact elevation may vary and the depth of excavation may differ from that shown on the drawings.
- (b) Drilling shall not commence until the rockfill is on site to backfill the shaft.
- (c) Any deleterious or sloughed material shall be removed from the rock column shaft prior to backfilling.
- (d) Discharge of water contained within the auger hole from displacement of the rockfill during backfill will be acceptable. The Contractor shall be responsible to contain and direct any displaced water such that it will not affect other construction work or cause excessive erosion of the native riverbank soils. The control of the water shall be considered incidental to the work.
- (e) The construction of the rock columns shall be a continuous operation with backfilling immediately following excavation.
- (f) The Contractor must complete backfilling of each rock column before commencing to excavate adjacent rock columns.
- (g) Excavated material shall be removed from the riverbank area immediately upon excavation and disposed of offsite. Stockpiling of excavated material on the riverbank area will not be permitted.

#### E46.4.4 Sleeving Rock Column Shafts

- (a) The Contractor shall install steel sleeving as required to control sloughing and caving of the shafts.

- (b) Shafts shall only be sleeved where it is not possible to advance and maintain an open hole during the excavating and backfilling procedures and the Contractor shall only be paid for sleeving approved by the Contract Administrator.

#### E46.4.5 Backfilling

- (a) Excavated rock column shafts shall be backfilled immediately upon excavated. No hole shall remain without backfill overnight, or for a period beyond four (4) hours.
- (b) After placement of the rockfill to the required dimensions shown on the Drawings, the impervious clay cap shall be placed in layers not exceeding 200 millimetres, and compacted to a minimum of 95% of the Standard Proctor Maximum Dry Density. The clay cap shall be located within undisturbed native material surrounding the caisson. Care shall be taken to ensure that an effective seal results between the wall of the shaft excavation and the clay material placed to protect against water infiltration into the shaft, as approved by the Contract Administrator.

#### E46.4.6 Supply of Rockfill

The Contractor shall monitor the supply rate of the rockfill material to ensure that the backfilling operations are not delayed.

#### E46.4.7 Stockpiling of Rockfill Material

The stockpiling of rockfill material on the lower bank area will not be permitted at locations where rockfill columns have not been installed. The methodology for the stockpiling of rockfill at the lower bank area at locations where rockfill columns have been installed shall be subject to the approval of the City of Winnipeg Planning, Property and Development Department Waterways Authority and will require a Waterways Permit Approval. The approvals shall be considered incidental to the cost of Rockfill Columns. Stockpiles of rockfill for the rock columns and trench shear key shall be kept separate.

#### E46.4.8 Contaminated Rockfill Material

Where crushed limestone has become contaminated with silt, clay, or other deleterious material due to the Contractor's method of operation, negligence, failure to backfill in a timely manner, etc. the material shall be classified as rejected backfill and shall be weighed prior to disposal for deduction from the total weight of crushed limestone measured for payment.

#### E46.5 Quality Control

##### E46.5.1 Inspection

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 the final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.

The Contract Administrator shall be afforded full access for the inspection and control testing of materials installation and compaction at the site to determine whether the material is being selected and placed in accordance with this Specification.

#### E46.6 Measurement and Payment

##### (i) Shaft Drilling

Shaft Drilling will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Shaft Drilling," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

The length to be paid for shall be the total number of vertical metres of shaft drilled, measured from the ground surface at the time of the rockfill column installation

(ii) Rockfill

Rockfill will be measured on a mass basis and will be paid for at the Contract Unit Price per metric tonne for "Rockfill," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

The Contractor shall provide the weigh tickets to the Contract Administrator for the material supplied to the site at the time of delivery. No payment will be made for any weigh tickets which are not supplied at the time of delivery, or which are lost.

(iii) Sleeving

Sleeving of the rockfill columns will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for "Sleeves," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## **E47. REINFORCED CONCRETE RETAINING WALL**

### **E47.1 Description**

E47.1.1 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 other things necessary or and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

### **E47.2 Materials**

E47.2.1 The concrete shall be supplied in accordance with CSA A23.1/A23.2 with an S-2 class of exposure.

E47.2.2 The reinforcement steel shall be supplied in accordance with CSA G30.18, grade 400W.

### **E47.3 Construction Methods**

E47.3.1 The Contractor shall place the concrete in accordance with CSA A23.1/A23.2.

E47.3.2 The reinforcement steel shall be placed in accordance with CSA G30.18.

E47.3.3 The wall shall have a joint cut every 5000 mm to a depth of 25 mm.

E47.3.4 The wall shall be cast integral to the footing.

### **E47.4 Measurement and Payment**

E47.4.1 Reinforced concrete retaining wall will be measured on a length basis and will be paid at the Contract Unit Price per linear metre for "Reinforced Concrete Retaining Wall," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E47.4.2 Items also considered incidental to this specification includes formwork, excavation, backfill, sub-drain with protective sleeve, compacted base sampling and placing concrete and supply and placing steel.

## **E48. INSTALLATION OF BOLLARDS**

### **E48.1 Description**

E48.1.1 This Specification covers the supply and installation of bollards as indicated on the Drawings.

### **E48.2 Construction Methods**

E48.2.1 All bollards judged by the Contract Administrator to be in unsatisfactory condition shall be disposed of by the Contractor and replace with equivalent new bollards.

- E48.2.2 In the event of damage to any materials by the Contractor, the Contractor shall immediately notify the Contract Administrator and make all repairs or replacements necessary, at his own expense, to the satisfaction of the Contract Administrator. In no case shall the Contractor install a damaged bollard component.

**E48.3 Measurement and Payment**

- E48.3.1 Supply and installation of bollards will be measured on unit basis and will be paid for at the Contract Unit Price per unit for "Supply and Installation of Bollards," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E49. TIMBER BUMPER FENCE**

**E49.1 Description**

- E49.1.1 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 other things necessary or and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

**E49.2 Materials**

- E49.2.1 The hardware shall be galvanized steel.
- E49.2.2 The posts and rails shall be treated timber.

**E49.3 Construction Methods**

- E49.3.1 Shop Drawings are to be submitted to the Contract Administrator prior to the Contractor proceeding with the Work. The shop drawings shall state the size and length of all hardware.
- E49.3.2 The existing timber bumper fence shall be removed. Each existing timber post shall be completely removed. The Contractor shall install the new timber fence posts to the depth and height as shown in the drawings. The holes shall be backfilled with compacted well graded granular material.
- E49.3.3 The timber rails shall be installed using the mounting brackets and carriage bolts as shown on the Contract Drawings. All end cuts shall be treated with topical solution.

**E49.4 Measurement and Payment**

- E49.4.1 Supply and installation of Timber Bumper Fence will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Timber Bumper Fence," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.
- Items also considered incidental to this specification includes supplying and installing the posts, timber rails, hardware, and backfilling post holes with compacted well graded granular material.
- E49.4.2 Removal of the existing timber bumper fence will be measured on a length basis and will be paid for at the Contract Unit Price per linear metre for "Removal of Existing Timber Bumper Fence," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E50. SUBDRAINS**

**E50.1 Description**

- E50.1.1 Further to the City of Winnipeg standard specification CW 3120 the following shall apply.

## E50.2 Construction Methods

### E50.2.1 Installation of Drainage Fabric

- (a) Install drainage fabric in the longest continuous practical length, free from tension, stress, folds, wrinkles and creases.
- (b) Overlap joints a minimum of 600 millimetres.
- (c) Install pins and place piles of drainage material as required to hold the drainage fabric in place.
- (d) Wrap the drainage fabric around the drainage material.
- (e) Cut drainage fabric as required to accommodate installation around existing gas lines. Patch the cut drainage fabric by overlapping piece of fabric to a minimum 600mm or as recommended by the manufacturer and approved by the Contract Administrator.
- (f) Remove and replace drainage fabric that has been improperly installed or damaged as directed by the Contract Administrator. Install drainage fabric in the longest continuous practical length, free from tension, stress, folds, wrinkles and creases.

### E50.2.2 Installation of Drainage Pipe

- (a) Install drainage pipe to line and grade shown on the Drawings or as directed by the Contract Administrator.
- (b) Assemble pipe in accordance with manufacturer's instructions so when complete the drainage pipe will have a smooth and uniform invert.
- (c) Install drainage pipe on 100 millimetres of drainage material ensuring uniform support under bell and pipe body throughout full length.
- (d) Use longest pipe length manufactured where practicable to reduce number of joints on the sub-drain.
- (e) Commence installation of drainage pipe at lowest point and proceed upgrade.
- (f) Lay drainage pipe with bell upgrade.
- (g) Install drainage pipe with perforations positioned towards.
- (h) Install caps on ends of all sub-drains and secure to drainage pipe in accordance with manufacturer's recommendations.
- (i) Allowable variance from specified line to be +/- 100 millimetres.
- (j) Allowable variance from specified grade to be +/- 25 millimetres.
- (k) Correct alignment and grade exceeding the allowable variance as directed by the Contract Administrator.

### E50.2.3 Placement of Drainage Material

- (a) Complete placement of drainage material in 150 millimetre lifts and compact to the satisfaction of the Contract Administrator.
- (b) Place drainage material to ensure no damage occurs to the drainage fabric and drainage pipe.

## E50.3 Measurement and Payment

### E50.3.1 Subdrain will be measured and paid for as described in CW 3120.

## E51. TREE REMOVAL

### E51.1 Description

#### E51.1.1 Further to CW 3010 and the City of Winnipeg "Tree Removal Guidelines", this specification shall cover the removal of trees as specified on the Contract Drawings.

**E51.2 Construction Methods**

E51.2.1 Remove trees in accordance with CW 3010.

**E51.3 Measurement and Payment**

E51.3.1 Tree removal will be measured on a unit basis and will be paid for at the Contract Unit Price per unit for "Tree Removal," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E52. PROTECTION OF NATIVE GRASS AREA**

**E52.1 Description**

E52.1.1 Further to E3, "Environmental Protection Plan," this specification will cover the protection of native grass areas along riverbanks.

**E52.2 Construction Methods**

- (a) The Contractor will mark required limits of work along riverbanks to retain and minimize damage of native grass areas and limits will remain marked throughout the construction period.
- (b) Vegetation will not be disturbed without written permission from the Contract Administrator.
- (c) The Contractor will protect plants or trees which may be at risk of accidental damage. Such measures may include protective fencing or signage and will be approved in advance by the Contract Administrator.
- (d) The Contractor will limit surface disturbance and vegetation clearing.
- (e) Areas where vegetation is removed during clearing, construction decommissioning activities, will be revegetated as soon as possible in accordance with the landscaping plans forming part of the Contract, or as directed by the Contract Administrator.
- (f) Any re-vegetation will require a 150 mm topsoil layer to be placed as well as erosion controls between the bank and the water.
- (g) Damaged native grass areas which are not viable will be replaced at the expense of the Contractor.

**E52.3 Materials**

E52.3.1 Where damaged native grass areas need to be replaced the Contractor will contact the City Naturalist at the address below to determine the requirements for planting and or re-seeding the area.

Naturalist Service Branch  
City of Winnipeg  
5006 Roblin Boulevard  
Winnipeg, MB R3R 0G7  
Phone: (204)986-7234  
Fax: (204)986-7236

**E52.3.2 Topsoil**

Topsoil placed will be in accordance with Clause 5.2 of CW 3540.

**E52.4 Measurement and Payment**

E52.4.1 Protection of native grass area will not be measured. Damaged native grass areas by the Contractor will be repaired and replaced at the expense of the Contractor. No measurement and payment will be made within this section.