



**THE CITY OF WINNIPEG**

# **BID OPPORTUNITY**

**BID OPPORTUNITY NO. 774-2013**

**RECONSTRUCTION OF THE ST. JAMES STREET BRIDGE OVER OMAND'S  
CREEK**

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## **PART B - BIDDING PROCEDURES**

### **B1. CONTRACT TITLE**

B1.1 RECONSTRUCTION OF THE ST. JAMES STREET BRIDGE OVER OMAND'S CREEK

### **B2. SUBMISSION DEADLINE**

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, November 22, 2013.

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.

### **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. CONFIDENTIALITY**

B5.1 Information provided to a Bidder by the City or acquired by a Bidder by way of further enquiries or through investigation is confidential. Such information shall not be used or disclosed in any way without the prior written authorization of the Contract Administrator. The use and disclosure of the confidential information shall not apply to information which:

- (a) was known to the Bidder before receipt hereof; or
- (b) becomes publicly known other than through the Bidder; or
- (c) is disclosed pursuant to the requirements of a governmental authority or judicial order.

B5.2 The Bidder shall not make any statement of fact or opinion regarding any aspect of the Bid Opportunity to the media or any member of the public without the prior written authorization of the Contract Administrator.

## **B6. ADDENDA**

- B6.1 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.
- B6.2 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.
- B6.2.1 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>
- B6.2.2 The Bidder is responsible for ensuring that he/she 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.
- B6.3 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.

## **B7. SUBSTITUTES**

- B7.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.
- B7.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.
- B7.3 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.
- B7.4 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.
- B7.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his/her 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.
- B7.6 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.

- B7.6.1 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/she wishes to inform.
- B7.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.
- B7.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base his/her 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 B16.
- B7.9 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.
- B7.10 Notwithstanding B7.2 to B7.9, and in accordance with B8.6 deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B16.1(a).

## **B8. BID COMPONENTS**

- B8.1 The Bid shall consist of the following components:
- (a) Form A: Bid;
  - (b) Form B: Prices;
  - (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;
- B8.2 Further to B8.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B7.
- B8.3 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.
- B8.4 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.
- B8.4.1 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.
- B8.5 Bidders are advised not to include any information/literature except as requested in accordance with B8.1.
- B8.6 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 B16.1(a).
- B8.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.
- B8.8 Bids shall be submitted to:
- The City of Winnipeg  
Corporate Finance Department  
Materials Management Division  
185 King Street, Main Floor  
Winnipeg MB R3B 1J1

**B9. BID**

- B9.1 The Bidder shall complete Form A: Bid, making all required entries.
- B9.2 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/her own name, his/her 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/her own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.
- B9.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B9.2.
- B9.3 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.
- B9.4 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/her 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, should be affixed;
  - (d) if the Bidder is carrying on business under a name other than his/her 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.
- B9.4.1 The name and official capacity of all individuals signing Form A: Bid should be printed below such signatures.
- B9.5 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.

**B10. PRICES**

- B10.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.
- B10.2 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.
- B10.3 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.
- B10.4 Payments to Non-Resident Contractors are subject to Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).

**B11. QUALIFICATION**

- B11.1 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.

B11.2 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>

B11.3 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);

B11.4 Further to B11.3(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 Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association's WORKSAFELY™ COR™ 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/>)

B11.5 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.

B11.6 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.

## **B12. BID SECURITY**

B12.1 The Bidder shall provide bid security in the form of:

- (a) a bid bond, in the amount of at least ten percent (50%) 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 (50%) 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.

- B12.1.1 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.
- B12.1.2 All signatures on bid securities shall be original.
- B12.1.3 The Bidder shall sign the Bid Bond.
- B12.1.4 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.
- B12.2 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.
- B12.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B12.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.
- B12.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.
- B12.3 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.

### **B13. OPENING OF BIDS AND RELEASE OF INFORMATION**

- B13.1 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.
  - B13.1.1 Bidders or their representatives may attend.
  - B13.1.2 Bids determined by the Manager of Materials, or his/her designate, to not include the bid security specified in B12 will not be read out.
- B13.2 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/>
- B13.3 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/>
- B13.4 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.

### **B14. IRREVOCABLE BID**

- B14.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.
- B14.2 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.

## **B15. WITHDRAWAL OF BIDS**

- B15.1 A Bidder may withdraw his/her Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.
- B15.1.1 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.
- B15.1.2 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.
- B15.1.3 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 B15.1.3(b), declare the Bid withdrawn.
- B15.2 A Bidder who withdraws his/her Bid after the Submission Deadline but before his/her Bid has been released or has lapsed as provided for in B14.2 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.

## **B16. EVALUATION OF BIDS**

- B16.1 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 there from (pass/fail);
  - (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B11 (pass/fail);
  - (c) Total Bid Price;
  - (d) economic analysis of any approved alternative pursuant to B7.
- B16.2 Further to B16.1(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.
- B16.3 Further to B16.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his/her Bid or in other information required to be submitted, that he/she is responsible and qualified.
- B16.4 Further to B16.1(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.
- B16.4.1 Further to B16.1(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.

B16.4.2 Further to B16.1(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

**B17. AWARD OF CONTRACT**

B17.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B17.2 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.

B17.2.1 Without limiting the generality of B17.2, 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.

B17.3 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 B16.

B17.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his/her Bid upon written request to the Contract Administrator.

B17.4 The City's intent is to award the Contract no later than December 20, 2013.

## **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 St. James Street Bridge over Omand's Creek

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

- (a) Removal of the existing precast concrete channel girder superstructure
- (b) Modifications to the existing concrete abutments and channel work
- (c) Supply and installation of precast prestressed concrete channel girders
- (d) Construction of new bridge superstructure
- (e) Associated roadworks including a new sidewalk on the east side of St. James Street from Dublin Ave. to Bangor Ave.
- (f) Electrochemical chloride extraction of the abutments and wingwalls.

#### D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

- (a) **Stage 1**" means all construction bridge works necessary to fully reopen the bridge to vehicular and pedestrian traffic, including but not limited to the following work;
  - (i) Traffic control for complete closure of St. James Street at the bridge over Omand's Creek to vehicular and pedestrian traffic (by others);
  - (ii) Removal and demolition work;
  - (iii) Structural excavation, subdrain installation, and backfilling;
  - (iv) Abutment concrete repairs and modifications;
  - (v) Installation of gabion walls and riprap;
  - (vi) Fabrication and installation of new precast prestressed concrete channel girders;
  - (vii) Pouring and curing cast-in-place concrete deck, reinforced sidewalk, traffic barriers, abutment diaphragms, approach slabs, sleeper slabs and roadway transition slabs;
  - (viii) Removal of heated enclosures for concrete curing;
  - (ix) Placement of temporary asphalt paving to transition vehicles between the existing roadway surface and the roadway transition slabs; and
  - (x) Placement of temporary asphalt paving to transition pedestrians between the new sidewalk and the existing sidewalk surface.
- (b) **"Stage 2"** means all construction surface works including but not limited to the following work;
  - (i) Traffic control for maintaining at least one lane in each direction on St. James Street (by Contractor);
  - (ii) Removal of temporary asphalt paving;
  - (iii) Concrete pavement replacement and asphalt paving on road surface and bridge deck;
  - (iv) Construction of concrete sidewalk beyond the approach slabs; and
  - (v) Miscellaneous surface works.

- (c) "**Stage 3**" means all construction works including but not limited to the following work;
  - (i) Traffic control for single lane closures during non-peak hours (by Contractor);
  - (ii) Electrochemical chloride extraction of the abutments and wingwalls; and
  - (iii) Miscellaneous cleanup and site restoration.
- (d) "**Fisheries Window**" means the time period from April 1, 2014 to June 15, 2014 in which no in-stream work shall occur.

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

D4.1 The Contract Administrator is Dillon Consulting Limited, represented by:

Sital Rihal, P.Eng.  
Project Manager  
1558 Willson Place  
Winnipeg, Manitoba R3T 0Y4  
Telephone No. 204 453-2301  
Facsimile No. 204 452-4412

D4.2 At the pre-construction meeting, Sital Rihal will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D4.3 Bids Submissions must be submitted to the address in B8.8

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

D5.1 At the pre-construction meeting, the Contractor shall identify his/her designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

#### **D6. OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON DISCLOSURE**

D6.1 The Contract, all deliverables produced or developed, and information provided to or acquired by the Contractor are the property of the City and shall not be appropriated for the Contractors own use, or for the use of any third party.

D6.2 The Contractor shall not make any public announcements or press releases regarding the Contract, without the prior written authorization of the Contract Administrator.

D6.3 The following shall be confidential and shall not be disclosed by the Contractor to the media or any member of the public without the prior written authorization of the Contract Administrator;

- (a) information provided to the Contractor by the City or acquired by the Contractor during the course of the Work;
- (b) the Contract, all deliverables produced or developed; and
- (c) any statement of fact or opinion regarding any aspect of the Contract.

D6.4 A Contractor who violates any provision of D6 may be determined to be in breach of Contract.

#### **D7. NOTICES**

D7.1 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.

D7.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in

D7.3, D7.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the facsimile number identified in D4.1.

- D7.3 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

- D7.4 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 facsimile number:

The City of Winnipeg  
Legal Services Department  
Attn: Director of Legal Services

Facsimile No.: 204 947-9155

## **D8. FURNISHING OF DOCUMENTS**

- D8.1 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/her at cost.

## **SUBMISSIONS**

### **D9. AUTHORITY TO CARRY ON BUSINESS**

- D9.1 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.

### **D10. SAFE WORK PLAN**

- D10.1 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.

- D10.2 The Safe Work Plan should 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>

### **D11. INSURANCE**

- D11.1 The Contractor shall provide and maintain the following insurance coverage:
- (a) commercial general liability insurance, in the amount of at least five million dollars (\$5,000,000.00) inclusive, with The City of Winnipeg added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability, broad form property damage cover and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;
  - (b) if applicable, Automobile Liability Insurance covering all motor vehicles, owned and operated and used or to be used by the Contractor directly or indirectly in the performance

of the Work. The Limit of Liability shall not be less than \$2,000,000 inclusive for loss or damage including personal injuries and death resulting from any one accident or occurrence.

- (c) an all risks Installation Floater carrying adequate limits to cover all machinery, equipment, supplies and/or materials intended to enter into and form part of any installation.

D11.2 Deductibles shall be borne by the Contractor.

D11.3 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 but in no event later than the date specified in C4.1 for the return of the executed Contract.

D11.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least thirty (30) Calendar Days prior written notice to the Contract Administrator.

## **D12. PERFORMANCE SECURITY**

D12.1 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.

D12.1.1 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.

D12.2 If the bid security provided in his/her Bid was not a certified cheque or draft pursuant to B12.1(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 but in no event later than the date specified in C4.1 for the return of the executed Contract.

## **D13. SUBCONTRACTOR LIST**

D13.1 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 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. 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 Gantt chart for the Work schedule  
all acceptable to the Contract Administrator.



- D14.3 Further to D14.2(a), the Gantt chart Work schedule shall clearly identify the start and completion dates, as well as critical path items for all activities listed under D19.
- D14.4 Further to D14.2(a), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.
- D14.5 The Contractor shall provide a tracked schedule showing actual progress in relation to the detailed work schedule on a regular basis. Update the schedule at least once per month and as requested by the Contract Administrator.

## **D15. ENVIRONMENTAL PROTECTION PLAN**

D15.1 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.

D15.2 The Contractor is advised that at a minimum the following Acts, Regulations and By-laws apply to the Work and are available for viewing on line 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.

### **D15.3 Federal**

- (a) Canadian Environmental Assessment Act (CEAA), 1992 c.37 (repealed);
- (b) Canadian Environmental Protection Act;
- (c) Fisheries Act, 1985 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.

### **D15.4 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 Pesticides Regulation, M.R. 94/88R
- (g) The Public Health Act, c. P210;
- (h) The Water Protection Act, c. W65;
- (i) Workplace Safety and Health Act, c. W210;
- (j) And current applicable associated regulations;
- (k) And any other applicable Acts, Regulations, and By-laws;

- (l) The Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat, Manitoba Natural Resources and DFO, 1996.

D15.5 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.

D15.6 The Contractor is advised that the following environmental protection measures apply to the Work.

- (a) 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 Engineer or 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.
- (b) Fuel Handling and Storage
  - (i) The Contractor will obtain all necessary permits from Manitoba Conservation and Water Stewardship 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 any temporary fuel storage areas established for construction of the project are contained by an impermeable dyke and are located a minimum distance of 100 m away from the Lot 16 Drain, Beaujolais Coulee and any other watercourse. Dykes will be designed, constructed, and maintained to retain not less than 100% of the capacity of the total number of containers or 110% of the largest container, whichever is greatest. The dykes will be constructed of clay or similar impervious material. If this type of material is not available, the dyke will be constructed of locally available material and lined with high-density polyethylene (HDPE). Furthermore, the fuel storage area(s) will be secured by a barrier such as a high fence and gate to prevent vandalism.
  - (v) The Contractor will ensure that all fuel storage containers are inspected daily for leaks and spillage.
  - (vi) Products transferred from the fuel storage area(s) to specific Work sites will not exceed the daily usage requirement.
  - (vii) 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.

- (viii) 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.
  - (ix) 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.
  - (x) The deposit of deleterious substances into water frequented by fish is prohibited under the Fisheries Act, 1985. 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.
  - (xi) Machinery is to arrive on Site in a clean condition and is to be maintained free of fluid leaks.
  - (xii) 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.
- (c) 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 approved 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.
- (d) 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.
- (e) 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 and Water Stewardship, 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 and Water Stewardship 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 and Water Stewardship 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 and Water Stewardship.
- (ix) City emergency response, 9-1-1, shall be used if other means are not available.

Table 1 - Environmental Accident Reporting Reportable Quantities of Spills that must be Reported to Manitoba Conservation and Water Stewardship [(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*

(f) 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.
- (iii) The Contractor will locate stationary noise generating equipment (e.g., generators) away from sensitive receptors and wildlife areas.
- (iv) Construction vehicles and equipment will adhere to posted speed limits.

(g) 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.

(h) 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 inwater 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/removal 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, 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.
- (i) 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 gulying 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.
- (j) Fish
- (i) The Contractor will adhere to all of the protection measures below , adhere to the DFO No Net Loss Policy for fish habitat.
  - (ii) Due to the presence of spawning fish species no in-stream works will occur between April 1 and June 15 of any given year.
  - (iii) If possible, bridge works will be constructed during periods of no flow or very low flow. Flowing water should be diverted around the construction area using a dam and bypass pump or temporary flume (culvert). Water will be diverted in a manner that avoids sediment generation to downstream areas and does not alter the volume of flow in the watercourse. Use coffer dams made of non-earthen material such as aquadams, sand bags, sheet pile or clean granular material wrapped in poly-plastic or other suitable isolation materials. Ensure any pump inlets are appropriately screened following the DFO Freshwater Intake End-of-Pipe Fish Screen Guidelines. Ensure all isolation materials are completely removed from the watercourse once construction is complete.
  - (iv) Any fish trapped within the isolated area will be captured and returned to the watercourse unharmed. Fish includes fin fish, crayfish and mussels (clams).
  - (v) All bridge works will be limited to within road's right-of-way.
  - (vi) A buffer of vegetation will be maintained when working along waterways, where possible.
  - (vii) Culverts will be installed according to the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Manitoba Natural Resources and DFO,

1996). The culverts will be embedded a minimum of 0.3 m or 10% of culvert vertical diameter, whichever is greater to maintain connectivity during lower flows in this forage fish stream.

- (viii) The duration of Work and amount of disturbance to the bed and banks of the water body will be minimized.
  - (ix) Use only clean rock for armouring the channel areas, 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.
  - (x) 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.
  - (xi) 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.
  - (xii) Excavation of the water body bed will be limited to within the road right of way and is the minimum required for the proper placement of the culvert crossing.
  - (xiii) Shoreline vegetation will be retained to the greatest extent possible to maximize the stability of the banks.
  - (xiv) Operate machinery from outside of the water and in a manner that minimizes disturbance to the banks of the water body.
  - (xv) 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.
- (k) 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.
- (l) 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.
- (m) 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 limit the removal of trees and snags (standing dead trees); surface disturbance and vegetation clearing.
  - (iv) Herbicides and pesticide will not be used adjacent to any surface watercourse.
  - (v) Trees or shrubs will not be felled into watercourses.
  - (vi) 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.
  - (vii) 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.
- (n) 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 revegetated 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.
- (o) 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.
- (p) 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.
- (q) 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.

#### **D16. REQUEST FOR INFORMATION AND NON-CONFORMANCE REPORTS**

- D16.1 For all Request for Information (RFI's) and Non-Conformance Reports (NCR's) submissions, the Contractor shall assume a minimum of 48 hour response time will be required per submission.
- D16.2 The Contractor shall not undertake work associated with these submissions until the Contract Administrator review is completed and responded to in writing.

#### **D17. SHIFT ACTIVITY LOG**

- D17.1 The Contract Administrator shall provide a daily recording tool for logging activities on site of the following;
  - (a) work activities;
  - (b) manpower;
  - (c) equipment used; and
  - (d) any additional remarks.
- D17.2 The recording of activities shall be completed by the Contract Administrator on a daily basis. The Contractor shall review and coordinate any revisions with the Contract Administrator.
- D17.3 Once reviewed and coordinated, both Contract Administrator and Contractor shall sign the Shift Activity Log on a daily basis.
- D17.4 The Contract Administrator shall retain the original and supply a paper copy to the Contractor for their records.

## **SCHEDULE OF WORK**

### **D18. COMMENCEMENT**

- D18.1 The Contractor shall not commence any Work until he/she is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work
- D18.2 The Contractor shall not close St. James Street prior to January 6, 2014.
- D18.3 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 D9;
    - (ii) evidence of the workers compensation coverage specified in C6.15;
    - (iii) the Safe Work Plan specified in D10;
    - (iv) evidence of the insurance specified in D11;
    - (v) the performance security specified in D12;
    - (vi) the Subcontractor list specified in D13; and
    - (vii) 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.

### **D19. CRITICAL STAGES**

- D19.1 The Contractor shall achieve Critical Stages of the work in accordance with the following requirements:
- (a) Completion of **Stage 1**, reopening of the St. James Street to vehicles and pedestrians, and completion of all in-stream work including riprap installation by March 31, 2014.
  - (b) Completion of **Stage 2** by June 30, 2014.

### **D20. SUBSTANTIAL PERFORMANCE**

- D20.1 The Contractor shall achieve Substantial Performance by August 15, 2014.
- 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 reinspected.
- 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 September 12, 2014.
- 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 reinspected.

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 Critical Stages or Total Performance in accordance with the Contract by the days fixed herein for the 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) Critical Stage listed in D19.1(a) – Two Thousand dollars (\$2,000.00).

(b) Critical Stage listed in D19.1(b) – One Thousand dollars (\$1,000.00).

(c) Substantial Performance – Five Hundred dollars (\$500.00).

(d) Total Performance – Five Hundred dollars (\$500.00).

D22.2 The amount specified for liquidated damages in D22.1 is based on a genuine pre-estimate of the City's damage in the event that the contractor does not achieve Critical Stages 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.

## **CONTROL OF WORK**

### **D23. JOB MEETINGS**

D23.1 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.

D23.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he/she deems it necessary.

### **D24. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)**

D24.1 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).

### **D25. RESTRICTED WORK HOURS**

D25.1 All Work shall be carried out between the hours of 07:00 and 22:00 Monday to Friday and between 09:00 and 21:00 Saturday or Statutory or Civic holidays.

D25.2 No Work shall be performed outside the hours stated in D25.1 or on Sunday or statutory or civic holidays without written permission from the Contract Administrator. Approval will only be granted if it is in the best interests of the City to do so.

D25.3 Further to clause 3.10 of CW 1130, the Contractor shall require written permission forty-eight (48) hours in advance from the Contract Administrator for any Work to be performed outside the hours stated in D25.1.

**D26. ENCROACHMENT ON PRIVATE PROPERTY**

- D26.1 Further to Section 3.11 of CW 3110 of the General Requirements, the Contractor shall confine his Work to the public right-of-ways and construction easements at all times, except if he has received written permission from the property owner. The Contractor shall provide the Contract Administrator with a copy of any written permission he has received to enter onto private property.
- D26.2 The Contractor's construction activities shall be confined to the minimum area necessary for undertaking the Work and he shall be responsible for all damage to private property resulting from his Work. Particular care shall be taken to assure no damage is done to buildings, fencing, trees and plants, and provision shall be made to maintain full drainage for private properties during construction.

**D27. DAMAGE TO EXISTING STRUCTURES AND PROPERTY**

- D27.1 Further to Section 3.13 of CW 1130 of the General Requirements, special care shall be taken to avoid damage to existing adjacent structures and properties during the course of Work.
- D27.2 Any damage caused by the Contractor or his Subcontractors to the adjacent structures of properties shall be promptly repaired by the Contractor at his own expense to the satisfaction of the Contract Administrator.

**D28. LAYOUT OF THE BRIDGE WORKS**

- D28.1 Further to C6, the Contract Administrator will provide the basic centrelines and an elevation of the works as shown for the bridge structure on the Drawings.
- D28.2 The Contractor shall be responsible for the true and proper layout of the Work and for the correctness of the location, levels, dimensions, and alignment of all aspects of the Work. The Contractor shall provide all required instruments and competent personnel for performing all layouts.
- D28.3 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 their own expense.
- D28.4 The Contract Administrator shall be notified at least one (1) Working Day prior to any Work being commenced in order to have the option to check and review all elevations and layouts at his discretion.
- D28.5 The Contractor shall carefully protect and preserve all benchmarks, stakes, and other items used in giving 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.
- D28.6 The Contractor shall arrange and carry on his Work so as not to conflict with the collection of any data in anyway by the Contract Administrator. The Contractor shall adjust Work and/or remove any interference as directed by the Contract Administrator at the expense of the Contractor.

**D29. LAYOUT OF THE ROAD WORKS**

- D29.1 Further to C6 of the General Conditions for Construction, the Contract Administrator will provide reference lines and final design elevations to the Contractor at intervals and offsets deemed necessary by the Contract Administrator.
- D29.2 The Contractor shall be responsible for the layout of any additional grades required as deemed necessary by the Contractor. Grades that the Contractor is responsible for includes but is not limited to sub-grade, sub-base and base course elevations.

- D29.3 The Contractor shall provide all required instruments and competent personnel for performing all layouts. Any Work found to be defective due to errors in layout completed by the Contractor shall be corrected at the expense of the Contractor.
- D29.4 The Contract Administrator shall be notified at least one (1) Working Day prior to any Work being commenced in order to have the option to check and review all elevations and layouts at his discretion.
- D29.5 The Contractor shall carefully protect and preserve all benchmarks, stakes, and other items used to convey the basic data to the Contractor 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. The Contract Administrator shall be notified at least two (2) Working Days prior to replacing any benchmarks, stakes and other items used to convey the basic data to the Contractor.
- D29.6 The Contractor shall arrange and carry on his Work so as not to conflict with the collection of any data and layout of reference lines and design elevations in anyway by the Contract Administrator. The Contractor shall adjust Work and/or remove any interference as directed by the Contract Administrator at the expense of the Contractor.

## **MEASUREMENT AND PAYMENT**

### **D30. PAYMENT**

- D30.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

### **D31. WARRANTY**

- D31.1 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.

**FORM H1: PERFORMANCE BOND**  
(See D12)

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. 774-2013

RECONSTRUCTION OF THE ST. JAMES STREET BRIDGE OVER OMAND'S CREEK

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)



**FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT  
(PERFORMANCE SECURITY)**  
(See D12)

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

The City of Winnipeg  
Legal Services Department  
185 King Street, 3rd Floor  
Winnipeg MB R3B 1J1

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 774-2013

RECONSTRUCTION OF THE ST. JAMES STREET BRIDGE OVER OMAND'S CREEK

Pursuant to the request of and for the account of our customer,

\_\_\_\_\_  
(Name of Contractor)

\_\_\_\_\_  
(Address of Contractor)

WE HEREBY ESTABLISH in your favour our irrevocable Standby Letter of Credit for a sum not exceeding in the aggregate

\_\_\_\_\_ Canadian dollars.

This Standby Letter of Credit may be drawn on by you at any time and from time to time upon written demand for payment made upon us by you. It is understood that we are obligated under this Standby Letter of Credit for the payment of monies only and we hereby agree that we shall honour your demand for payment without inquiring whether you have a right as between yourself and our customer to make such demand and without recognizing any claim of our customer or objection by the customer to payment by us.

The amount of this Standby Letter of Credit may be reduced from time to time only by amounts drawn upon it by you or by formal notice in writing given to us by you if you desire such reduction or are willing that it be made.

Partial drawings are permitted.

We engage with you that all demands for payment made within the terms and currency of this Standby Letter of Credit will be duly honoured if presented to us at:

\_\_\_\_\_  
(Address)

and we confirm and hereby undertake to ensure that all demands for payment will be duly honoured by us.

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 (2007 Revision), International Chamber of Commerce Publication Number 600.

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

Per: \_\_\_\_\_  
(Authorized Signing Officer)

Per: \_\_\_\_\_  
(Authorized Signing Officer)



## 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>Drawing No.</u>	<u>Drawing Name/Title</u>
B126-13-01	Cover Sheet
B126-13-02	General Notes
B126-13-03	General Arrangement
B126-13-04	Construction Staging
B126-13-05	Bore Holes
B126-13-06	Existing Abutment – Demolition Details
B126-13-07	Abutment Modifications 1 of 3
B126-13-08	Abutment Modifications 2 of 3
B126-13-09	Abutment Modifications 3 of 3
B126-13-10	Bearing Layout and Details
B126-13-11	Girders 1 of 5
B126-13-12	Girders 2 of 5
B126-13-13	Girders 3 of 5
B126-13-14	Girders 4 of 5
B126-13-15	Girders 5 of 5
B126-13-16	Deck Slab and Sidewalks 1 of 2
B126-13-17	Deck Slab and Sidewalks 2 of 2
B126-13-18	Bridge Approach Slabs
B126-13-19	Concrete Barrier Rail and Aluminum Barrier Layout
B126-13-20	Aluminum Barrier Rail Standard Details
B126-13-21	Roadway Transition Slabs
B126-13-22	Roadway – Plan, Cross Sections, & Details
B126-13-23	Roadway – Plan & Profile
B126-13-24	Miscellaneous Creek Works
B126-13-25	Reinforcing Steel Schedule – Abutment, Girder and Deck Slabs
B126-13-26	Reinforcing Steel Schedule – Approach slabs, Barrier and Transition Slabs

### GENERAL REQUIREMENTS

#### E2. MOBILIZATION AND DEMOBILIZATION

- E2.1 Description
- E2.1.1 This Specification shall cover all operations relating to the mobilization and demobilization of the Contractor to the Site, as specified herein.

E2.1.2 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.

## E2.2 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 E4 "Site Office Facilities";
  - (iii) Maintaining and removing any access roadways;
  - (iv) Supplying and installing secure fencing around the site;
  - (v) Restoring all Site facilities

## E2.3 Materials

E2.3.1 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.

E2.3.2 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.

### E2.3.3 Work Site Construction Fencing

- (a) The bridge construction Site and the staging area shall be protected from the public by a secure fencing (for paved areas) and snow fencing (elsewhere).
- (b) The Contractor shall be responsible for maintenance of the Work Site construction fencing.

E2.3.4 The Contractor's Site supervisor is required to carry, at all times, a cellular telephone, with voice mail.

E2.3.5 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.

## E2.4 Equipment

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

## E2.5 Construction Methods

### E2.5.1 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.

### E2.5.2 Secure Site Fencing

- (a) A minimum 1.8 m high 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

### E2.5.3 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.

### E2.5.4 Restoration of Existing Facilities

- (a) Upon completion of the Work and demobilization, the Contractor shall restore existing facilities.

## E2.6 Quality Control

### E2.6.1 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.
- (c) The Contract Administrator reserves the right to reject any materials or Works which are not in accordance with the requirements of this Specification.

### E2.6.2 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.

## E2.7 Measurement and Payment

E2.7.1 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.

E2.7.2 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.

## E3. SHOP DRAWINGS

### E3.1 Description

E3.1.1 This Specification provides instructions for the preparation and submission of shop drawings.

- (a) The term 'shop drawings' means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, including Site erection drawings

which are to be provided by the Contractor to illustrate details of a portion of the Work; and,

- (b) Submit specified shop drawings to the Contract Administrator for review. All submissions must be in metric units. Where data is in imperial units, the correct metric equivalent shall also be shown on all submissions for Contract Administrator review.

### E3.2 Shop Drawings

E3.2.1 Original drawings shall be prepared by Contractor, Subcontractor, supplier, distributor or manufacturer to illustrate appropriate portion of Work including fabrication, layout, setting or erection details as specified in appropriate sections.

E3.2.2 Shop drawings for the following components shall bear the seal of a Professional Engineer registered in the province of Manitoba:

- (a) Temporary Shoring, as requested by the Contract Administrator;
- (b) All Form Details, as requested by the Contract Administrator;
- (c) Form Details for Deck Pours;
- (d) Bearing Layout and Details;
- (e) Metal Fabrications, Layout, and Erection Details for Girders;

### E3.3 Contractor's Responsibilities

- (a) Review shop drawings, product data and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.
- (b) Verify:
  - (i) Field Measurements;
  - (ii) Field Construction Criteria; and,
  - (iii) Catalogue numbers and similar data.
- (c) Coordinate each submission with requirements of Work and Contract Documents. Individual shop drawings will not be reviewed until all related drawings are available.
- (d) Notify Contract Administrator, in writing at time of submission, of deviations from requirements of Contract Documents.
- (e) Responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator's review of submission, unless Contract Administrator gives written acceptance of specified deviations.
- (f) Responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- (g) Make any corrections required by the Contract Administrator and resubmit the required number of corrected copies of shop drawings. Direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.
- (h) After Contract Administrator's review and return of copies, distribute copies to Subcontractors and others as appropriate.
- (i) Maintain one (1) complete set of reviewed shop drawings, filed by Specification Section Number, at the Site of the Work for use and reference of the Contract Administrator and Subcontractors.

### E3.4 Submission Requirements

- (a) Schedule submissions at least fourteen (14) Calendar Days before dates reviewed submissions will be needed, and allow for a fourteen (14) Calendar Day period for review by the Contract Administrator of each individual submission and re-submission, unless noted otherwise in the Contract Documents.

- (b) Submit two (2) paper prints of shop drawings. The Contract Administrator will retain one (1) copy of all submittals and return one (1) copy to the Contractor.
- (c) Accompany submissions with transmittal letter containing:
  - (i) Date
  - (ii) Project title and Bid Opportunity number
  - (iii) Contractor's name and address
  - (iv) Number of each shop drawing, product data and sample submitted
  - (v) Specification Section, Title, Number and Clause
  - (vi) Drawing Number and Detail / Section Number
  - (vii) Other pertinent data
- (d) Submissions shall include:
  - (i) Date and revision dates
  - (ii) Project title and Bid Opportunity number
  - (iii) Name of:
    - (i) Contractor
    - (ii) Subcontractor
    - (iii) Supplier
    - (iv) Manufacturer
    - (v) Detailer (if applicable)
  - (iv) Identification of product or material
  - (v) Relation to adjacent structure or materials
  - (vi) Field dimensions, clearly identified as such
  - (vii) Specification section name, number and clause number or drawing number and detail / section number
  - (viii) Applicable standards, such as CSA or CGSB numbers
  - (ix) Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents

### E3.5 Other Considerations

- (a) Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.
- (b) Material and equipment delivered to the Site of the Works will not be paid for at least until pertinent shop drawings have been submitted and reviewed.
- (c) Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.
- (d) No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions and review of shop drawings.

## E4. SITE OFFICE FACILITIES

E4.1 The Contractor shall supply office facilities meeting the following requirements:

- (a) The field office shall be for the exclusive use of the Contract Administrator.
- (b) The building shall be conveniently located near the Site of the Work.
- (c) The building shall have a minimum floor area of 15 square metres, a height of 2.4 m with two window for cross ventilation and a door entrance with a suitable lock.
- (d) The building shall be suitable for all weather use. It shall be equipped with an electric heater and air conditioner so that the room temperature can be maintained between 16 - 25 C.



- (e) The building shall be adequately lighted with fluorescent fixtures and have a minimum of three wall outlets.
- (f) The building shall be furnished with one desk, one table 3 m x 1.2 m, one drafting table, one four drawer legal size filing size filing cabinet with lock, and a minimum of 5 chairs
- (g) Provide a small fridge, microwave, water cooler with disposable cups and coffee maker.
- (h) A portable toilet shall be located near the field office building. The toilet shall have a locking door.
- (i) The field office building and the portable toilet shall be cleaned on a weekly basis immediately prior to each site meeting. The Contract Administrator may request additional cleaning when he/she deems it necessary.

E4.2 The office facilities will be provided from the date of the commencement of the Work and as follows:

- (a) for Stage 1; and
- (b) to the completion of Stage 2.

E4.3 The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the office facilities.

E4.4 No separate measurement or payment will be made for performing all operations herein described and all other items incidental to the Work described.

## **E5. PROTECTION OF EXISTING TREES**

E5.1 The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing boulevard trees within the limits of the construction area:

- (a) The Contractor shall not stockpile materials and soil or park vehicles and equipment on boulevards within 2 metres of trees.
- (b) Trees 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.
- (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), with the outcome read in feet, from the closest edge of the trunk. Where roots must be cut to facilitate excavation, they shall be pruned neatly at the face of excavation.
- (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.

E5.2 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/her designate.

E5.3 Elm trees shall not be pruned at any time between April 1 and July 31.

E5.4 No separate measurement or payment will be made for performing all operations herein described and all other items incidental to the Work described.

## **E6. WATER OBTAINED FROM THE CITY**

- E6.1 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.

## **E7. VERIFICATION OF WEIGHTS**

- E7.1 All material which is paid for on a weight basis shall be weighed on a scale certified by Consumer & Corporate Affairs, Canada.
- E7.2 All weight tickets shall have the gross weight and the time and date of weighing printed by an approved electro/mechanical printer coupled to the scale.
- E7.3 The tare weight and net weight may either be hand written or machine printed. All weights, scales and procedures shall be subject to inspection and verification by the Contract Administrator. Such inspection and verification may include, but shall not be limited to:
- (a) Checking Contractor's scales for Consumer & Corporate Affairs certification seals.
  - (b) Observing weighing procedures.
  - (c) Random checking of either gross or tare weights by having such trucks or truck/trailer(s) combinations as the Contract Administrator shall select weighed at the nearest available certified scale.
  - (d) Checking tare weights shown on delivery tickets against a current tare.
- E7.4 No charge shall be made to The City for any delays or loss of production caused by such inspection and verification.
- E7.5 The Contractor shall ensure that each truck or truck/trailer(s) combination delivering material which is paid for on a weight basis carries a tare not more than one (1) month old.
- E7.6 The tare shall be obtained by weighing the truck or truck/trailer(s) combination on a certified scale and shall show:
- (a) Upon which scale the truck or truck/trailer(s) combination was weighed.
  - (b) The mechanically printed tare weight.
  - (c) The license number(s) of the truck and trailer(s).
  - (d) The time and date of weighing.
- E7.7 No separate measurement or payment will be made for performing all operations herein described and all other items incidental to the Work described.

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

- E8.1 Description
- (a) The Work covered under this item shall include all items relating to traffic and pedestrian control at the Site.
  - (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.
- E8.2 Notification
- (a) The Contractor shall notify the City of Winnipeg Customer Service at 204-986-5640, on day in advance of traffic lane closures.
- E8.3 Construction Methods

### E8.3.1 General

- (a) Traffic control shall be carried out in accordance with the latest edition of the "Manual of Temporary Traffic Control in Work Areas on City Streets," issued by the City of Winnipeg as specified herein.
- (b) Traffic lanes and sidewalk closures shall only be undertaken if necessary and as approved by the Contract Administrator.
- (c) Barricades shall be supplied, installed, and maintained by the Contractor and include the telephone number(s) at which the Contractor can be reached twenty-four (24) hour per day, seven (7) days per week.
- (d) Improper signing will be sufficient reason to immediately shutdown the entire job.

### E8.3.2 Specific

- (a) Traffic and Pedestrian Control for Stage 1 of the Work shall be as follows:
  - (i) Complete closure of the St. James Street Bridge over Omand's Creek will be required to complete Stage 1.
  - (ii) Partial (i.e. "soft") closures will be provided and maintained by the City of Winnipeg. The intent of the soft closures are to permit traffic to access businesses located along St. James Street between Dublin Ave. and Bangor Ave. Soft closures will be provided by the City of Winnipeg as shown in the Drawings.
  - (iii) Complete (i.e. "hard") closures will be provided and maintained by the City of Winnipeg. The intent of the hard closures are to completely close the bridge to all traffic. Hard closures will be provided by the City of Winnipeg as shown on the Drawings.
- (b) The Contractor will be responsible to erect and maintain gates and manage all site access for construction purposes.
- (c) Traffic and Pedestrian Control for Stage 2 of the Work shall be provided by the Contractor as follows:
  - (i) Maintain one lane in each direction on St. James Street.
  - (ii) Maintain at minimum a 1.5 m wide sidewalk for pedestrian access on one side of St. James Street.
- (d) Traffic and Pedestrian Control for Stage 3 of the Work shall be provided by the Contractor as follows:
  - (i) Single lane closures are not permitted from 7:00 am to 9:00 am as well as from 3:30 pm to 5:30 pm, Monday through Friday.
  - (ii) The Contractor shall call the Lane Closures reporting line at 204-986-5640 and the Traffic Management Branch at 204-986-5079 at least one day prior to beginning work on any particular street.
  - (iii) Intersecting street and private approach access shall be maintained at all times.
- (e) Pedestrian Safety
  - (i) During the project, a temporary snow fence shall be installed at open excavations within ten metres of any existing or constructed sidewalk or active transportation path. The Contractor shall be responsible for maintaining the snow fence in a proper working condition.
  - (ii) St. James Street Bridge over Omand's Creek will be closed to pedestrian traffic for the duration of Stage 1. The Contractor shall be responsible for supplying and installing all necessary pedestrian closure signs and protection measures to the satisfaction of the Contract Administrator.
  - (iii) During Stage 2 and Stage 3, the east sidewalk may be closed and the Contractor shall maintain pedestrian access on the west side of St. James Street. The Contractor shall be responsible for supplying and installing all necessary pedestrian closure signs and protection measures to the satisfaction of the Contract Administrator.

- (iv) If any active transportation path or sidewalk is completed prior to Substantial Performance, the Contractor shall place barricades indicating "Sidewalk Closed" at all access points to the path/sidewalk. The Contractor shall be responsible for maintaining the barricades until Substantial Performance is reached.

#### E8.4 Measurement and Payment

- (a) Traffic and Pedestrian Control will be considered incidental to E2 "Mobilization and Demobilization" and no additional measurement or payment will be made.

### **E9. SURFACE RESTORATIONS**

- E9.1 Further to clause 3.3 of CW 1130, when Total Performance is not achieved in the year the Contract is commenced, the Contractor shall temporarily repair any Work commenced and not completed to the satisfaction of the Contract Administrator. The Contractor shall maintain the temporary repairs in a safe condition as determined by the Contract Administrator until permanent repairs are completed. The Contractor shall bear all costs associated with temporary repairs and their maintenance.

### **E10. BRIDGE SITE SECURITY**

- E10.1 During the project the Contractor shall be responsible for maintaining only authorized Site access twenty-four (24) hours a day. Any existing security fencing, etc. that may be altered during construction will need to have an equivalent replacement upon the completion of the Project. No separate measurement or payment shall be made for this work.

### **E11. BRIDGE DEMOLITION AND REMOVALS**

#### E11.1 Description

- (a) This Specification shall cover all operations related to the demolition and removal of portions 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.
- (c) Scope of Work
  - (a) The Work under this Specification shall involve the following:
    - (i) Removal of existing components of the existing bridge as shown on the Drawings;
    - (ii) All material from the demolished bridge shall be removed from Site by the Contractor in accordance with the Contractor's Environmental Protection Plan; and
    - (iii) Excavation or any other works beyond the limits shown on the Drawings to facilitate the removals and demolition of the existing bridge.

#### E11.2 Materials

##### E11.2.1 General

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

#### E11.3 Submittals

- (a) The Contractor shall prepare a demolition and removals 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 bridge. The

demolition plan shall be in strict accordance with the Regulatory Approvals and the Environmental Protection Plan.

- (b) The demolition and removals 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 7 days prior to the commencement of the demolition of either existing bridge.

#### E11.4 Measurement and Payment

- (a) Bridge demolition and removal will not be measured and will be paid for at the Contract Lump Sum Price for "Bridge Demolition and Removals", 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.
- (b) Demolition and removals of the existing bridge will be paid for at a percentage of the Contract Lump Sum Price for "Bridge Demolition and Removals" specified as follows:
  - (i) 80% of this pay item will be paid upon the completion of removal of the existing precast prestressed concrete channel girders.
  - (ii) 20% of this pay item will be paid upon completion of all required demolition and removals of the existing bridge structure.

### E12. CONCRETE REPAIRS

#### E12.1 Description

- (a) The Work covered under this item shall include all operations relating to concrete patch repairs of the existing abutment and wingwalls in locations as directed by the Contract Administrator.
- (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.

#### E12.2 Materials

##### E12.2.1 General

- (a) Unless otherwise listed herein, materials shall be in accordance with E18 "Structural Concrete".

##### E12.2.2 Concrete

- (a) The Contractor shall be responsible for the design and performance of all concrete mixes supplied under this specification. Either ready mix concrete or proprietary repair mortars, where applicable, may be used having the following minimum properties in accordance with CSA A23.1-09:
  - (i) Class of Exposure : C-1
  - (ii) Compressive Strength @ 28 days = 35 MPa
  - (iii) Water / Cementing Materials Ratio = 0.4
  - (iv) Air Content: Category 1 per Table 4 of CSA A23.1-09
- (b) Mix design for ready mix concrete shall be submitted to Contract Administrator at least two weeks prior to concrete placing operations.
- (c) The workability of each concrete mix shall be consistent with the Contractor's placement operations.
- (d) Any proposed proprietary repair mortar shall be subject to the approval of the Contract Administrator and must meet or exceed the properties of the ready mix concrete.

- (e) The temperature of all types of concrete shall be between 15°C and 25°C at discharge. Temperature requirements for concrete containing silica fume shall be between 10°C and 18°C at discharge unless otherwise approved by the Contract Administrator.
- (f) Concrete materials susceptible to frost damage shall be protected from freezing.
- (g) Concrete repair material shall be compatible with the concrete substrate and the Contractor's method of placement. The Contractor may choose to use a proprietary repair mortar subject to the approval of the Contract Administrator.
- (h) Repair mortars, concrete and bonding agents shall be Portland cement-based materials with suitable electrical conductivity less than 15,000 ohm-cm.

#### E12.2.3 Galvanic Anodes

- (a) Embedded galvanic anodes shall have the following nominal dimensions: 64 mm in diameter by 27 mm deep, pre-manufactured, and consist of a minimum of 100 grams of zinc in compliance with ASTM B6 Special High Grade cast around a pair of steel tie wires in compliance with bright annealed ASTM A82 and encased in a highly alkaline cementitious shell with a pH of 14 or greater. The cementitious shell shall contain no added sulfate nor shall it contain chloride, bromide or other constituents that are corrosive to reinforcing steel. Anode units shall be supplied with integral unspliced wires with loop ties for directly tying to the reinforcing steel. Embedded galvanic anodes shall be Sika Galvashield® XP+ available from Sika Corporation or approved equal.

#### E12.3 Equipment

##### E12.3.1 General

- (a) Equipment shall be in accordance with E18 "Structural Concrete".

#### E12.4 Construction Methods

##### E12.4.1 General

- (a) The Contractor may consider form and pour, pressure grouting or low velocity spraying as application methods for girder end concrete repairs. Other methods shall be subject to the approval of the Contract Administrator.

##### E12.4.2 Removal of Existing Concrete and Concrete Surface Preparation

- (a) All areas requiring repair shall have their perimeters sawcut to a depth of 20 mm. The only exception to sawcutting will be in areas where there is no room for a concrete saw.
- (b) Remove all concrete in the repair area to a minimum depth
  - (i) 20 mm beyond the exposed rebar,
  - (ii) 6 mm larger than the largest size aggregate in the repair material beyond the exposed rebar, or,
  - (iii) to the depth of delamination,whichever is greater.
- (c) In locations where anodes or post-installed rebar will be present, remove concrete to provide a minimum of 50 mm cover.
- (d) Concrete removal may be undertaken by mechanical means with chipping hammers of appropriate size so as not to damage the girder substrate concrete as accepted by the Contract Administrator. Alternatively, hydrodemolition may be used.
- (e) Clean all resulting concrete and steel surfaces by grit-blasting. All unsound and stained concrete shall be fully removed. Exposed rebar shall be cleaned to a near-white condition.

- (f) If recommended by the mortar/grout manufacturer's directions, prewet the patch surfaces for the duration recommended.

#### E12.4.3 Installation of Anodes

- (a) Install anodes and repair material immediately following preparation and cleaning of the steel reinforcement and concrete substrate.
- (b) Galvanic anodes shall be installed along the perimeter of the repair or interface at a spacing of 450 mm as specified on the drawings and as directed by the Contract Administrator.
- (c) Provide sufficient clearance between anodes and substrate to allow repair material to encase anode.
- (d) Secure the galvanic anodes as close as possible to the patch edge using the anode tie wires. The tie wires shall be wrapped around the cleaned reinforcing steel and twisted tight to allow little or no free movement.
- (e) Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm,  $\Omega$ ) or potential (mV) with a multi-meter.
- (f) Electrical connection is acceptable if the DC resistance measured with a multi-meter is less than 1  $\Omega$  or the DC potential is less than 1 mV.
- (g) Confirm electrical continuity of the exposed reinforcing steel within the repair area. If necessary, electrical continuity shall be established with steel tie wire.
- (h) Electrical continuity between test areas is acceptable if the DC resistance measured with multi-meter is less than 1  $\Omega$  or the potential is less than 1 mV.

#### E12.4.4 Form Work and Shoring

- (a) Formwork and shoring shall be in accordance with E18 "Structural Concrete".

#### E12.4.5 Formliner

- (a) Formliner shall be used on all exposed formed surfaces.

#### E12.4.6 Bonding New Concrete to Existing Concrete

- (a) The Contractor is responsible to create a bond between the new mortar/concrete and the existing substrates. This may be done by either the application of a suitable bonding agent or grout or by using a self-bonding mortar or concrete. The Contract Administrator will check all repaired areas for bond using a hammer "sounding" method after form removal. Place mortar or concrete by trowelling, pumping, spraying, or into forms ensuring that all entrapped air is removed.
- (b) Should a bonding grout be used, it shall be applied immediately before concrete placement. It shall be thoroughly brushed onto the existing hardened concrete surface in a thin and even coating that will not puddle.

#### E12.4.7 Mixing and Placing Concrete

- (a) Mixing and placing concrete shall be in accordance with E18 "Structural Concrete". Where proprietary repair mortars are used, they shall be prepared in accordance with the manufacturer's instructions.

#### E12.4.8 General Curing

- (a) Concrete Curing shall be in accordance with E18 "Structural Concrete". Where proprietary repair mortars are used, they shall be cured in accordance with the manufacturer's instructions.
- (b) Refer to Clauses E18.6.21 and E18.6.22 for cold weather and hot weather curing requirements, respectively.

#### E12.4.9 Form Removal

- (a) Form Removal shall be in accordance with E18 "Structural Concrete".

E12.4.10 Patching of Formed Surfaces

- (a) Patching of Formed Surfaces shall be in accordance with E18 "Structural Concrete".

E12.4.11 Cold Weather Concreting

- (a) Cold Weather Concreting shall be in accordance with E18 "Structural Concrete".

E12.4.12 Hot Weather Concreting

- (a) Hot Weather Concreting shall be in accordance with E18 "Structural Concrete".

E12.5 Measurement and Payment

E12.5.1 Supply and Install Galvanic Anodes

- (a) Supply and Install Galvanic Anodes will be measured on a unit basis and paid for at the Contract Unit Price per anode for "Supply and Install Galvanic Anodes" 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.

E12.5.2 Concrete Repairs

- (a) Concrete repairs will be measured on area basis and paid for at the Contract Unit Price per square meter for "Concrete Repairs" 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. DISTRIBUTED GALVANIC CORROSION PROTECTION**

E13.1 Description

- E13.1.1 The work under this section consists of supplying, installing, and energizing a zinc-based distributed galvanic corrosion protection system, including required electrical connections, materials, testing, and ensuring continuity of the reinforcing steel to all elements as outlined in the construction drawings.

E13.2 Materials

E13.2.1 Zinc Anodes

- (a) Distributed galvanic units shall be alkali-activated zinc with nominal exterior dimensions of 32 mm. The distributed anode unit shall consist of 0.89 kg. of zinc per linear meter of anode. The zinc anode shall be manufactured in compliance with ASTM B 418 Type II (Z13000) and ASTM B69 Rolled Special High Grade Zinc (Z13004) using zinc in compliance with ASTM B6 Special High Grade (Z13001) with iron content less than 15 ppm.
- (b) The zinc shall be alkali-activated with a pH greater than 14. The anode unit shall contain no constituents that are corrosive to reinforcing steel as per ACI 222R such as chlorides, bromides, or other halides. The anode unit shall be supplied with a minimum of two lead wires of sufficient length to make connections between anodes and the reinforcing steel.
- (c) The galvanic protection shall be Galvanode DAS distributed anode system supplied by Vector Corrosion Technologies, Winnipeg, MB, (204) 489-6300, [www.vector-corrosion.com](http://www.vector-corrosion.com), or approved equal.
- (d) Application for approved equals shall be requested in writing two weeks before submission of project bids. Application for galvanic anode equals shall include verification of the following information:
  - (i) The zinc anode is alkali-activated with a pH of 14 or greater.



- (ii) The anode unit does not contain any corrosive constituents detrimental to reinforcing steel, e.g. chloride, bromide, etc.
- (iii) Proven track record of the anode technology showing satisfactory field performance with a minimum of three projects of similar size and application.
- (iv) Independent third party evaluation of the anode technology, e.g. Hitec, Concrete Innovations Appraisal Service, BRE, etc.

#### E13.2.2 Concrete

- (a) Concrete encapsulating the distributed galvanic units shall be supplied in accordance with E18 "Structural Concrete".

#### E13.3 Construction Methods

##### E13.3.1 General

- (a) The galvanic corrosion protection shall consist of the anodes as indicated on the Drawings. The anode units are connected to the reinforcing steel and encased in a concrete with a minimum of 2 inches of clear concrete cover over the anode units.

##### E13.3.2 Manufacturer Technical Assistance

- (a) The contractor will enlist and pay for the services of a NACE-qualified corrosion technician supplied by the galvanic anode manufacturer to provide training and on-site technical assistance during the installation of the galvanic column protection system. The qualified corrosion technician shall have verifiable experience in the installation and testing of embedded galvanic protection systems for reinforced concrete structures.
- (b) The contractor shall coordinate its work with the designated corrosion technician to allow for site support during project startup and initial anode installation. The technician shall provide contractor training and support for development of application procedures, shop drawings for submittals, anode and concrete installation, reinforcing steel connection procedures, and verification of electrical continuity of embedded steel.

##### E13.3.3 Surface Preparation

- (a) The abutments concrete removals shall be performed in accordance with the lines and grades shown on the Drawings.
- (b) After the removals, any additional spalled and delaminated concrete should be removed until solid concrete is encountered.
- (c) Exposed reinforcing steel and concrete should be cleaned by abrasive blasting or other means to remove all corrosion by-products and other materials that may inhibit bonding of the concrete encasement.

##### E13.3.4 Reinforcing Steel Connections

- (a) The Contractor shall directly connect each anode unit to exposed reinforcing steel on each abutment receiving corrosion protection. Alternately, the anodes can be wired together and connected to a minimum of two electrical (negative) connections per abutment. Whenever possible, electrical connections should be located where reinforcing steel is exposed. If no exposed steel exists after preparation of the abutment, a small area of concrete shall be removed to expose a tie.
- (b) Electrical connections to the reinforcing steel shall be established using suitable mechanical, welded stud or brazing techniques. Proposed electrical connection details shall be approved by the anode manufacturer and shall be detailed on the shop drawing submittal.

E13.3.5 Electrical Continuity

- (a) Reinforcing steel shall be tested for electrical continuity. Maximum DC resistance shall be 1 ohm or maximum DC voltage shall be 1 mV. Steel found to be discontinuous shall have continuity re-established by tying to other bars with steel tie wire or other approved means.

E13.3.6 Installation of Anodes

- (a) Distributed galvanic anode units shall be installed as shown on the Drawings. The anodes shall be installed as per manufacturer's instructions.

E13.3.7 Concrete Placement

- (a) Concrete shall be placed in such a manner to ensure that no segregation or air voids exist after concrete placement.

E13.4 Method of Measurement and Basis of Payment

- E13.4.1 The supply and installation of distributed galvanic protection system as shown on the Drawings will not be measured and paid for at the Contract Lump Sum Price for the "Supply and Install Distributed Galvanic Anode System" which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E14. ELECTROCHEMICAL CHLORIDE EXTRACTION (ECE)**

E14.1 Description

- (a) This Specification shall cover the use of electrochemical treatment to remove chloride from salt-contaminated concrete and, thereby, prevent and /or performed by applying an electrical field between the reinforcement corrosion. This electrochemical treatment (ECE) is performed by applying an electrical field between the reinforcement and an anode mesh placed in a reservoir on the surface of the concrete
- (b) The treatment shall be applied to the contaminated area of the structure. All work shall be completed by the Contractor unless otherwise specified. If any delaminations and spalls are detected in the concreted, they shall be repaired allowing sufficient curing (7days) of the concrete, or utilizing rapid curing repair mortar before proceeding with the treatment.
- (c) The chloride contaminated areas to be treated are as follows:
  - (i) Exposed surfaces of the north abutment and wingwalls
  - (ii) Exposed surfaces of the south abutment and wingwalls

E14.2 Materials and Equipment

E14.2.1 Materials for Concrete Repair

- (a) Only Portland cement concrete or mortars having an appropriate electrical resistivity shall be used in repairs.

E14.2.2 Anode System

- (a) General
  - (i) The anode system shall consist of an anode mesh embedded in a reservoir on the concrete surface. The electrolyte reservoir may consist of either cellulose fiber, or felt cloth, saturated with an electrolyte.
- (b) Anode Mesh
  - (i) Steel mesh may be used
- (c) Cellulose Fibres
  - (i) For optimum spraying and moisture retention properties, Fosroc Norcure FG2000 fibre or approved equal shall be used. Prior to spraying of the

cellulose fibres onto the concrete surface to be treated, wooden battens spacer shall be fixed to the concrete.

(d) Felt Cloth

- (i) In order to provide appropriate spacing and moisture retention the felt cloth shall be no less than 3 mm thick, and shall be limited to use on horizontal or deck surfaces.

(e) Electrolyte

- (i) The electrolyte shall consist of potable water; Calcium Hydroxide may be added as proposed by the manufacturer and approved by the Contract Administrator.

E14.2.3 Electrical Insulating Material

- (a) The electrical insulating material to be used to cover all electrical connections shall be waterproof.

E14.2.4 AC Power Supply

- (a) The Contractor will provide an appropriate AC power supply.

E14.2.5 DC Power Supply

(a) General

- (i) The DC power rectifiers supplied by the Contractor shall have a sufficient number of independent AC/DC converter circuits for the number of individual concrete zones to be treated
- (ii) Each AC/DC converter shall be rated to provide total output current and voltage to meet the current demand of the individual zone. A current distribution box shall be provided for each zone, so that each zone can be divided into subzones that can operate electrically in parallel. The voltage on the secondary side shall be limited to approximately 40 VDC. These converters shall be rated to operate continuously at maximum output under site conditions of temperature and relative humidity.

(b) Enclosures

- (i) The converters shall be housed in vandal-proof enclosures suitable for site conditions.

E14.2.6 Tests for Monitoring Chloride

(a) Chloride Analysis

- (i) Sampling of concrete for chloride analysis is performed by the Contractor by drilling either cores or powder samples. Cores shall be cut into slices and crushed to fine powder.
- (ii) Analyses to determine the residual water-soluble chloride content in the concrete shall be in accordance to CSA A23.2-4B.

(b) Sampling Procedure

- (i) Care shall be taken to prevent cross contamination between samples. As chlorides in unreinforced concrete do not cause any deterioration of the concrete, the main purpose of the Norucre process is to treat the concrete in the vicinity of the rebar. It is therefore important that this is the area which is tested (particularly post treatment samples).

E14.3 Installation Procedure

E14.3.1 Preparation of the Concrete for Treatment

(a) Pre-Installation Survey

- (i) Visual and sounding surveys shall be carried out by the Contractor over the full surface area of the structure to determine where delaminations and where previous repairs have been carried out. In addition, areas where concrete cover over the rebars is insufficient (i.e., less than 10 mm) shall be located, by

means of a cover meter/pachometer survey and selective chip-outs. Also a pretreatment corrosion potential survey shall be performed throughout the surface area which will be repeated within one year after completion of the treatment.

- (b) Removal and Replacement of Delaminated Concrete
  - (i) Delaminated and spalled concrete areas shall be repaired by the Contactor before treatment in accordance with E12 "Concrete Repairs".
- (c) Remediation for Insufficient Concrete Cover
  - (i) A cement-based screed (grout) shall be applied by the Contractor over all areas determined to have insufficient concrete cover until the total cover at each area is at least 10 mm.
- (d) Insulation of Visible or Shallow Metal Components
  - (i) Any tie wires, nails, or other metal components, that are close to the surface or visible on the surface of the concrete, shall be removed or insulated by the Contractor, with silicone rubber or non-conductive epoxy. If necessary, these may be cut back to not less than 10 mm below the surface, then patched with a cement-based grout.
- (e) Reinforcement Continuity
  - (i) The Contactor shall ensure that the top-layer rebar in the structure are electrically continuous prior to treatment. This can be done either at existing spall locations, or at cathode (rebar) connection points. If necessary additional holes can be drilled or chipped. If the voltage difference between any 2 rebar (from different locations in the structure) is no more than 1.0 mV (when measured with a high input impedance voltmeter with a resolution of no less than 0.1 mV), or resistance is less than 5 Ohms (when measured with a Ohms/multi-meter) these rebar are considered to be continuous.
  - (ii) Drawings of the structure showing reinforcement details shall be inspected to locate areas where continuity might not exist, and direct measurements of voltage differences or resistance between rebar in these areas and other areas in the structure shall be made. In addition, measurement points shall include the perimeters and the middle of each structural component. Records of the locations of measurement points and the measured voltage/resistance differences shall be submitted to the Contract Administrator with the final report, or sooner if requested.
  - (iii) Where any electrical discontinuity is identified, proposals for providing continuity shall be submitted to the Contract Administrator for approval before proceeding.
- (f) Reinforcement (Negative) Connections
  - (i) There shall be at least 1 rebar connection per 50 m<sup>2</sup> of concrete surface area, and never less than 2 connections per zone. Rebar connections shall be made by drilling a 19 mm (3/4") hole down to the rebar, ensuring that the rebar surface is cleaned by the action of the drill. Then insert a lead plug connected to the cathode wire into the hole, and compress the lead plug against the rebar with the use of the setting tool. Immediately after a connection has been made, the connection shall be coated with a non-conductive material, such as silicon rubber by the Contractor, or the hole may be sealed with an approved patch repair mortar.
- (g) Connection of metal fixtures
  - (i) Any metal fixtures attached to the concrete structure must be protected against corrosion by electrical connection to the reinforcement. Exposed steel shall also be masked and protected from contact to the anode mesh.

#### E14.3.2 Installation of the Anode System

- (a) Preparation of the Concrete Surface

- (i) The surface of the concrete shall be cleaned of any grease, coating, etc., that may interfere with the passage of electrical current, to ensure optimum treatment efficiency. Sandblasting or water jetting may be required to achieve this.
  - (ii) To prevent short circuits, any exposed steel, in or on the surface of the concrete, shall be adequately masked and, if necessary, connected to the reinforcement or removed, before applying the anode system.
- (b) Electrolytic Reservoir
- (i) The reservoir shall consist of any anode mesh embedded within electrolyte-saturated material (cellulose fibre or felt cloth).
  - (ii) The fibres and the electrolyte shall be delivered through separate hoses, then mixed at a nozzle and sprayed directly onto the surface of the concrete. The anode mesh shall be securely fixed using wooden batten or suitable plastic spacers. (Plastic screws and plugs must be used with wooden battens). The distance between the wooden battens shall depend upon the geometry of the structure and the dimensions of the anode meshes proposed for use. There shall be at least 2 wooden battens for each face of any pier cap and square column (that is no more than 1200 mm wide), and at least four batten for each cylindrical column.
  - (iii) The fibre-electrolyte mixture shall be applied only after the anode mesh is securely installed. The fibre-electrolyte mixture shall be installed in 2 layers, with the anode mesh installed in between. The total fibre electrolyte layer shall be approximately 10 mm to 50 mm thick.
  - (iv) For horizontal applications, felt cloth shall be implemented as the electrolyte reservoir. Felt shall be laid on the surface, followed by placement of the anode mesh and a topped with a final layer of felt; such that a felt/anode/felt "sandwich" is formed.
  - (v) After the anode and reservoir have been stalled, the entire area shall be wrapped with plastic and secured to reduce dehydration. Throughout the ECE treatment, the reservoir shall be wetted with electrolyte and kept saturated. The Contractor shall provide the necessary water supply and containers.
  - (vi) Any waste water generated from the ECE process shall be filtered to collect any debris or deleterious material from entering the watercourse.

#### E14.3.3 Inspection of the Installation

- (a) The installed anode system, its electrical connections, and power cables shall be fully inspected by the Contractor's technician prior to the initiation of the ECE treatment. AC power shall be connected by a certified electrician as per relevant codes.

#### E14.4 System Operation and Maintenance

##### E14.4.1 System Start-up

- (a) Circuit verification
  - (i) Prior to start-up or energization of power, tests shall be undertaken to ensure that all measurements and power distribution circuits are correctly wired, connected and labeled. Where appropriate, the circuits shall have the expected resistances.
  - (ii) Using a suitable voltmeter, the negative polarity of the reinforcement shall be confirmed when the power sources are switched on.
- (b) Adjustment of current output
  - (i) Initial energizing of the system shall be undertaken only upon completion of the procedures described in clause E14.3.1(a) "Pre-Installation Survey".
  - (ii) The current used for the chloride removal treatment shall generally be between 1 A/m<sup>2</sup> to 2 A/m<sup>2</sup> and shall not exceed 5 A/m<sup>2</sup>.

- (iii) During the treatment, the current output shall be measured individually in each anode cable (as detailed in Section E14.4.2, "Monitoring of the System Operation". The total current can be adjusted by decreasing or increasing the applied voltage. If the results indicated an unexpected current distribution, an inspection shall be carried out to determine the reason, and remedial action shall be taken and documented.

#### E14.4.2 Monitoring of the System Operation

##### (a) Inspections

- (i) During the treatment, the operation of the system shall be checked daily by the Contractor and the following records shall be made:
  - ◆ Date and Time
  - ◆ Current (to each zone and subzone)
  - ◆ Voltage (to each zone and subzone)
- (ii) If a problem develops the Contractor shall determine the cause, rectify the problem, and report it to the Contract Administrator.
- (iii) In addition, visual inspection of cable connections, cable insulation, and anode meshes, and wetting of the cellulose fibre shall be conducted daily.
- (iv) Any interruption in the operation shall be recorded and reported to the Contract Administrator.

##### (b) Determination of chloride content

- (i) In addition to the regular inspection, determination of the residual water soluble chloride shall be carried by the Contractor during the ECE treatment. The determination shall be conducted on concrete samples to be taken at pre-determined points at the level of the rebar. The Contractor shall provide these locations to the Contract Administrator, in the Quality Management Plan, and approved by the Contract Administrator prior commencement of treatment.
- (ii) If the results of any of these analyses indicate that the system is not operating properly, the Contractor shall determine the cause and rectify the situation.

#### E14.5 Termination of the Electrochemical Chloride Extraction (ECE) Treatment

##### (a) The ECE treatment shall be performed:

- (i) For approximately 60 days; or
- (ii) Until a total of 600 A-hrs/m<sup>2</sup> of current has been passed; or
- (iii) Until the chloride in the concrete in the vicinity of the reinforcing steel has decreased to 0.0% by weight of concrete after correction for background chlorides; whichever is the earliest.

#### E14.6 Dismantlement and Disposal of the System

- (a) After the system is turned off, the Contractor shall remove all electrical cables, conduits hangers, and power supplies from the site. The cellulose fibre, anode mesh and wooden battens shall also be removed from the site or be disposed in accordance with applicable disposal and regulations.

#### E14.7 Post Treatment Cleaning and Patching of the Concrete

- (a) The surface of all treated concrete shall be cleaned using a light abrasive blast.
- (b) The entire treated structure shall then be inspected; the occurrence, location, and extent of any physical damage or changes to the concrete shall be noted. Any such defects such as holes made on the concrete (to install wooden battens, conduit hangers, system negative connections, etc.) shall then be repaired by the Contractor.
- (c) The site shall be completely clean at the end of the job.

#### E14.8 Documentation

- (a) Within 100 days upon completion of the surface treatment, the Contractor shall submit a written final report to the Contract Administrator detailing the installation and all operating data for the system. This shall include records of all tests and measurements made before and during treatment, including those listed in "Inspections".
- (b) The final report shall include, and describe in detail, at least the following information:
  - (i) locations of previous repairs and new damages (found and repaired before the treatment\_ in as-built drawings and descriptions of such;
  - (ii) rebar continuity on the structure and locations of any continuity bondings made;
  - (iii) surface preparation performed before treatment;
  - (iv) description of the ECE installation and procedure used;
  - (v) materials used with manufacturers' data sheets;
  - (vi) distribution of test locations and test procedures'
  - (vii) current and voltage readings during treatment;
  - (viii) all test results including pre – and post – C1 – levels;
  - (ix) pre corrosion potential survey readings;
  - (x) locations and repair of any damage to the concrete arising from the treatment;
  - (xi) discussion of results, including consideration of any local anomalies or variations in results; and
  - (xii) statement on effectiveness of the treatment
- (c) The Contractor shall undertake the post treatment corrosion potential survey within one year form the completion of the treatment. The final report shall be resubmitted, including the post treatment corrosion potential survey reading, to the Contract Administrator within 30 days.

#### E14.9 Measurement and Payment

- (a) Electrochemical chloride extraction will not be measured and paid for at the Contract Lump Sum Price for "Electrochemical Chloride Extraction" which price shall be payment in full for supplying all materials and 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. STRUCTURAL EXCAVATION**

#### E15.1 Description

##### E15.1.1 The Work under this Specification shall include the following:

- (a) Excavation required to construct the abutment modifications, abutment diaphragms, approach slabs, approach roadways, channel modifications and riprap placement as shown on the Drawings.
- (b) The design, fabrication, erection, and removal of all temporary shoring, and such temporary protective measures as may be required to construct the Works.
- (c) The Contractor shall include construction access for all excavation works required for construction.
- (d) The off-site disposal of surplus and unsuitable material.
- (e) Dewatering and/or precipitation removal at the excavations as may be required for construction of the structure in the dry.

##### E15.1.2 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 Work as hereinafter specified.

#### E15.2 References

- E15.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (a) CW 3110 – Subgrade, Sub-Base, and Base Course Construction;
  - (b) CW 3170 – Earthwork and Grading;
- E15.3 Submittals
- E15.3.1 The Contractor shall submit the following to the Contract Administrator seven (7) Days prior to mobilization on site:
- (a) Plan(s) highlighting the Site Layout which includes; laydown area location(s), staging areas, office facility location, access road(s), temporary secure fencing limits, and gate locations for review and approval.
  - (b) Shop drawings for the temporary shoring in accordance with E3.2 for information purposes, bearing the seal of a Professional Engineer registered in the province of Manitoba:
- E15.4 Equipment and Materials
- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
  - (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 workmanship like manner, to the satisfaction of the Contract Administrator.
  - (c) All excavated materials 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 Owner for any materials taken by the Contract Administrator for testing purposes.
  - (d) Excavated material shall be unclassified excavation and shall include the excavation and satisfactory disposal of all cleared and grubbed materials, earth, gravel, sandstone, loose detached rock, shale, rubbish, cemented gravel or hard pan, disintegrated stone, rock in ledge or mass formation wet or dry, trees, shrubs, or all other material of whatever character which may be encountered.
- E15.5 Construction Methods
- (a) Excavations shall be completed to the elevations required to construct the Works or to such other elevations as may be directed by the Contract Administrator in the field. Excavation sequence shall be done in a “top down” direction, in order to maintain stability. The dimensions of the excavation shall be such as to give sufficient clearances for the construction of forms and their subsequent removal.
  - (b) All material shall be brought to the surface by approved method, and shall be disposed of off-site.
  - (c) After each excavation is completed, the Contractor shall notify the Contract Administrator.
  - (d) The Contractor shall excavate only material that is necessary for the expeditious construction of the structure or as set out by the Contract Administrator in the field. If the Contract Administrator permits the excavation of runways, existing stock piling, or trenches within the right-of-way, the Contractor shall, on completion of the Work, backfill the runways and trenches to the elevation of the original ground existing at the time of excavation and compact the backfill material, all at his own expense and as directed by the Contract Administrator.
  - (e) All excess excavated material shall become the property of the Contractor and shall be removed from the Site.
- E15.6 Measurement and Payment
- (a) The excavation required for the construction of abutment modifications, abutment diaphragms, approach slabs, approach roadways, channel modifications and riprap



placement will not be measured and paid for at the Contract Lump Sum Price for "Structural Excavation", which price shall be payment in full for supplying all materials and 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. STRUCTURAL BACKFILL**

### **E16.1 Description**

E16.1.1 The Works in this section include the following:

- (a) Granular Backfill required behind the abutment diaphragms, under miscellaneous structural slabs, and under riprap in the vicinity of the bridge as shown on the Drawings and to the requirements of this Specification.
- (b) For winter construction, heating of subgrade and granular backfill prior to placement.

E16.1.2 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 Work as hereinafter specified.

### **E16.2 References**

E16.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) CW 3110 – Subgrade, Sub-Base, and Base Course Construction;
- (b) CW 3170 – Earthwork and Grading.
- (c) CW 3130 – Supply and Installation of Geotextile Fabrics

### **E16.3 Equipment**

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

### **E16.4 Materials**

#### **E16.4.1 Granular Material**

- (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 Owner for any materials taken by the Contract Administrator for testing purposes.
- (b) All materials shall be accepted by the Contract Administrator at least fourteen (14) 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) 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) All granular backfill, including levelling base fill, shall be clean and free from organic material, meeting the following gradation requirements:

<b>CANADIAN METRIC SIEVE SIZE</b>	<b>PERCENT PASSING BY WEIGHT</b>
---------------------------------------	--------------------------------------

50 000	100
20 000	75 - 100
5 000	45 - 85
2 500	35 - 55
315	15 - 35
160	5 - 20
80	0 - 7

- (e) Excavated material may be used for backfilling provided it meets the above requirements. Excavated granular material intended to be used for backfilling is not be contaminated by top soil or organic materials.

**E16.4.2 Geotextile Fabric**

- (a) Geotextile fabric placed along the limits or within structural backfill shall be "Separation Geotextile Fabric" supplied in accordance with CW 3130.
- (b) Supply of geotextile fabric for structural backfill shall be considered incidental to Structural Backfill and no separate measurement or payment will be made.

**E16.5 Construction Methods**

**E16.5.1 Granular Backfill Material**

- (a) The Contract Administrator shall be notified at least one (1) working day in advance of any backfilling operations. No backfill shall be placed against any concrete until accepted by the Contract Administrator.
- (b) All granular backfill material shall be supplied, placed, and compacted in lifts of 150 mm (maximum) to a minimum of 98% of Standard Proctor Dry Density. Lifts shall be brought up on all sides at the same time.
- (c) The Contractor shall be required to provide necessary water or equipment during compaction of backfill material to achieve the required densities.
- (d) The Standard Proctor Density for granular shall be determined at the optimum moisture content in accordance with standard laboratory Proctor Compaction Test Procedure.
- (e) The field density of the compacted layers shall be verified by Field Density Tests in accordance with ASTM Standard, Test for Density of Soil in Place by the Sand-Cone Method, or equivalent as accepted by the Contract Administrator.
- (f) The frequency and number of tests to be made shall be as determined by the Contract Administrator.

**E16.5.2 Heating for Granular Backfill**

- (a) In locations of frozen subgrade, the Contractor shall preheat the subgrade prior to placement of granular backfill such that a minimum of 300 mm of unfrozen subgrade material is present during placement and compaction of granular backfill.
- (b) The Contractor shall pre-heat all granular backfill such that it is placed and compacted in an unfrozen state.
- (c) For subsequent lifts of granular backfill, the previous lift(s) will be considered the subgrade, and the requirements for unfrozen subgrade shall apply.
- (d) Heating for Granular Backfill shall be considered incidental to Structural Backfill.
- (e) Heating of the subgrade for the purposes of placing riprap bedding will not be required.

**E16.5.3 Installing Geotextile Fabric**

- (a) Geotextile fabric shall be installed in accordance with CW 3130, and as shown on the Drawings.

- (b) Installation of geotextile fabric for structural backfill shall be considered incidental to Structural Backfill and no separate measurement or payment will be made.

#### E16.6 Quality Control

- (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 operations from the selection and production of materials through to final acceptance of the specified Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or acceptance that may have previously been 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 Contract Administrator shall be afforded full access for the inspection and control testing of constituent materials both at the Site of the Work and at any plant used for production of the materials to determine whether the material is being supplied and placed in accordance with this Specification.
- (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.

#### E16.7 Measurement and Payment

- (a) The backfilling required behind the abutment diaphragms, under miscellaneous structural slabs, and under riprap in the vicinity of the bridge as shown on the Drawings will not be measured and paid for at the Contract Lump Sum Price for "Structural Backfill" which price shall be payment in full for supplying all materials and 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. SUBDRAINS

#### E17.1 Description

- (a) Further to the City of Winnipeg standard specification CW 3120 the following shall apply.

#### E17.2 Construction Methods

##### E17.2.1 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.

##### E17.2.2 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 perforated drainage pipe with perforations pointing down.
- (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.

#### E17.2.3 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.

#### E17.2.4 Subdrain Connections, Penetrations and Terminations

- (a) Install subdrains complete with all necessary connections, penetrations through concrete or other elements, and terminations in accordance with the Drawings.
- (b) All subdrain connections, penetrations and terminations shall be considered incidental to the Work and no separate payment will be made.

#### E17.3 Measurement and Payment

- (a) Subdrains will be measured and paid for as described in CW 3120.

### **E18. STRUCTURAL CONCRETE**

#### E18.1 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.

#### E18.2 Scope of Work

- (a) The Work under this Specification shall include:
  - (i) Supplying and placing structural concrete for abutment modifications;
  - (ii) Supplying and placing structural concrete abutment diaphragms;
  - (iii) Supplying and placing structural concrete for deck slab, reinforced sidewalk and traffic barriers;
  - (iv) Supplying and placing structural concrete for approach slab, sleeper slab and roadway transition slab.

#### E18.3 Submittals

##### E18.3.1 General

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least fourteen (14) 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 fourteen (14) Days prior to the commencement of any Work on Site, the proposed materials to be used.

#### E18.3.2 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 and may be used as information related to supplementary testing and investigation of suspected defective concrete. The City of Winnipeg will advise the Supplier if the information needs to be released to third parties. The concrete mix design shall contain a description of the constituents and proportions, and at the minimum the following:
  - (i) Cementitious content in kilograms per cubic metre or equivalent units, and type of cementitious materials;
  - (ii) Designated size, or sizes, of aggregates, and the gradation;
  - (iii) Aggregate source location(s);
  - (iv) Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis;
  - (v) Maximum allowable water content in kilograms per cubic metre or equivalent units and the water/cementitious ratio;
  - (vi) The limits for slump;
  - (vii) The limits for air content; and,
  - (viii) Quantity of other admixtures.
- (c) The concrete mix design statements must be received by the Contract Administrator a minimum of fourteen (14) days prior to 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.
  - (i) The mix design statement shall also include the expected slump measurement for each concrete type. The tolerances for acceptance of slump measurements in the field, by the Contract Administrator, shall be in accordance to CSA A23.1-04 Clause 4.3.2.3.2.
  - (ii) 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.

#### E18.3.3 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-S6-06, Section 16, Fibre Reinforced Structures, Clause 16.6.
- (iii) 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 in accordance to ASTM C1609-10. The average of the peak loads is the cracking load of the concrete ( $P_{cr}$ ).
  - ◆ A second set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure in accordance with ASTM C1399-04. The average of the peak loads during 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. Tests conducted in accordance to ASTM C1399-04 will be considered invalid by the Contract Administrator if the initial crack in the specimen has occurred after 0.5 mm deflection. Provide all load deflection curves with test submissions (initial and reloading curves).
- (iv) 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 the form. At the discretion of the Contract Administrator, if the Contractor can demonstrate a relationship between the plastic concrete properties at the point of discharge into the formwork and the end of the chute of the delivery truck, the Contract Administrator may accept test results at the end of the chute with the appropriate adjustments to the wet concrete performance requirements as being representative of what is in the formwork.

#### E18.3.4 Aggregates

- (a) 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.
- (b) 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.
- (c) 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.
- (d) 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.

- (e) 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.
- (f) 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.
- (g) 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.

E18.3.5 The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

E18.3.6 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.

E18.3.7 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 falsework, 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) All forms shall be of wood, metal or other materials as approved by the Contract Administrator.
  - (ii) The falsework, formwork, and shoring for these Works shall be designed by a Professional Engineer registered in the Province of Manitoba. Falsework shall be designed according to the requirements of CSA S269.1, "False Work for Construction Purposes." The shop drawings shall bear the Professional Engineer's seal. Shop drawings submitted without the seal of a Professional Engineer will be rejected. The submission of such shop drawings to the Contract Administrator shall in no way relieve the Contractor of full responsibility for the safety and structural integrity of the formwork and shoring.
  - (iii) The falsework, 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 CSA Standard CAN/CSA S269.3-M92. All proposed fastening methods to the existing deck superstructure must be submitted to the Contract Administrator for review and approval.
  - (iv) The loads and lateral pressures outlined in Part 3, Section 102 of "Recommended Practice for Concrete Formwork", (ACI 347) and wind loads as specified by the National 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.
- (v) As a minimum, the following spacing's shall apply for studding and walers:
    - ◆ 20-mm plywood: studding 400 mm centre to centre (max.),
    - ◆ walers 760 mm centre to centre (max.)
  - (vi) 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.
  - (vii) Formwork shall be designed to provide chamber, 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.
  - (viii) 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.
  - (ix) Shores shall be designed 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 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.
  - (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 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.
  - (xiv) 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. Falsework 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 falsework, 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.

#### E18.3.8 Screed for Deck Slab Concrete

- (a) Plans for anchoring support rails shall be submitted to the Contract Administrator for review and acceptance at least fourteen (14) 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.

#### E18.3.9 Concrete Deck Slab Pour Sequence and Schedule

- (a) The Contractor shall pour the deck slab concrete in accordance with the pour sequence as outlined in the Drawings, or in the absence of Drawings as directed by the Contract Administrator. Should the Contractor opt to submit an alternate



construction pour sequence for the deck slab 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 fourteen (14) 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 fourteen (14) Days prior to scheduled commencement of concrete placement, the proposed concrete placement schedule for all other structural concrete placements of this Specification.

**E18.4 Materials**

**E18.4.1 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.

**E18.4.2 Handling and Storage of Materials**

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

**E18.4.3 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 Table E18.1.

<b>TABLE E18.1 REQUIREMENTS FOR HARDENED CONCRETE</b>							
<b>Type of Concrete</b>	<b>Location</b>	<b>Nominal Compressive Strength [MPa]</b>	<b>Class of Exposure</b>	<b>Air Content Category</b>	<b>Max Aggregate Size</b>	<b>Special Requirements</b>	<b>Post Residual Cracking Index</b>
Type 1	Abutment Modifications	35 @ 28 Days	C-1	1	20 mm	Resistivity < 15,000 ohm-cm	N/A
Type 2	Deck Slab, Approach Slab, Sleeper Slab, Roadway Transition Slab, Reinforced Sidewalk, Traffic Barrier	35 @ 28 Days	C-1	1	20 mm	Synthetic Fibres	0.15

- (c) Design Requirements

- (i) The Contractor shall design falsework, formwork and shoring for the bridge deck slab overhang.

#### E18.4.4 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 CAN/CSA A23.1 latest edition, for S-1 class of exposure, except as follows:
  - (i) 20 MPa at 28 days.
- (c) The Working Base shall be considered incidental to the work and no separate payment will be made.

#### E18.4.5 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 A23.2-27A-04. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA A23.2-14A-04 or CSA A23.2-25A-04 is required.
- (iii) Petrographic analysis when performed shall be in accordance with MTO (Ministry of Transportation Ontario) Lab Test Method LS 609. The (weighted) petrographic number shall not exceed 130.

#### E18.4.6 Fine Aggregate

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

#### E18.4.7 Coarse Aggregate - Standard

- (a) The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CSA A23.1-04, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 2% shall pass a 75 um sieve. Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; shall have a minimum of two fractured faces; and shall have an absorption not exceeding 3%.
- (b) 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.
- (c) Coarse aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than 30%.

- (d) Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12, for concrete exposed to freezing and thawing.

#### E18.4.8 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.

#### E18.4.9 Cementitious Materials

- (a) Cementitious materials shall conform to the requirements of CSA-A3001 and shall be free from lumps.
- (b) Should the Contractor choose to include a silica fume admixture in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of cement.
- (c) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class 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.

#### E18.4.10 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 CSA A23.1-04 and shall be free of oil, alkali, acidic, organic materials or deleterious substances. The Contractor shall not use water from shallow, stagnant or marshy sources.

#### E18.4.11 Synthetic Fibres

- (a) The synthetic fibres shall consist of 100% virgin polypropylene or 100% virgin polyolefin as accepted by the Contract Administrator. The dosage shall be designed by the Contractor to meet the requirements for post-cracking residual strength index (Ri) and fibre dispersion in accordance to the CHBDC CSA-S6-06, Fibre-Reinforced Structures, Clause 16.6 except the post-cracking residual strength index (Ri) shall be determined in accordance with ASTM C1609.

#### E18.4.12 Formwork

- (a) Formwork materials shall conform to CSA Standard A23.1-04, and American Concrete Publication SP4, "Formwork for Concrete."
- (b) Form sheeting plywood to be covered with form liner or to be directly in contact with soil shall be exterior Douglas Fir, concrete form grade, conforming to CSA Standard O121-M1978, a minimum of 20 mm thick.
- (c) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CSA Standard O121-M1978. Approved Manufacturers are "Evans" and "C-Z."
- (d) Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.
- (e) No formwork accessories will be allowed to be left in place within 50 mm of the surface following form removal. Items to be left in place must be made from a non-rusting material or stainless 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 falsework is not acceptable and shall not be used by the Contractor unless specifically shown on the Drawings.

E18.4.13 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 B7.

E18.4.14 Permeable Formwork Liner

- (a) Formwork liner shall be Texel Drainform, Hydroform, or equal as accepted by the Contract Administrator, in accordance with B7. 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 deck slab 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.

E18.4.15 Curing Compound

- (a) Curing compounds shall be liquid membrane-forming and conform to the requirements of ASTM Standard C309-98a.
- (b) Curing compound for approach slabs and slope paving shall be resin-based and white-pigmented.
- (c) WR Meadows 1215 WHITE Pigmented Curing Compound is an approved product, or equal as accepted by the Contract Administrator, in accordance with B7.

E18.4.16 Curing Blankets

- (a) Curing blankets for wet curing shall be 100 percent polyester, 3 mm thick, white in colour. An approved product is "Mirafi Geotextile P150". Alternately, a 10 oz burlap, 5 mil polyethylene, curing blanket white in colour shall be used; "Curelap" manufactured by Midwest Canvas, together with a second layer of burlap, or equal as accepted by the Contract Administrator, in accordance with B7.

E18.4.17 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 B7. 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) Bonding Grout
  - (i) The grout for bonding the new deck slab concrete to the existing concrete deck slab concrete shall be mixed in an agitating hopper slurry pump and shall consist of the following constituents, by weight:
    - ◆ 1 part water;
    - ◆ 1 part latex bonding agent; and,
    - ◆ 1½ 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.

E18.4.18 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 B7.

E18.4.19 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 B7.

E18.4.20 Cementitious Grout

- (a) Cementitious grout shall be nonshrink and nonmetallic. 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 B7. The minimum compressive strength of the grout at 28 days shall be 40 MPa.

E18.4.21 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.

E18.4.22 Flexible Joint Sealant

- (a) Flexible joint sealant for all horizontal, vertical, and sloping joints shall be guaranteed non-staining, grey polyurethane, accepted by the Contract Administrator and applied in strict accordance with the details shown on the Drawings and the Manufacturer's instructions including appropriate primers if recommended. 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 B7.

E18.4.23 Fibre Joint Filler

- (a) Fibre joint filler shall be rot-proof and of the preformed, nonextruding, resilient type made with a bituminous fibre such as Flexcell and shall conform to the requirements of ASTM Standard D1751-99 or equal as accepted by the Contract Administrator, in accordance with B7.

E18.4.24 EMSEAL Precompressed Foam Joint Filler

- (a) Expansion joint seal shall be EMSEAL BEJS or equivalent as approved by the Contract Administrator to ASTM C711 and ASTM G155-00A.
- (b) Sealant system shall be comprised of three components:
  - (i) Cellular polyurethane foam impregnated with hydrophobic 100% acrylic, water-based emulsion, factory coated with highway-grade, fuel resistant silicone;
  - (ii) Field-applied epoxy adhesive primer; and,
  - (iii) Field-injected silicone sealant bands.

- (c) Impregnation agent to have proven non-migratory characteristics. Silicone coating to be highway-grade, low-modulus, fuel resistant silicone applied to the impregnated foam sealant at a width greater than maximum allowable joint extension and which when cured and compressed will form a bellows. Depth of seal as recommended by manufacturer. BEJS foam seal to be installed into manufacturer's standard field-applied epoxy adhesive. The BEJS SYSTEM is to be installed recessed from the surface such that when the field-applied injection band of silicone is installed between the substrates and the foam-and-silicone-bellows, the system will be ½" (12 mm) down from the substrate surface.
- (d) Material shall be capable, as a dual seal, of movements of +50% to -50% (100% total) of nominal material size. Changes in plane and direction shall be executed using factory fabricated "Universal 90" transition assemblies. Transitions shall be warranted to be watertight at inside and outside corners through the full movement capabilities of the product.
- (e) All substitute candidates to be certified in writing to be free in composition of any waxes or asphalts, wax compounds or asphalt compounds. All substitute candidates shall be certified in writing to be:
  - (i) Capable of withstanding 65°C for three (3) hours while compressed down to the minimum of movement capability dimension of the basis of design product (-50% of normal material size) without evidence of any bleeding of impregnation medium from the material; and,
  - (ii) That the same material after the heat stability test will self-expand to the maximum of movement capability dimension of the basis-of-design product (+50% of nominal material size) within twenty-four (24) hours at room temperature 20°C.

E18.4.25 Ethafoam Joint Filler

- (a) Ethafoam joint filler shall be non-staining, polyethylene, closed-cell product for expansion and contraction and/or isolation joint application and shall be the type accepted by the Contract Administrator in accordance with B7.

E18.4.26 Low Density Styrofoam

- (a) Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B7.

E18.4.27 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%.

E18.4.28 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 B7.
- (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 B7.

E18.4.29 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 B7.

- (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 B7.

E18.4.30 Miscellaneous Materials

- (a) Miscellaneous materials shall be of the type specified on the Drawings or as accepted by the Contract Administrator, in accordance with B7.

E18.4.31 Benchmark Plugs

- (a) Benchmark plugs shall be supplied by the City of Winnipeg. Installation by the Contractor shall be considered incidental to these Works. Installation locations shall be determined by the Contract Administrator.

E18.5 Equipment

E18.5.1 General

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

E18.5.2 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 have standby vibrators available at all times during the pour.

E18.5.3 Placing and Finishing Equipment for Bridge Deck Concrete, Approach Slabs, and Roadway Transition Slabs

- (a) Placing Equipment
  - (i) Adjacent exposed reinforcing steel shall be adequately protected during concrete placement.

E18.5.4 Screed

- (a) The Contractor may choose to use a mechanical or non-mechanical screed to strike the surface of the deck slab concrete.
- (b) The screed shall be constructed to span the full out-to-out width of the bridge deck for concrete placement in one continuous operation.
- (c) Screed rails are required and shall be sufficient in number and length to ensure that the concrete cover is maintained and the finished elevation of the deck slab concrete meets the design elevations.
- (d) 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.
- (e) The mechanical screed on guides or rails shall be supported so that they are completely clear of the finished surface.
- (f) Internal vibration of the concrete will be required with mechanical screeding. Care shall be taken not to overwork the concrete surface.

- (g) 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.
- (h) Screed surface touching concrete shall not be made of aluminum (magnesium acceptable).
- (i) The supply, setup, operation, and takedown of the screed for deck slab concrete shall be considered incidental to the placement of the deck slab concrete. No separate measurement or payment shall be made for this Work.

#### E18.5.5 Moveable Work Bridges for Deck Slab Concrete

- (a) 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 deck slab concrete.
- (b) These moveable Work Bridges shall travel guided on rails supported clear of the finished structural deck concrete.
- (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.

#### E18.6 Construction Methods

##### E18.6.1 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 C309-98a for the texture of concrete the curing compound is being applied to.

##### E18.6.2 Temporary False Work, Formwork, and Shoring

- (a) Construction Requirements
  - (i) The Contractor shall construct falsework, formwork and shoring for the new deck slab concrete overhangs strictly in accordance with the accepted shop drawings.
  - (ii) 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 superstructure.
  - (iii) The falsework, 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.
  - (iv) 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.
  - (v) 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.
  - (vi) 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.
  - (vii) Shores shall be provided with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.
  - (viii) 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.
- (ix) 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.
  - (x) All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.
  - (xi) 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.
  - (xii) 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 matching colour of surrounding concrete.
  - (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.

- (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 E18.6.15, "Preparation for Concreting Against Hardened Concrete", for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

#### E18.6.4 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 will 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.

#### E18.6.5 Concrete Bridge Traffic Barrier Joints

- (a) For the joint sealing at all locations, the contractor shall submit shop drawings and his proposed installation procedures to the Contract Administrator for approval fourteen (14) days prior to installation.
- (b) The installation of the fibre joint filler and the EMSEAL joint sealing shall be undertaken as shown on the drawings.
- (c) EMSEAL joint seals shall not be field spliced except when specifically permitted by the Contract Administrator in writing.
- (d) 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.
- (e) The EMSEAL joint sealing at the barrier joints shall be installed as per the Manufacturer's recommendations.
- (f) All joint sealing of Bridge traffic barriers shall take place prior to the installation of the Bituminous Paving.
- (g) The supply and installation of EMSEAL joint sealing and fibre joint fillers shall be considered incidental to the Work, and no additional measurement or payment shall be made for this Work.

#### E18.6.6 Anchor Units for Bridge Traffic Barrier Posts and End Rail Units

- (a) All anchor units shall be as specified on the Drawings.
- (b) All anchor units shall be held securely in place so as not to become displaced during concrete placement operations.

#### E18.6.7 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.

E18.6.8 Architectural Formwork Liner

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

E18.6.9 Control Joint Seals

- (a) Formed control joints sealant for all horizontal, vertical and sloping joints shall be applied in strict accordance with the details shown on the Drawings and the Manufacturer's instructions including appropriate primers if recommended.
- (b) Form control joints shall be thoroughly cleaned before sealing.

E18.6.10 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.

E18.6.11 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.

E18.6.12 Approach Slabs Works

- (a) The Contractor shall undertake the approach slab Works, as shown on the Drawings.

E18.6.13 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 CSA A23.1-04, Clause 5.2, Production of Concrete.
- (c) Time of Hauling
  - (i) The maximum time allowed for all types of concrete to be delivered to the Site of the Work, including the time required to discharge, shall not exceed 120 minutes after batching. Batching of all types of concrete is considered to occur when any of the mix ingredients are introduced into the mixer, regardless of whether or not the mixer is revolving. For concrete that includes silica fume and fly ash, this requirement is reduced to 90 minutes.
  - (ii) Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of batching. In hot or cold weather, or under conditions contributing to quick stiffening of the concrete, a time less than 120 and/or 90 minutes may be specified by the Contract Administrator. The Contractor will be informed of this requirement twenty-four (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 E18.1, "Requirements for Hardened Concrete", no retarders shall be used.
  - (v) The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water. If the slump of the concrete is less than that designated by the mix design statement, then water can be added on site provided the additional water meets the requirements of CSA A23.1-04 5.2.4.3.2. If additional water is to be added on site, it must be done under the guidance of the Suppliers' designated quality control person. The Supplier shall certify that the addition of water on site does not change the Mix Design for the concrete supplied. Any other water added to the concrete without such control will be grounds for rejection of the concrete by the Contract Administrator.
  - (vi) A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the Owner upon request.
- (d) Delivery 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 rehandling, and without damage to the structure or the concrete.

#### E18.6.14 Concrete Placement Schedule

- (a) 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; and,
  - (iii) In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting.
- (b) The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

#### E18.6.15 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 median slab, during concreting of the deck slab, the top surface of the concrete shall be roughened using a small rake running longitudinally between barrier dowels.

#### E18.6.16 Placing Structural Concrete

- (a) 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.
- (b) 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.
- (c) 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.
- (d) The nomograph, Figure D1, Appendix D of CSA Standard A23.1-04 shall be used to estimate surface moisture evaporation rates.
- (e) 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.
- (f) 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.
- (g) Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.
- (h) 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.
- (i) Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.
- (j) 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.
- (k) Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.
- (l) 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.
- (m) 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.

- (n) 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.
- (o) 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.
- (p) Before any concrete is placed for the approach slabs, or Bridge deck 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.

#### E18.6.17 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.
  - (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 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 - 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 E18.4.17, E18.4.18, and E18.6.20 of this Specification.

- (ii) All surfaces below 300 mm below finish grade shall receive dampproofing in accordance with E18.4.29 of this Specification.
- (e) 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 works of this specification, and no separate measurement or payment shall be made for this Work.

#### E18.6.18 General Curing Requirements

- (a) Refer to E18.6.21 for cold weather curing requirements and E18.6.22 of this Specification for hot weather curing requirements.
- (b) 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 overlay.
- (c) 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 and continuously wetted for at least seven (7) consecutive days thereafter. Construction joints shall be cured by means of wet curing blankets only.
- (d) Curing compound shall be applied at the rate required by ASTM P198 for the accepted product. The compound must be applied uniformly and by roller. Spraying of the compound will not be permitted.
- (e) 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 twenty-four (24) hours. Concrete shall be protected from freezing until at least twenty-four (24) hours after the end of the curing period.
- (f) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3°C in one hour or 20°C in twenty-four (24) hours.
- (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.
- (h) Formed surfaces shall receive, immediately after stripping and patching, the same curing as finished surfaces, with the exception of the Bridge deck overhang surfaces.
- (i) 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.

#### E18.6.19 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 for deck extensions shall be 25 MPa, with the added provision that the member shall be of sufficient strength to safely carry its own weight, together with super-imposed construction loads. Bridge deck overhang forms shall be loosened before forms are constructed and concrete is placed for

bridge traffic barriers. Stripping of these forms shall not be permitted until a concrete strength of 28 MPa has been achieved by the deck slab concrete and the concrete bridge traffic barriers.

- (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.

#### E18.6.20 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 twenty-four (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 (1) 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.

#### E18.6.21 Cold Weather Concreting

- (a) The requirements of CSA Standard A23.1-09 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.

#### E18.6.22 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 deck slab 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 E18.2, "Acceptable Concrete Temperature", for the indicated size of the concrete section.

<b>TABLE E18.2: ACCEPTABLE CONCRETE TEMPERATURES</b>		
<b>THICKNESS OF SECTION</b>	<b>TEMPERATURE °C</b>	
	<b>MINIMUM</b>	<b>MAXIMUM</b>
Less than:		
1.0 m	10	27
1.2 m	5	25

E18.6.23 Cleanup

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

E18.7 Quality Assurance and Quality Control

E18.7.1 General

- (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 CSA Standard A23.1-04. An outline of the quality tests is indicated below.
- (g)

#### E18.7.2 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.

#### E18.7.3 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.

#### E18.7.4 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 CSA Standard A23.1-04.
- (c) All testing of materials shall conform to CSA Standard A23.2-04.
- (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.

#### E18.7.5 Concrete Testing

- (a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C-04, "Slump of Concrete". If the measured slump falls outside the limits in E18.3.2 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-04, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E18.3.2 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 test method of ASTM C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C-04, shall be determined prior to the start of construction on cylinders of concrete made with the same materials, mix proportions, and mixing procedures as intended for the project. If deemed necessary by the Contract Administrator to further check the air-void system during construction, testing of cylinders may be from concrete as delivered to the job Site and will be carried out by the Contract Administrator. The concrete will be considered to have a satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.
- (d) Rapid chloride permeability testing shall be performed in accordance with ASTM C 1202 and shall meet the requirements of each class of concrete.
- (e) Testing for post-cracking residual strength index of FRC shall be conducted at the Contractor's own expense as follows: One set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure using the same test set up in ASTM C 1399-04 without the steel plate. The average of the peak loads is the cracking load of the concrete (P<sub>cr</sub>), and shall be provided to the Contract Administrator. A second set of five concrete beam specimens shall be tested to failure in accordance with ASTM C 1399-04. The average of the peak loads is the post cracking load of the concrete (P<sub>pcr</sub>). Specimens shall be sampled in accordance with E18.7.5(g). Testing shall include the specified number of specimens from the trial batch concrete for mix design approval as well as specimens from sub-structure concrete, traffic barrier concrete and deck slab concrete for a total of four (4) complete tests. The Contractor shall promptly submit a summary of the results to the Contract Administrator upon the conclusion of each test.
- (f) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C-04, "Sampling Plastic Concrete".
- (g) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C-04, "Making and Curing Concrete Compression and Flexure Test Specimens".
- (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-04, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which will be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.
- (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 E18.1 of this Specification and also to

check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field-cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C-04, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

**E18.7.6 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.

**E18.8 Measurement and Payment**

**E18.8.1** Supplying and placing structural concrete will not be measured. This Work shall 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 supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

**E18.8.2** Items of Work:

- (a) Supply and Place Structural Concrete:
  - (i) Abutment Modifications;
  - (ii) Deck Slab and Abutment Diaphragms;
  - (iii) Reinforced Sidewalk;
  - (iv) Traffic Barriers;
  - (v) Approach Slabs;
  - (vi) Sleeper Slabs;
  - (vii) Roadway Transition Slabs

**E18.8.3** Supplying and installing all the listed materials, concrete design requirements, equipment, construction methods, and quality control measures associated with this Specification and Drawings shall be considered incidental to "Supply and Place Structural Concrete", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

**E18.8.4** Concrete Heating and Hoarding

- (a) Heating concrete and supplying, setting up, heating, and removing the hoarding will not be measured and will be paid for at the Contract Lump Sum Price for "Concrete Heating and Hoarding", which price shall be payment in full for supplying all materials and 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. SUPPLYING AND PLACING REINFORCING STEEL**

**E19.1** Description

- (a) This Specification shall cover all operations relating to the supply, fabrication, delivery, and placement of black steel reinforcing, hot-dipped galvanized steel reinforcing and stainless steel reinforcing, 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.

**E19.2 Scope of Work**

- (a) The Work under this Specification shall involve supplying and placing all steel reinforcing, as shown on the Drawings for the following Works:

<b>SCOPE OF WORK</b>	
<b>Item</b>	<b>Type of Steel Reinforcing</b>
Abutment Modifications	Stainless Steel Reinforcement
Deck	Stainless Steel Reinforcement
Reinforced Sidewalk	Stainless Steel Reinforcement
Abutment Diaphragms	Stainless Steel Reinforcement
Approach Slabs	Stainless Steel Reinforcement
Sleeper Slabs	Stainless Steel Reinforcement
Roadway Transition Slabs	Stainless Steel Reinforcement
Traffic Barriers	Stainless Steel Reinforcement

**E19.3 References**

- (a) All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (i) ASTM A955M – Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcing;
  - (ii) ASTM A615M – Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement;
  - (iii) ASTM A143 – Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement.
  - (iv) ASTM A780/A780M – Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings;
  - (v) ASTM A767/A767M – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement;
  - (vi) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
  - (vii) CAN/CSA G30.18-M92 – Billet Steel Bars for Concrete Reinforcement;
  - (viii) ACI 315R – Manual of Engineering and Placing Drawings for Reinforced Concrete Structures; and,
  - (ix) Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.

**E19.4 Submittals**

**E19.4.1 General**

- (a) At least twenty-one (21) Days prior to the scheduled commencement of any fabrication, the qualifications of the Contractor and its Operators shall be submitted to the Contract Administrator for review and approval.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least fourteen (14) Days prior to commencement of any schedule Work on the Site, a proposed schedule, including methods and sequence of operations.

- (c) The Contractor shall submit to the Contract Administrator for review, at least fourteen (14) 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) Contractor shall submit all original mill certificates to the Contract Administrator prior to placement of reinforcing on site.
- (e) Contractor to submit Quality Control Testing Program to the Contract Administrator in accordance with E18.1073774592.1( )()□.
- (f) Contractor to submit Shop Drawings (including bar lists) in accordance with section E3 and the latest edition of the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada (RSIC).

## E19.5 Materials

### E19.5.1 General

- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification. All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.
- (b) Bundles of reinforcing steel shall be identified by tags containing bar marks.
- (c) The reinforcing steel shall not be placed directly on the ground. Sufficient timber pallets or blocking shall be placed under the reinforcing steel to keep them free from dirt and mud.

### E19.5.2 Handling and Storage of Stainless Steel Reinforcing

- (a) Stainless steel reinforcing shall be store 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 for steel bands used for shipping shall not be in direct contact with stainless steel reinforcing. Wood or approved alternate should be used to protect the bars
- (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.

### E19.5.3 Reinforcing Steel

- (a) Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) All reinforcing steel shall conform to the requirements of CSA Standard CAN/CSA G30.18-M92, Grade 400W, Billet-Steel Bars for Concrete Reinforcement.
- (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 E19.1, "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 dimension recommended by Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.
- (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. No additional costs will be applied to this Contract for the replacement of deficient 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 CSA Standard CAN/CSA G30.18-M92 and ASTM A955M.

<b>TABLE E19.1 TYPE OF STAINLESS STEEL REINFORCING</b>		
<b>Common or Trade Name</b>	<b>AISI Type</b>	<b>UNS Designation</b>
Type 316 LN	316 LN	S31653
Type 2205	Duplex 2205	S31803
Type 2304	EnduraMet 2304	S32304

E19.5.4 Galvanizing

(a) Shop Applied

- (i) The galvanizing shall be shop applied and strictly in accordance with CSA Standard G164 and ASTM A767M latest addition to a retention equal to a Class II level (610 g/m<sup>2</sup>), except as otherwise specified herein.
- (ii) Submit an original and three (3) copies of the coating applicator's notarized Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements.
- (iii) Pre-clean reinforcing steel using acceptable methods to produce an acceptable surface for quality hot-dip galvanizing. If sulfuric acid or hydrochloric acid is used as a pickling bath for pre-cleaning, care shall be exercised to minimize the immersion time. If signs of hydrogen embrittlement are present after pickling due to excessive immersion time, all reinforcing in that shipment will be rejected and shall be replaced at no additional cost to this Contract.
- (iv) Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.
- (v) The surface finish shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect detrimental to the stated end use of the coated article.
- (vi) Coating adhesion shall withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.
- (vii) Sheared ends of bars shall be coated with a zinc-rich formulation before rusting occurs and before shipment to the job site.
- (viii) Furthermore, all field welds, as well as cracking and other visible damage or deterioration of the hot-dip galvanizing as a result of handling or bending operations, or any other causes, shall be galvanize-coated with field applied galvanizing touch-up material as specified hereinafter.

(b) Field Applied

- (i) All field applied galvanized coatings shall be applied in accordance with ASTM A780M.
- (ii) Further to ASTM A780M, paints used for field applied galvanizing shall contain zinc dust above 92% in the dried film.
- (iii) At least seven (7) days prior to any field applied galvanizing, the Contract shall submit the galvanizing product and application details to the Contract Administrator for review.
- (iv) Spray applied field galvanizing will not be permitted. Where restrictions occur that brush applied field galvanizing is not possible, spray applied field galvanizing may be permitted if accepted in writing by the Contract Administrator prior to application.

- (v) All field applied galvanized coatings shall be applied in accordance with the manufacturer's recommendations and as directed by the Contract Administrator.
- (vi) The maximum area to be repaired in the field shall be 2,000 mm<sup>2</sup>. Any damaged article with a damaged area greater shall be rejected, removed, and replaced at the Contractor's expense.

#### E19.5.5 Bar Accessories

- (a) Bar accessories shall be of types suitable for each type of reinforcing and a type 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 cementitious material as acceptable to the Contract Administrator. Plastic, PVC or galvanized bar chairs may be permitted if accepted in writing by the Contract Administrator prior to installation.
- (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 or Nylon coated wire for black steel reinforcing;
  - (ii) Nylon coated wire or 1.6 mm galvanized coated wire for hot-dipped galvanized steel reinforcing; and,
  - (iii) Stainless steel, fully annealed 1.6 mm diameter wire, Type 316 or 316L for stainless steel reinforcing.
- (f) Approved products are as supplied by Con Sys Inc., Box 341, Pinawa, Manitoba, Canada R0E 1L0 (204) 753-2404, or equal as accepted by the Contract Administrator in accordance with B7.
- (g) Bar accessories are not included in the Drawings and shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices and are to be acceptable to the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

#### E19.5.6 Mechanical Splices

- (a) Mechanical splices shall be stainless steel, meeting the requirements of ASTM A955M, Type 316L, Type 2005, or Type 2304.

#### E19.6 Construction Methods

##### E19.6.1 Fabrication of Reinforcing Steel

- (a) General
  - (i) Reinforcing steel shall be fabricated in accordance with CSA Standard CAN/CSA G30.18-M92 to the lengths and shapes as shown on the Drawings.
- (b) Black Steel Reinforcing
  - (i) Heating shall not be used as an aid in bending black steel reinforcing.
  - (ii) Hooks and bends should be smooth and not sharp.
  - (iii) Fabrication of the black steel reinforcing shall be straight and free of paint, oil, mill scale, and injurious defects.
- (c) Galvanized Reinforcing Steel
  - (i) The reinforcing fabricator shall consult with the Contractor, Contract Administrator and hot-dip galvanizer regarding potential problems or potential handling problems prior or during the galvanizing process.



- (ii) Remove all welding slag, splatter, antisplatter compounds, and burrs prior to delivery for galvanizing.
  - (iii) Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil, paint, and other deleterious material prior to fabrication.
  - (iv) Remove by blast cleaning or other methods surface contaminants and coatings which would not be removable by the normal chemical cleaning process in the galvanizing operation.
  - (v) Hooks or bends should be smooth and not sharp. Bars are to be bent prior to galvanizing. Minimum bend diameters shall be provided in accordance with ASTM A767 latest edition.
  - (vi) The reinforcing shall be a minimum of 10°C prior to bending and galvanizing operations, regardless of ambient temperatures in the plant. Where ambient temperatures fall below 10°C, bending and galvanizing in a facility that is not enclosed and temperature controlled will not be permitted.
  - (vii) The Contractor is responsible to ensure that accelerated strain-embrittlement does not occur during the manufacturing, bending practices and galvanizing of the reinforcing steel. The Contractor shall submit to the Contract Administrator the following;
    - ◆ Reinforcing Supplier standards of practice for working of reinforcing steel. This shall include bending practices as per ASTM A767-latest addition and temperature requirements during fabrication (bending) of reinforcing. This is to be submitted with the Certificate of Compliance from the Manufacturer as specified in E19.4.1(c).
    - ◆ Contractor is to carry out a Quality Control Testing Program following the requirements as per ASTM A143/A143M-latest addition. This will include but not limited to random bent bars to be tested after galvanizing, photos of items before and after testing, and a report submitted to the Contract Administrator for each trailer load received on site. Testing criteria shall be submitted for review and approval to the Contract Administrator at least ten (10) Business days prior to manufacturing of reinforcing.
- (d) Stainless Steel Reinforcing
- (i) Heating shall not be used as an aid in bending stainless steel reinforcing.
  - (ii) Hooks and bends should be smooth and not sharp.
  - (iii) Fabrication of the solid stainless steel reinforcing shall be such that the bar surfaces are not contaminated with deposits of iron and/or non-stainless steel or damage to the surface of the bars.
  - (iv) 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 wire brushes only.
  - (v) All hand tools shall be stainless tools that have not been used on carbon steel.

#### E19.6.2 Placing of Reinforcing Steel

- (a) 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.
- (b) 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.

- (c) 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 will not be permitted.
- (d) Place reinforcing bars to provide a clear space between the reinforcing bars as shown on the Drawings to accurately place preformed holes where necessary.
- (e) Reinforcing steel shall not be straightened or rebent in a manner that will injure the metal or create excess damage to the galvanized coating. Bars with bends not shown on the Drawings shall not be used.
- (f) Heating of reinforcing steel will not be permitted without prior acceptance by the Contract Administrator.
- (g) A minimum of twenty-four (24) hours advance notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for inspection of the reinforcement.
- (h) Following placement of galvanized-coated bars, all areas of damaged coating shall be repaired using approved touch-up coating material specified in Clause E19.5.4(b).

#### E19.7 Quality Control

##### E19.7.1 Inspection

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

##### E19.7.2 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.

##### E19.7.3 Quality Testing

- (a) Quality control testing may 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 control tests and provide such assistance and use of tools and construction equipment as is required.

#### E19.8 Measurement and Payment

- (a) Reinforcing steel bars will be paid for on a unit basis and paid for at the Contract Unit Price for "Items of Work" listed below. The amount to be paid for will be on a mass basis and shall be paid for at the Contract Unit Price per kilogram in accordance with this Specification, Drawings, and accepted and measured by the Contract Administrator.

##### E19.8.1 Items of Work:

- (a) Supply and Delivery of Reinforcing Steel
  - (i) Black Steel Reinforcing
  - (ii) Galvanized Steel Reinforcing
  - (iii) Stainless Steel Reinforcing
- (b) Placing Reinforcing Steel

- (i) Black Steel Reinforcing
  - (ii) Galvanized Steel Reinforcing
  - (iii) Stainless Steel Reinforcing
- (b) Supplying and installing all the listed materials, construction methods, and quality control measures associated with this Specification and Drawings shall be considered incidental to "Supply and Delivery of Reinforcing Steel", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

## **E20. PRECAST CONCRETE GIRDERS**

### **E20.1 Description**

E20.1.1 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 channel 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.

### **E20.2 References and Related Specifications**

#### **E20.2.1 References**

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

#### **E20.2.2 Related Specifications**

- (a) Specification E18 "Structural Concrete"
- (b) Specification E19, "Supplying and Placing Reinforcing Steel"

### E20.3 Submittals

- (a) The Contractor shall submit the following to the Contract Administrator:
- (i) 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.
  - (ii) 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.
  - (iii) Stressing calculations shall be stamped, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba and include the following:
    - ◆ 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.
    - ◆ A calibration graph for each jack, calibrated not more than 6 months prior to stressing operation.
    - ◆ The proposed method of tensioning the draped strands, including a comprehensive description and drawing of the proposed hold-up and hold-down devices.
    - ◆ The proposed sequence of stressing and destressing operations.
    - ◆ The anchorage losses experienced by the Contractor under similar loading applications, and the proposed method of measuring the anchorage losses during the stressing operation.
    - ◆ A copy of the proposed "Record of Concrete Strength" and "Record of Pre-Tensioning" forms to be used by the Contractor.
  - (iv) Copies of the stress-strain curve for the prestressing steel and the lateral stressing cables.
  - (v) 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.
  - (vi) 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).
  - (vii) 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.
  - (viii) Bending procedures for strands extended at girder ends.

### E20.4 Materials

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

#### E20.4.1 Concrete

- (a) 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.

#### E20.4.2 Coarse Aggregate

- (a) 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.

- (b) 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.

#### E20.4.3 Fine Aggregate

- (a) 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 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.
- (b) Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1, Table 12.

#### E20.4.4 Admixtures

- (a) Air-entraining admixtures shall conform to the requirements of ASTM C 260. The City of Winnipeg Specification
- (b) Chemical admixtures shall conform to the requirements of ASTM C 494 or C 1017 for flowing concrete.

#### E20.4.5 Cementitious Materials

- (a) Cementitious materials shall conform to the requirements of CSA-A3001.
- (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 and the substitution shall not exceed 15% by mass of cement.

#### E20.4.6 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, anchor rods and 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.

#### E20.4.7 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.

- (e) 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,
- shall be replaced either by the Contractor or cleaned to the satisfaction of the Contract Administrator.

E20.4.8 Reinforcing Steel

- (a) Reinforcing steel shall be Grade 400 MPa and shall conform to the requirements of CSA Standard G30.18 and E18 "Structural Concrete" of this Specification.

E20.4.9 Stainless Steel Reinforcing

- (a) Stainless steel reinforcing shall be in accordance with E19 "Supplying and Placing Reinforcing Steel" of this Specification.

E20.4.10 Materials for Lateral Stressing

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

E20.4.11 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. Inserts shall be galvanized in accordance with ASTM A123 to a net retention of 610 g/m<sup>2</sup>.

E20.4.12 Anchor Rods

- (a) Anchor rods shall be ASTM F1554 Grade 55 (380 MPa), galvanized in accordance with ASTM F2329.

E20.4.13 Form Retarder

- (a) Form retarder for achieving exposed aggregate finish in areas to be in contact with grout after girder erection shall be MBT Tuf-Cote or equal as accepted by the Contract Administrator, in accordance with B7.

E20.4.14 Other Materials

- (a) 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.

E20.5 Manufacture

E20.5.1 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.

#### E20.5.2 Shop drawings

- (a) Shop drawings shall be 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 channel girder fabrication.

#### E20.5.3 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.

#### E20.5.4 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 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 E20.5.3 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
  - (i) 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.
  - (ii) 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.
  - (iii) 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.
- (e) The following formed surfaces require an exposed aggregate finish:
  - (i) exposed surfaces in the shear keys
  - (ii) exposed surfaces in the recesses for lifting devices, etc.
  - (iii) interior portions of the fixed end dowel holes.

#### E20.5.5 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 and 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 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.
- (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 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 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.

#### E20.5.6 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) Intersecting bars shall be tied positively at each intersection.

#### E20.5.7 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.

#### E20.5.8 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.

#### E20.5.9 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.

#### E20.5.10 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 determination of 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.

- (d) 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:
  - (i) slump
  - (ii) air
  - (iii) temperatureand to record the results of such tests.
- (e) 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.
- (f) 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.

#### E20.5.11 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. Surface vibrators shall be applied only long enough to embed the coarse aggregate and to bring enough mortar to the surface for satisfactory screeding.
- (h) 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.
- (i) The tops of all members shall receive a screeded, untrowelled surface.
- (j) 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.
- (k) 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.
- (l) 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
- (m) All objectionable fins, projections, offsets, steaks, or other surface imperfections shall be totally removed to the Contract Administrator's satisfaction by approved means.

#### E20.5.12 Concrete Finish

- (a) The top surfaces of the 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.
- (i) Surfaces to be in contact with grout after girder erection (recesses for lifting devices, shear keys, etc.) shall be given an exposed aggregate finish.

#### E20.5.13 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  $\pm 3^{\circ}$  C. During steam curing the ambient air temperature shall rise at a rate not to exceed  $15^{\circ}$  C per hour to a maximum temperature of  $70^{\circ}$  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  $15^{\circ}$ 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.

#### E20.5.14 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.

E20.5.15 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.

E20.5.16 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 E20.5.12 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.
- (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.

## E20.6 Erection

### E20.6.1 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.

#### E20.6.2 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.

#### E20.6.3 Channel Girders

- (a) All channel 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 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.

#### E20.6.4 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.

#### E20.6.5 Placing and Grouting of Anchor Rods



- (a) The Contractor shall drill holes in the substructure unit to the size and depth as shown on the plans.
- (b) Drilling shall be done through holes already provided in the designated girders. The Contractor shall exercise utmost care not to damage the girders during drilling operations.
- (c) After the holes have been drilled and cleaned out by compressed air, anchor rods shall be placed and grouted as shown on the plans.
- (d) Cement grout shall be prepared as specified in Section E20.4.6 of this Specification.
- (e) The Contractor shall install and grout the anchor rods for the following girder(s) prior to lateral stressing:
  - (i) For spans with an odd number of girders, the center girder, or
  - (ii) For spans with an even number of girders, both girders on either side of the bridge centerline.
- (f) After lateral stressing operations, the remaining anchors shall be installed and grouted.

#### E20.6.6 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.

#### E20.6.7 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.

#### E20.6.8 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.

## E20.7 Measurement and Payment

### E20.7.1 Supply of Precast Concrete Girders

- (a) 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.

### E20.7.2 Erection of Precast Concrete Girders

- (a) 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.

## E21. SUPPLY AND INSTALLATION OF BEARINGS

### E21.1 Description

- (a) The Work shall consist of supplying and installing bearings, top plate, masonry plate, fasteners and bolts including grout pads (where applicable) as shown on the Drawings and in this Specification.

### E21.2 References

- (a) All related Specifications and reference Standards are in accordance with the most current issue or latest revision.

### E21.3 Submittals

- (a) The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:

#### E21.3.1 Bearings

- (a) The Contractor shall submit to the Contract Administrator detailed Shop Drawings for the bearings that are stamped, signed and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba in accordance with E3 "Shop Drawings".
- (b) The Contractor shall submit to the Contract Administrator documentation of all Quality Control testing undertaken for bearings as specified herein.

### E21.4 Materials

#### E21.4.1 Bearings

- (a) The bridge bearings shall be supplied and installed by the Contractor as shown on the Drawings.
- (b) Expansion bearings shall be laminated elastomeric as shown on the Drawings.
- (c) Fixed bearings shall be laminated elastomeric as shown on the Drawings.

#### E21.4.2 Bearing Miscellaneous

- (a) All miscellaneous plates and fittings shall be supplied and installed by the Contractor as shown on the Drawings.

#### E21.4.3 Grout

- (a) Grout pads and anchor bolt grout shall be SIKA 212 Flowable grout or approved equal by the Contract Administrator. Grout shall be non-shrink and have a minimum 28 day compressive strength of 35 MPa.

#### E21.4.4 High Strength Bolts, Nuts and Washers

- (a) Unless otherwise specified on the Drawings, all fasteners shall be in accordance with ASTM A325.

#### E21.4.5 Anchor Bolts

- (a) Anchor bolts shall be in accordance with ASTM F1554, Grade 55 (380 MPa), hot dip galvanized.

#### E21.4.6 Welding Consumables

- (a) The requirements of E24 "Supply, Fabrication and Erection of Miscellaneous Metal" shall apply.

#### E21.5 Bearing Fabrication and Supply

- (a) Bearings shall be fabricated from new materials. Bearings shall be designed and fabricated in accordance with the latest editions of AASHTO LRFD Bridge Design Manual, AASHTO LRFD Bridge Construction Specifications and AASHTO M251 "Standard Specification for Plain and Laminated Elastomeric Bridge Bearings".
- (b) Internal steel reinforcing plates for laminated bearings shall be rolled mild steel with a minimum yield strength of 260 MPa. All other steel shall be in accordance with the latest edition of CAN/CSA G40.21, Grade 300W.
- (c) Stainless steel plates shall conform to the latest edition of ASTM Standard A167, Type 304.
- (d) PTFE surface shall be unfilled flat sheets made from pure virgin PTFE resin satisfying the requirements of the latest edition of ASTM D4894. PTFE shall be resistant to all acids, alkalis and petroleum products, stable at temperatures from -220°C to +260°C, non-flammable and non-absorbing of water.
- (e) Elastomer shall be neoprene or natural rubber, AASHTO low temperature Grade 4 or 5 with a Shore A Hardness of 60 and a shear modulus (G) between 0.90 and 1.38 MPa.
- (f) Recess the PTFE into the steel backing plate to a depth of one half the PTFE thickness. The shoulders of the recess shall be sharp end square. Prepare the steel surface by grit blasting and bond over the entire area using an adhesive approved by the PTFE manufacturer.
- (g) All exposed surfaces of the steel plates shall be zinc metalized. Surfaces to be metalized shall be blast cleaned in accordance with SSPC-SP5, "White Metal Blast Cleaning".
- (h) The overall dimensions of the bearings shall be within a tolerance of +/- 3mm in plan and height. PTFE fabrication tolerances shall be in accordance with the latest edition of the AASHTO LRFD Bridge Construction Specifications. Other fabrication tolerances for the elastomeric pads shall be in accordance with the latest version of AASHTO M251.
- (i) Bearings shall be clearly marked with their position on site and direction of installation. Markings shall be clearly visible on all bearings to prevent mix-up on site. Information marked on the bearings must correspond with the information contained on the approved Shop Drawings for the bearings. Bearings shall be supplied with suitable handling devices as required. Temporary clamping devices shall be used to maintain the correct orientation of the parts during handling, transport, storage, and installation but are not to be used for slinging or suspending bearings unless specifically designed for this purpose. Bearings shall be protected during handling, transport, storage, and installation from damage, distortion, and all deleterious material and contaminants including moisture and dust.
- (j) The bearing Supplier shall verify the condition of the bearings supplied to the work site.

#### E21.6 Construction Methods

##### E21.6.1 General

- (a) Any structural steel components that in the opinion of the Engineer have been damaged or otherwise rendered useless by the improper handling by the Contractor shall be replaced by the Contractor at his own expense.

- (b) Bearings stored on site shall be carefully handled, stored, and protected from direct sunlight, moisture, extreme temperatures, heavy loads, and to the satisfaction of the Contract Administrator.

#### E21.6.2 Grout Pads

- (a) When shown on the Drawings or described in the Specification, the Contractor shall construct grout pads using SIKA 212 flowable grout or equivalent, accepted by the Contract Administrator. Construction of grout pads shall be done by workers competent in this Work.
- (b) Grouts shall be packaged in waterproof containers with the production date and shelf life of the material shown. It shall be mixed, placed, and cured in strict accordance with the Manufacturer's recommendations.
- (c) The method of forming and pouring the grout shall be submitted to the Contract Administrator for review and approval prior to the work being undertaken. Dry-pack methods of constructing grout pads will not be accepted.
- (d) When the daily minimum air temperature or the temperature of the girders, bearings, or substructure concrete in the immediate area of the grouting falls below 5°C, or when there is a probability of it falling below 5°C within twenty-four (24) hours of grouting, the following provisions for cold weather grouting shall be implemented:
  - (i) Before grouting, adequate preheat shall be provided to raise the temperature of the adjacent areas of the girders, bearings, and substructure concrete to at least 10°C.
  - (ii) Temperature of the grout during placing shall be between 10°C and 25°C.
  - (iii) The grout pads (and girders where appropriate) shall be enclosed and kept at 15°C to 25°C for at least five days. The system of heating shall be designed to prevent excessive drying-out of the grout.

#### E21.6.3 Anchor Bolts

- (a) The Contractor shall remove all anchor bolt void forming materials prior to grouting. Any residues on the concrete surface, such as oils, grease, or other contaminants that can reduce bonding characteristics, shall be removed by sandblasting.
- (b) Anchor bolts shall be set accurately and grouted with non-shrink cement grout accepted by the Contract Administrator. All methods and materials for setting anchor bolts and building bearing pads shall be submitted to the Contract Administrator for review and acceptance.
- (c) Where applicable, the location of the anchor bolts in relation to the expansion bearing assembly shall correspond with the temperature at the time of erection, as directed by the Contract Administrator.

#### E21.6.4 Bearings

- (a) 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 Drawings and Specifications. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.
- (b) The Contractor shall accurately assemble and install the bearings as specified on the Drawings and as directed by the Contract Administrator.
- (c) Bearing centrelines shall be within +/-3mm of their correct positions after installation. Threaded fixings shall be tightened uniformly to avoid overstressing any part of the bearing. Bearings and their surrounding areas shall be left clean after installation.
- (d) Where applicable, the stainless steel surface of the bearings, the Teflon coated bearing pads and the machined surfaces of steel bearings that have been cast

into the girders shall be protected from damage at all times. The plywood and polyethylene covers shall not be removed until immediately prior to the positioning of the bearings over the bearing seats.

- (e) When steel bearings are employed in conjunction with grout pockets in the substructure, the bearings shall be set accurately on galvanized steel shims, and grouted as detailed on the Drawings, after the girder erection has been completed. The shims must be located so that a minimum of 75 mm grout coverage is provided. When the grout pockets are not detailed, the bearing plates shall be set on the property finished bearing areas in exact position and shall have a full and even bearing on the concrete.
- (f) Where the design requires that the girders bear on neoprene pads placed directly on pier or abutment seat concrete, the Contractor shall supply and install shims cut from lead sheeting as determined by the Contract Administrator to ensure full and uniform bearing.
- (g) Any bearings that in the opinion of the Contract Administrator have been damaged or otherwise rendered unusable by improper storage or handling by the Contractor shall be replaced by the Contractor at his expense.

#### E21.6.5 Equipment

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

#### E21.7 Guarantee

##### E21.7.1 Fabrication Guarantee

- (a) Upon installation of the bearings the bearing Supplier shall inspect the bearings and certify in writing that the bearings have been properly installed. The Contractor shall provide a written guarantee that the bearings will perform satisfactorily within the design range of movement under the design loads for a period of five (5) years from the date of bearing installation. 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 of Winnipeg in the event that the bearings do not perform satisfactorily within the design range of movement and under the design loads.

##### E21.7.2 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 Total Performance. Provided in the guarantee for the replacement of the bearings at no cost to the City of Winnipeg in the event that the bearings do not perform satisfactorily in the range of design movement and under the design loads.

#### E21.8 Measurement and Payment

E21.8.1 Supply and Installation of Bearings will be measured on a unit basis and paid for at the Contract Unit Price for "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

##### E21.8.2 Items of Work:

- (a) Supply and Installation of Bearings
  - (i) Expansion Bearings

(ii) Fixed Bearings

**E22. RUBBERIZED ASPHALT WATERPROOFING**

**E22.1 Description**

- (a) This Specification shall cover all operations relating to the supply of labour, equipment, tools and material necessary for the installation of the hot poured rubberized asphalt waterproofing 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, handling and storage, and all things necessary for and incidental to the satisfactory performance and completion of all Work as herein specified.
- (c) The scope of work consists of:
  - (i) Preparing the surface of elements to be waterproofed;
  - (ii) Installing the wick drains, where applicable;
  - (iii) Supplying and applying primer;
  - (iv) Supplying and applying the hot poured rubberized asphalt waterproofing system to the elements to be waterproofed;
  - (v) Supplying and applying polyester fabric and protection board.
- (d) The elements to be waterproofed are:
  - (i) Roadway surface of the bridge deck.

**E22.2 Submittals**

- (a) The Contractor shall submit to the Contract Administrator for review and approval, fourteen (14) days prior to commencement of the Work, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit the following to the Contract Administrator for review:
  - (i) Manufacturer's product data sheet indicating physical, mechanical and chemical characteristics, such as durability, resistance, strength and bonding.
  - (ii) Manufacturer's installation instructions and general recommendations regarding each material to be used.
  - (iii) Manufacturer's Material Safety Data Sheets (MSDS) for all materials used.

**E22.3 Materials**

**E22.3.1 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.

**E22.3.2 Wick Drains**

- (a) Wick Drains shall be Nilex MD7407 or approved equivalent by the Contract Administrator.

**E22.3.3 Primer**

- (a) Primer shall receive a prime coat of CGSB37-GP-Ma, 930-18 (BAKOR) or approved equivalent by the Contract Administrator, at an application rate in accordance with the manufacturer's recommendations.

**E22.3.4 Hot Poured Rubberized Asphalt Waterproofing (2 layers)**

- (a) Hot Poured Rubberized asphalt waterproofing shall be Bemalastic 1213 BDM by Bemac products or 6790-11 by BAKOR or an approved equivalent as accepted by the Contract Administrator.
- (b) The waterproofing membrane shall be melted, mixed and applied according to the manufacturer's recommendations. The laying operation shall be such that the waterproofing membrane is applied in two 2.0 – 3.0 mm thick layers. Discontinuities in the waterproofing membrane shall be avoided and joints lapped a minimum of 150 mm.
- (c) The Contract Administrator shall be free to take samples from kettles for testing for every 600 m<sup>2</sup> of area waterproofed at no additional cost.

E22.3.5 Polyester Fabric

- (a) The intermediate reinforcing layer shall be spun-bonded polyester fabric such as Remay 2016 grade, BAKOR Polyester Fabric Reinforcing Sheet, McAsphalt Fabric Reinforcement BP-16 or approved equivalent as accepted by the Contract Administrator.

E22.3.6 Protection Board

- (a) The protection board shall be BAKOR Asphalt Protection Board, McAsphalt Protection Board BP-Asp Pb or approve equivalent as accepted by the Contract Administrator. The protection boards shall be placed on top of the upper layer of waterproofing and rolled by means of linoleum or lawn type roller while the membrane is still warm to ensure good contact with the membrane.

E22.3.7 Elastomeric Sheet Membrane

- (a) The elastomeric sheet membrane shall be a heavy duty sheet. The elastomeric sheet membrane shall be Elaso-Petrotech No. 240 or approved equal as accepted by the Contract Administrator and is to be compatible with the hot-poured rubberized asphalt waterproofing.

E22.3.8 Cement

- (a) Cement shall be normal Portland Cement.

E22.3.9 Surface Conditioner

- (a) Surface conditioner, to be applied to the concrete surfaces of the bridge deck and roof slabs, shall conform to the requirements of the Manufacturer of the rubberized asphalt waterproofing.

E22.3.10 Melting On-Site

- (a) Cakes of rubberized asphalt waterproofing shall be melted in an approved double shell melter under continuous agitation until the material can be drawn free flowing and lump free from the melter.
- (b) The temperature of the rubberized asphalt waterproofing shall not exceed 218°C at any time during the entire melting procedure.

E22.4 Equipment

E22.4.1 General

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

E22.5 Construction Methods

E22.5.1 Concrete Preparation

- (a) The concrete bridge deck and roof slab surfaces onto which the hot-poured rubberized asphalt waterproofing to be applied shall be thoroughly cleaned. The surfaces shall be sound, free from curing compounds, laitance and scaling. All rough spots, ridges and edges in the concrete surface resulting from protrusions of



concrete aggregate or cement paste shall be removed by light chipping or grinding to leave a smooth and level surface. Immediately prior to the application of the hot poured rubberized asphalt waterproofing, a final cleaning of the concrete surfaces shall be done using high velocity compressed air. The concrete surfaces shall be dry, clean and free from frost, dust, dirt and all foreign matter. The Contractor shall contain and collect all products of the shot blasting operation including dust, debris and spent abrasive so as to ensure that all of these materials are prevented from entering into land drainage system or ditches. All debris and spent abrasive shall be collected and disposed of off-site by the Contractor at an approved disposal facility.

- (b) The Contractor is responsible to ensure that the concrete surfaces onto which the hot poured rubberized asphalt waterproofing is to be applied is prepared (including supply and application of waterproofing primer) to the degree that the hot poured rubberized asphalt waterproofing can be installed in accordance with the manufacturer's requirements.

#### E22.5.2 Application

- (a) After the deck slab has been cleaned and meets all manufacturers' requirements, the entire concrete bridge deck and roof slabs surface shall be covered with primer.
- (b) The quantity used shall be 160 mL/m<sup>2</sup>, or as recommended by the Manufacturer. The primer shall be allowed to dry before the application of the rubberized asphalt waterproofing.
- (c) The hot poured rubberized asphalt waterproofing shall be brought to a temperature of between 190°C and 218°C, and then applied to the deck slab.
- (d) The application of the rubberized asphalt waterproofing shall be carried out under the supervision of experienced personnel.
- (e) The Contractor shall apply the rubberized asphalt waterproofing membrane over the entire deck area and roof slab area, along the vertical face of the curb and the vertical face of the expansion joint concrete, to the required height (proposed elevation) of the bituminous pavement.
- (f) The hot poured rubberized asphalt waterproofing membrane shall be a two layer, fabric-reinforced system. Each layer shall be 2.0 to 3.0 mm thickness. The intermediate fabric reinforcing layer shall be placed between the layers of the waterproofing membrane.
- (g) The intermediate reinforcing shall be set into the first layer of waterproofing membrane to achieve a minimum of 50% bleed through. There should not be any dry sheet-to-sheet overlap and a maximum overlap or gap between sheets of 5 mm.
- (h) The Contractor shall supply and install approved protection board to cover the hot poured rubberized asphalt waterproofing membrane. The installation of the protection board shall replace the requirements of dusting the waterproofing membrane with Portland cement.
- (i) The protection board shall be a durable panel of 3 mm thickness specifically designed to provide a protective cushion between the hot mix asphalt pavement and the hot poured rubberized asphalt waterproofing membrane for bridges and shall be approved by the Contract Administrator.
- (j) The protection boards shall be placed with edges overlapping 25 mm both longitudinally and transversely. The protection board edge shall be within 5 mm of all barriers. Protection boards shall be placed such that the longitudinal (direction of traffic) joints are staggered at least 150 mm. In instances where edges of the protection board curl up, the edges shall be cemented down using asphalt waterproofing. Protection boards that are warped, distorted or damaged in any way shall be rejected.

- (k) The Contractor shall supply and install an elastomeric sheet membrane which is compatible with the hot-poured rubberized asphalt waterproofing material. The elastomeric sheet membrane shall be installed at the locations shown on the Drawings or as directed by the Contract Administrator. Installation of the heavy-duty elastomeric sheet membrane shall be in accordance with the Manufacturer's recommendations.
- (l) The finished elastomeric sheet membrane top surface shall be lightly dusted with Normal Portland Cement. The quantity used shall be one bag of cement per 45 m<sup>2</sup>.

## E22.6 Quality Control

### E22.6.1 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.

### E22.6.2 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.

## E22.7 Measurement and Payment

- (a) Rubberized asphalt waterproofing will be measured on a square metre basis and paid for at the Contract Unit Price per square metre for "Rubberized Asphalt Waterproofing", which price shall be payment in full for supplying all materials and 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. ASPHALTIC CONCRETE PAVING ON BRIDGE**

### E23.1 Description

- (a) This Specification shall cover all operations relating to the supply of labour, equipment, tools and material necessary for the application of tack coat and the placing and compaction of the asphaltic hot mix overlay on the bridge deck and approach slabs. The thickness of the overlay shall be as specified 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, handling and storage, and all things necessary for and incidental to the satisfactory performance and completion of all Work as herein specified and as indicated on the Drawings.
- (c) Scope of Work:
  - (i) Surface preparation of the bridge deck and approach slabs;
  - (ii) Supplying and applying the tack coat;
  - (iii) Supplying, hauling, placing and compacting of asphaltic hot mix (overlay) on the bridge deck and approach slabs, including all work at the joints; and,
  - (iv) The quality control (QC) testing of all materials.

### E23.2 References

- (a) All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
  - (i) City of Winnipeg's Specification CW 3410 (latest edition) - Asphaltic Concrete Pavement Works.
  - (ii) E22 Rubberized Asphalt Waterproofing

#### E23.3 Submittals

- (a) In addition to Specification CW 3410 - Asphaltic Concrete Pavement Works, the Contract shall submit the following to the Contract Administrator fourteen (14) days prior to the Work, the proposed mix design and test results for verification and approval.

#### E23.4 Materials

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

##### E23.4.1 Tack Coat and Bituminous Pavement

- (a) The tack coat and bituminous pavement for the class specified on the Drawings shall conform to the requirements of the Specification CW 3410 - Asphaltic Concrete Pavement Works
- (b) Asphalt shall be Type 1A.

##### E23.4.2 Caulking Compound and Miscellaneous Joint Materials

- (a) Caulking compound and miscellaneous joint materials shall be as shown on the Drawings or approved by the Contract Administrator.

#### E23.5 Construction Methods

##### E23.5.1 Surface Preparation

- (a) Surfaces to receive asphalt concrete paving shall be thoroughly cleaned by means of a power broom and compressed air. All surfaces to which the tack coat is to be applied shall be dry and free from scale, dirt, grime, grease, oil or other contaminants.

##### E23.5.2 Application of Tack Coat

- (a) Tack coat shall be applied to the entire surface of the deck and approach slabs. The quantity used shall not exceed 550 mL/m<sup>2</sup>. Curbs and all other like appurtenances having a vertical face shall receive a brushed-on application of tack coat to the height of the compacted asphalt mat. All puddles or other excess of the tack coat shall be thoroughly spread out by brushing the material over the surrounding surface.
- (b) The vertical surfaces of the curbs and all other like appurtenances and the bridge deck areas within one foot of such abutting surfaces, shall receive a further coating of paving grade (150/200 penetration) asphalt cement.
- (c) The treated surface shall be allowed to cure until it becomes tacky before applying the asphalt mix.

##### E23.5.3 Distribution

- (a) The distributor used in applying the liquid bituminous tack coat shall be of a type, size and equipped as to meet the following requirements:
  - (i) It shall be capable of applying bituminous tack coat on the deck and approach slabs in accurately measured quantities.
  - (ii) It shall be equipped with:
    - ◆ A heating unit capable of maintaining the asphalt in the tank at the specified temperature.

- ◆ A thermometer so placed as to accurately measure the temperature of the material in the tank.
  - ◆ A tachometer operated by an independent wheel, or a similar suitable device, that will allow the operator to determine the correct travel speed for applying the specified quantity of asphaltic material.
  - ◆ A pressure gauge to indicate to the operator that the required nozzle pressure is being maintained.
  - ◆ Spray nozzles, with quick acting positive shutoff, of a design which will ensure a uniform fan-shaped spray.
  - ◆ A strainer on the discharge line to prevent clogging.
  - ◆ A spray bar of adjustable length that can be raised or lowered.
  - ◆ A spray bar having a heating device, asphalt circulation system, or other device which will provide a uniform viscosity of material in all portions of the spray bar.
  - ◆ A hose and nozzle attachment to be used for spraying, by hand, areas inaccessible to the distributor spray bar.
- (iii) On smaller bridge decks, the use of manual spraying equipment suitable for applying the liquid bituminous material uniformly at the desired rate will be allowed.

#### E23.5.4 Transportation of Bituminous Pavement Mixture

- (a) The mixture shall be transported from the mixing plant to the job site in vehicles with tight boxes having metal bottoms previously cleaned of all foreign materials. When directed by the Contract Administrator, the vehicles shall be suitably insulated. Each vehicle shall be equipped with a closely fitting tarpaulin of canvas or other suitable material of sufficient size to overhang the truck box on all sides when the vehicle is loaded. Tarpaulins shall be used to completely cover the mixture at all times, even during the placing of the load into the spreader.
- (b) All loads not properly covered will be rejected.

#### E23.5.5 Placing Asphaltic Concrete Paving Mixture

- (a) The Contractor shall spread the asphalt pavement mixture by means of a self-propelled mechanical paver complete with screed. The paver shall be equipped with both automatic and manual controls capable of adjusting the screed to produce the required profile, cross section and longitudinal joint matching. Unless otherwise permitted the paver shall be operated using automatic controls. The automatic control of profile shall be accomplished by reference to a floating beam or skid. The beam or skid shall have a minimum length of 9 metres. A floating beam shall be supported by wheels or skis in a floating tandem arrangement. The number and arrangement of wheels or skis and the nature of the beam or skid shall be subject to the Engineer's approval. When paving adjacent to a newly laid lane on final lift or adjacent to a curb, control of profile may be accomplished by reference to a shoe on the adjacent final lift or curb.
- (b) The paver shall produce a uniformly textured surface free from tearing, tracking or other objectionable surface irregularities. If the surface condition is not acceptable, spreading operations shall cease until equipment adjustments, repairs or replacement are made. Spreading operations shall not recommence without the approval of the Contract Administrator. Delays and expense entailed in adjustments, repairs or replacement of equipment shall be the responsibility of the Contractor.
- (c) The paver shall proceed in the same direction as the lap of the protection board and the sequence of spreading operations with respect to lanes and lifts shall be approved by the Contract Administrator.
- (d) The spreader shall be capable of spreading the mixture true to the elevations, grades and crown as shown on the Drawings. The allowable variation in the

bituminous pavement surface shall not exceed 6 mm when measured using a 3 meter straight edge. Particular attention shall be paid to the setting of the spreader when laying the mixture in the areas adjacent to protruding joints in order to avoid bumps in the areas of such joints. In correcting the areas adjacent to a joint or when removing excess mixture, the material shall be picked up and not cast on the surface of the freshly spread bituminous pavement.

- (e) Immediately after the course is screeded, and before roller compaction is started, the remainder of the surface shall be checked, all inequalities adjusted, and all high spots removed and replaced with satisfactory material. Irregularities in alignment and grade along the curb shall be corrected by the addition or removal of mixture before the edge is rolled.
- (f) The speed of the spreader shall be maintained at a uniform rate that is in balance with the amount of bituminous pavement mixture being delivered to the bridge site.
- (g) The Contractor shall apply a tack coat between successive lifts as approved by the Contract Administrator.

#### E23.5.6 Compaction of Asphalt Overlay Mixture

- (a) The breakdown and finishing operations shall be carried out by a steel three-wheeled or tandem roller. The intermediate rolling shall be done by a self-propelled pneumatic-type roller. Delays in rolling freshly-spread mixture will not be tolerated.
- (b) All areas next to vertical curb median faces and protruding deck joints shall be worked with hot iron tampers, mechanical vibratory tampers or by other means satisfactory to the Contract Administrator.

#### E23.5.7 Construction Joints in Asphalt Overlay

- (a) Longitudinal and transverse joints shall be made in a careful manner in order to assure a well-bonded, sealed and level joint. A transverse joint shall be cut back to its full depth perpendicular to the mat at the end of the run. On resuming laying of the paving mixture, the exposed edges shall be painted with a thin coat of hot asphalt cement.
- (b) Before placing the paving mixture against them, all contact surfaces of longitudinal joints, curbs, leaders, etc., shall be painted with a thin coat of hot asphalt cement, as well as heated with a propane joint heater.
- (c) The allowable variation in the surface across a transverse joint shall not exceed 6 mm when measured using a 3 m straight edge centred on the joint.
- (d) In raking joints, excess mix material shall be picked up and removed from the surface of the freshly spread asphalt.

#### E23.5.8 Joints in Asphalt Overlay

- (a) When called for on the Drawings, the Contractor shall, after the completion of the asphalt paving, saw-cut the asphalt in the transverse direction for the full roadway width at every pier and abutment to the dimensions as shown on the Drawings. The joints shall then be constructed in accordance with the Drawings.

#### E23.5.9 Weather

- (a) Paving asphalt to be laid to a compacted thickness of less than 40 mm shall not be started unless the air temperature is at least 10°C and rising, and not until all frost or moisture has evaporated to leave a dry surface. For greater thicknesses of asphalt pavement, the temperature requirement may be reduced to 5°C, providing the temperature is rising.

#### E23.5.10 Protection of Exposed Bridge Surfaces

- (a) Utmost care shall be taken to prevent the surfaces of the curbs above the compacted asphalt mat, as well as the newel posts and approach railing, from

being disfigured by materials such as tack coating, caulking compound, cement and asphalt mixture.

- (b) If the exposed surfaces are marred as a result of the Contractor's operations, restoration shall be made by the Contractor at his expense and to the satisfaction of the Contract Administrator.

#### E23.6 Quality Control and Quality Assurance

##### E23.6.1 Quality Control

- (a) The quality control testing by the Contractor shall meet the requirements specified in the Specification CW 3410 - Asphaltic Concrete Pavement Works.

##### E23.6.2 Quality Assurance

- (a) All materials supplied by the Contractor to be permanently incorporated in the finished product are subject to the inspection and approval of the Contract Administrator.
- (b) The Contractor shall take random field samples and conduct quality assurance tests on the materials, including the asphalt hot mix as directed by the Contract Administrator. If any material or the asphalt hot mix is proven to be of inferior quality, the Contract Administrator will reject such material.
- (c) In cases where bituminous pavements have already been laid and are proven in later tests to be inferior, the Contractor shall remove such material and replace it with proper material at his own expense.

#### E23.7 Measurement and Payment

- (a) Asphalt paving will be measured on a mass basis and paid for at the Contract Unit Price per tonne for "Asphalt Overlay on Bridge", which price shall be payment in full for supplying all materials and 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. SUPPLY, FABRICATION AND ERECTION OF MISCELLANEOUS METAL**

#### E24.1 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.
- (b) Miscellaneous metal includes, but is not limited to;
  - (i) Retaining angles and related assemblies, prefabricated and pre-set stainless steel anchors for bridge aluminum barrier rail, barrier rail posts, galvanized steel templates, anchor bolts, fasteners, washers and nuts, and anchor rods.
  - (ii) Quality control of materials and fabrication, including magnetic particle testing of welds.
  - (iii) Galvanizing of miscellaneous metal.
- (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 other things necessary for and incidental to the satisfactory completion of all Work as hereinafter specified.
- (d) Scope of Work
  - (i) Supply and install galvanized retaining angles attached to the underside of the girders.
  - (ii) Supply and install galvanized pre-set, pre-fabricated retaining angle mounting plate and anchorage units into the substructure unit to the retaining angles complete with galvanized bolts, nuts and washers.

#### E24.2 References and Related Specifications

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

#### E24.2.1 References

- (a) CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- (b) CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding
- (c) CSA W59, Welded Steel Construction (Metal Arc Welding)
- (d) CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles
- (e) CSA W47.1, Certification of Companies for Fusion Welding of Steel
- (f) ASTM A36, Standard Specification for Carbon Structural Steel
- (g) ASTM A53, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
- (h) ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- (i) ASTM A123, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
- (j) ASTM A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- (k) ASTM A276, Standard Specification for Standard Specification for Stainless Steel Bars and Shapes
- (l) A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- (m) ASTM A320, Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
- (n) ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- (o) ASTM A404, Standard Specification for General Requirements for Stainless Steel Bars, Billets and Forgings
- (p) ASTM A449, Standard Specification for Quenched and Tempered Steel Bolts and Studs
- (q) ASTM A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
- (r) ASTM A500, Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- (s) ASTM A514, Standard Specification for High- Yield- Strength, Clenched and Tempered Alloy Steel Plate, Suitable for Welding
- (t) ASTM A516, Standard Specification for Pressure Vessel Plates, Carbon Steel, For Moderate and Low Temperature Service
- (u) ASTM A517, Standard Specification for Pressure Vessel Plates, Alloy Steel, High Strength, Quenched and Tempered
- (v) ASTM A615, Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement
- (w) ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- (x) ASTM B22, Standard Specification for Bronze Castings for Bridges and Turntables
- (y) ASTM B29, Standard Specification for Refined Lead

- (z) ASTM B100, Standard Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use
- (aa) ANSI B46.1, Surface Texture (Surface Roughness, Waviness, and Lay)
- (bb) AASHTO/AWS D1.5M/D1.5, Bridge Welding Code
- (cc) AWS D1.1, Structural Welding Code – Steel
- (dd) AWS D1.6, Structural Welding Code – Stainless Steel

#### E24.3 Submittals

- (a) The Contractor shall submit the following to the Contract Administrator:
  - (i) 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.
  - (ii) Certification of chemical analysis and physical tests for all materials.
  - (iii) 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.
  - (iv) Manufacturer's test reports of mechanical tests on high strength bolts, if requested by the Contract Administrator.

#### E24.4 Materials

##### E24.4.1 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.

##### E24.4.2 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.

##### E24.4.3 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.

##### E24.4.4 Zinc

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

##### E24.4.5 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



#### E24.4.6 Structural Inserts for Expansion 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 ASTM A123.

#### E24.5 Construction Methods for Fabrication

##### E24.5.1 General

- (a) 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.
- (b) The punching of identification marks on members will not be allowed unless authorized in writing by the Contract Administrator.
- (c) 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.
- (d) Dimensions and fabrication that control field matching of parts shall receive careful attention in order to avoid field adjustments.
- (e) 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.
- (f) Cutting shall be in accordance with AWS D1.1, D1.6 and CSA W59.

##### E24.5.2 Clean Material

- (a) 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.

##### E24.5.3 Finish

- (a) 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.

##### E24.5.4 Bending

- (a) 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.

##### E24.5.5 Holes

- (a) 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.
- (b) 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.

- (c) 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.
- (d) 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.
- (e) 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.

#### E24.5.6

#### Welding

- (a) Specifications
  - (i) 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.
- (b) Welding Operator Qualification
  - (i) 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.
  - (ii) 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.
  - (iii) 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.
  - (iv) The Contractor shall bear the whole cost and be fully responsible for the qualification of all welding operators.
- (c) Welding Procedures, Specifications and Qualification
  - (i) 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.
  - (ii) 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.
  - (iii) The Contract Administrator may accept previous qualifications of the welding procedure.
- (d) Welding Materials
  - (i) 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.
- (ii) 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.
  - (iii) 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.
  - (iv) 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.
  - (v) 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.
  - (vi) 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°C + 15°C before being used.
  - (vii) 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°C + 15°C before being used. Electrodes shall be dried prior to use if the hermetically sealed container shows evidence of damage.
  - (viii) 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°C.
  - (ix) 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.
  - (x) In humid atmospheres, these time limits will be reduced as directed by the Contract Administrator.
  - (xi) Electrodes that have been wet shall not be used. Electrodes shall be re-dried no more than once.
  - (xii) 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°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.

- (e) Preheat and Interpass Temperature
  - (i) The minimum preheat and interpass temperatures for welding miscellaneous metal shall conform to AWS D1.1, D1.6 and CSA W59.
- (f) Welding Processes
  - (i) 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.
- (g) Distortion and Shrinkage Stresses
  - (i) 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 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.
- (h) Tack Welding
  - (i) 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.

#### E24.5.7 Hot-Dip Galvanizing

- (a) Galvanizing, when called for on the Drawings, for items other than fasteners shall be done in accordance with ASTM A123. 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.

#### E24.5.8 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) 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.

#### E24.5.9 Erection

- (a) 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.
- (b) 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.

(c) 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 Contactor's expense will be final and binding.

(d) 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.

(e) 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.

E24.6 Quality Control / Quality Assurance

E24.6.1 Quality Control

- (a) 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.
- (b) 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.

E24.6.2 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.

E24.7 Measurement and Payment

- (a) 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.

## **E25. BRIDGE ALUMINUM BARRIER RAIL**

### **E25.1 Description**

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

### **E25.2 Scope of Work**

- (a) The Work under this Specification shall involve:
  - (i) Supply and installation of the bridge aluminum barrier rails and posts on the concrete traffic barriers.
  - (ii) Supply and installation of the anchors for the bridge aluminum barrier rails on the concrete traffic barriers.

### **E25.3 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 clearly show shapes, dimensions, detail, connection (including proper CSA welding identification), bolt holes, and accessories.

### **E25.4 Materials**

- (a) Rail posts for the aluminum barrier rail on the concrete traffic barriers shall be fabricated in accordance with the Drawings and E24 "Supply, Fabrication and Erection of Miscellaneous Metal".
- (b) The anchors for the aluminum barrier rail on the concrete traffic barriers shall be in accordance with the Drawings and E24 "Supply, Fabrication and Erection of Miscellaneous Metal".

### **E25.5 Measurement and Payment**

- (a) Supplying and installing the bridge aluminum barrier rail, posts and anchors will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Bridge Aluminum Barrier Rail", 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. RIPRAP**

### **E26.1 General**

- (a) Riprap shall be random stone riprap and supplied and installed in accordance with Specification CW 3615, except as specified herein.

### **E26.2 Materials**

#### **E26.2.1 Riprap**

- (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 riprap 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 riprap shall be well graded having a full range and even distribution of sizes and shall conform to the following gradation:
  - (i) 100% passing 350 mm
  - (ii) 50% passing 200 mm
  - (iii) 20% passing 100 mm
- (d) 30% by volume of granular will be blended with the stone riprap prior to placement in order to fill the interstitial voids within the rock.
- (e) The granular blended with the riprap shall be clean gravel or clean crushed rock with the following gradation
  - (i) 100% passing 19 mm
  - (ii) 50% passing 9 mm
  - (iii) 20% passing 3 mm

#### E26.2.2 Granular Bedding

- (a) The granular bedding for riprap shall be clean gravel or clean crushed rock with the following gradation:
  - (i) 100% passing 19 mm
  - (ii) 50% passing 9 mm
  - (iii) 20% passing 3 mm
- (b) Supply and placing the granular bedding shall be considered incidental to the Random Stone Riprap and Geotextile and no separate payment will be made.

#### E26.2.3 Geotextile

- (a) The geotextile shall be non-woven type, and supplied and placed in accordance with CW 3130-R4 for "Separation Geotextile Fabric".

#### E26.3 Construction Methods

- (a) Place the granular bedding on the subgrade.
- (b) Place the geotextile on the granular bedding.
- (c) Place the rock riprap carefully on the geotextile fabric so that it does not tear.

#### E26.4 Measurement and Payment

##### E26.4.1 Measurement

- (a) Supply and placement of riprap will be measured on a mass basis per tonne of blended riprap delivered and installed in accordance with these Specifications. The mass shall be obtained from the delivery tickets collected by the Contract Administrator.
- (b) No measurement of geotextile fabric or granular bedding will be made as these are considered incidental to the installation of riprap

##### E26.4.2 Payment

- (a) Supply and placement of riprap will be paid for at the Contract Unit Price for "Random Stone Riprap", 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.

### **E27. EROSION CONTROL BLANKET (ECB)**

#### E27.1 Description

- (a) This Specification covers the supply, installation, and maintenance of erosion control blanket to be installed around the perimeter of the stone rip rap and to the limits determined by the Contract Administrator.

## E27.2 Materials and Equipment

### 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 159 mm x 159 mm mesh and on the bottom side with a lightweight photodegradable polypropylene netting with a maximum 127 mm x 127 mm mesh. The blanket shall be sewn together on 381 mm centres (maximum) with degradable thread
- (c) ECB shall have the following properties:
  - (i) Matrix 70% Straw Fibre (0.19 kg/m<sup>2</sup>) and 30% Coconut Fibre (0.08 kg/ m<sup>2</sup>).
  - (ii) Netting top side heavyweight photodegradable with UV additives (1.47 kg/100 m<sup>2</sup>).
  - (iii) Bottom side lightweight photodegradable minimum netting weight (0.73 kg/100 m<sup>2</sup>).
  - (iv) Degradable thread.

### E27.3 Submittals

- (a) 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 fourteen (14) days before construction.

### E27.4 Construction Methods

- (a) 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.
- (b) Actual alignment and location of the ECB may be adjusted in the field by the Contract Administrator.

### E27.5 Maintenance

- (a) The areas covered with ECB shall be regularly inspected especially after severe rainfall or storm events, to check for blanket separation or breakage.
- (b) 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.
- (c) 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 five (5) working days of discovery unless precluded by legal, regulatory, or physical access restraints. If precluded, removal and restoration must take place within five (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



- (a) Supplying and placing Erosion Control Blanket will be measured on a square metre basis. The area to be measured shall be the total number of square metres of Erosion Control Blanket supplied and placed in accordance with this Specification, acceptable to the Contract Administrator, as computed from the Drawing dimensions. This item of Work will be paid for at the Contract Unit Price per square metre for "Supply and Install Erosion Control Blanket" performed in accordance with this Specification and accepted by the Contract Administrator.

## **E28. SUPPLY AND INSTALLATION OF GABIONS**

### **E28.1 Description**

- (a) This Specification shall cover the supply of all material, labour, plant, and equipment required to furnish, assemble, and fill woven wire mesh gabions and gabion mats with rock as specified in the Contract to the dimensions, lines and grades shown on the Drawings.

### **E28.2 Materials**

#### **E28.2.1 Gabion Crushed Limestone Base**

- (a) Base course material for the gabion base shall be a well graded crushed limestone conforming to CW 3110-R17 amended as follows:
  - (i) Crushed limestone when subjected to the Los Angeles abrasion test shall have a loss of not more than thirty-two percent (32%).
  - (ii) Crushed limestone when subjected to the Magnesium Sulphate Soundness test shall have a loss of not more than thirteen percent (13%).
- (b) The sample material shall be crushed to 37.5 mm maximum aggregate size and tested in accordance with ASTM C131 - Resistance to Degradation of Small Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine and ASTM C88 - Soundness of Aggregates by Use of Magnesium Sulphate.
- (a) Supply and installation of crushed limestone base will be considered incidental to Supply and Installation of Gabions, and no separate payment will be made.

#### **E28.2.2 Gabions**

- (a) Wire Mesh
  - (i) The wire for wire mesh, selvage wire, lacing wire, and internal connections shall be galvanized wire, soft temper, Class 3 coating, according to ASTM A 641. The wire diameter shall be according to Table 4. The tensile strength of the wire shall be according to ASTM A 641 as tested according to ASTM A 370. Galvanizing on the wire shall meet the requirements of Table 4 as tested according to ASTM A 90M.
- (b) PVC Coating
  - (i) PVC coating shall be according to ASTM A 975 and shall have a minimum thickness of 0.38 mm with a nominal thickness of 0.50 mm. Prior to UV and abrasion degradation, the PVC polymer coating shall have a projected durability life of 60 years as tested according to UL 746B.
- (c) Fasteners
  - (i) Fasteners shall be fabricated such that when the ends of the fastener are brought together and properly locked, the fastener forms a closed loop. The inside area of the closed loop shall be at least 325 mm<sup>2</sup> to enclose up to four selvage wires.
  - (ii) Locked fasteners shall be able to resist a minimum direct force across any axis of 3 kN while remaining closed and locked.
- (d) Stainless Steel Rings

- (i) Stainless steel rings shall be manufactured from 3 mm diameter stainless steel spring wire Type 302, Class 1, according to ASTM A 313M.

(e) Interlocking Wire Fasteners

- (i) Interlocking fasteners shall be manufactured from 3 mm diameter steel mechanical spring wire Class 1, Finish 2, Type B, Tensile Class 2, according to ASTM A 764.

E28.2.3

Gabion Production

(a) General

- (i) Gabion baskets and gabion mats shall be manufactured so that the sides, ends, lid, base, and diaphragms can be readily assembled into rectangular units.
- (ii) Where the length of the gabion basket exceeds its horizontal width, the gabion basket shall be divided into equal cells by diaphragms. Cell length shall not exceed its horizontal width. Diaphragms shall be made of wire mesh and shall be secured in the proper position on the base section. Gabion mats shall have diaphragms spaced at 1.0 m across the width of the mat and 3.0 m along the length of the mat.
- (iii) Gabion baskets or gabion mats shall be manufactured with all components connected at the production facility with the exception of the gabion mat lid. Gabion baskets manufactured from galvanized wire mesh shall be assembled using either lacing wire or fasteners. Gabion baskets and gabion mats manufactured from PVC coated galvanized wire mesh shall be assembled using stainless steel ring fasteners. Fasteners shall be installed at a maximum spacing of 150 mm with at least one fastener per gabion mesh opening.

(b) Dimensions and Tolerances

- (i) Gabion baskets and gabion mats shall be produced to the sizes and dimensions shown in Tables 1 and 2. All dimensions are subject to a tolerance limit of  $\pm 5\%$ , except depth dimensions, which are subject to tolerance limit of  $\pm 5\%$  for gabion baskets and  $\pm 10\%$  for gabion mats.

(c) Packaging and Marking

- (i) Each gabion basket and gabion mat shall be clearly colour coded according to Tables 1 and 2 or otherwise suitably identified to indicate its size.
- (ii) Gabion baskets shall be shipped folded flat in bundles. Each bundle shall contain an equal number of one size of gabion baskets, except as necessary to complete an order. Each bundle shall be clearly marked to show the size and number of baskets it contains. The maximum weight of one bundle shall be 850 kg.
- (iii) Gabion mats shall be shipped in rolls with ends, sides, and dividers attached to the base. The gabion mat lid and base units are to be shipped unattached, but rolled together as one. The maximum weight of one roll shall be 850 kg.

**TABLE 1**

**Gabion Basket Sizes and Dimensions**

Size Number	Number of Diaphragms	Approximate Dimensions and Volumes				Colour Code
		Length m	Width m	Depth m	Capacity m <sup>3</sup>	
1	1	2.00	1.00	0.30	0.60	Blue/Red
2	1	2.00	1.00	0.50	1.00	Red
3	1	2.00	1.00	1.00	2.00	Blue
4	2	3.00	1.00	0.30	0.90	Blue/Yellow
5	2	3.00	1.00	0.50	1.50	Green
6	2	3.00	1.00	1.00	3.00	White
7	3	4.00	1.00	0.30	1.20	Blue/Green
8	3	4.00	1.00	0.50	2.00	Yellow
9	3	4.00	1.00	1.00	4.00	Black
10	1	2.00	0.50	0.50	0.50	White/Yellow
11	2	3.00	0.50	0.50	0.75	White/Green

**TABLE 2**

**Gabion Mat Sizes and Dimensions**

Size Number	Number of Dividers	Number of Diaphragms	Approximate Dimensions and Areas				Colour Code
			Length m	Width m	Depth m	Area m <sup>2</sup>	
12	1	18	30	2	0.23	60	Black/Green
13	2	27	30	3	0.23	90	Black/Yellow
14	1	18	30	2	0.30	60	Black/Blue
15	2	27	30	3	0.30	90	Black/White

**TABLE 3**  
**Minimum Strength Requirements of Mesh and Connections**

Test Description	Galvanized Gabion Basket	PVC Coated	
		Gabion Basket	Gabion Mat
Parallel to Twist	51.1 kN/m	42.3 kN/m	33.6 kN/m
Perpendicular to Twist	26.3 kN/m	20.4 kN/m	13.1 kN/m
Connection to Selvages	20.4 kN/m	17.5 kN/m	10.2 kN/m
Panel to Panel Connection Using Lacing Wire or Fasteners	20.4 kN/m	17.5 kN/m	10.2 kN/m
Punch Test	26.7 kN	23.5 kN	17.8 kN

**TABLE 4**  
**Gabion Baskets and Gabion Mats**

	Galvanized Gabion Basket	PVC Coated	
		Gabion Basket	Gabion Mat
Mesh Type	80 x 100 mm	80 x 100 mm	80 x 100 mm
Mesh Opening	83 x 114 mm	83 x 114 mm	83 x 114 mm
Wire Diameter for Mesh	2.95 mm	2.70 mm	2.20 mm
Wire Diameter for Selvages and Corners	3.85 mm	3.40 mm	2.65 mm
Wire Diameter for Lacing and Internal Connections	2.20 mm	2.20 mm	2.20 mm
Galvanizing for Mesh Wire	244 g/m <sup>2</sup> min	244 g/m <sup>2</sup> min	213 g/m <sup>2</sup> min
Galvanizing for Selvage Wire	274 g/m <sup>2</sup> min	260 g/m <sup>2</sup> min	244 g/m <sup>2</sup> min
Galvanizing for Lacing Wire	213 g/m <sup>2</sup> min	213 g/m <sup>2</sup> min	213 g/m <sup>2</sup> min

E28.3.1 Stone fill:

- (a) Hard, durable, and abrasion resistant such that it will not disintegrate from action of wetting and drying, wave action, freezing and thawing cycles
- (b) Minimum 100 mm to maximum 200 mm dimension for individual stones.
- (c) The Contractor shall submit samples of the stone fill for approval by the Contract Administrator.

#### E28.3.2 Geotextile

- (a) Geotextile shall be Separation/Reinforcement Geotextile Fabric in accordance with CW 3130-R4.
- (b) Supply and installation of geotextile fabric will be considered incidental to Supply and Installation of Gabions, and no separate payment will be made.

#### E28.4 Construction Methods

- (a) This specification shall provide a general summary of assembly and installation procedures for PVC coated gabions. The Contractor shall reference the construction drawings as well as the manufacturer's product installation manual(s) for further details on proper gabion assembly and installation.

##### E28.4.1 Site Preparation

- (a) Prior to assembly and installation of the gabions, the following base preparation shall be completed:
  - (i) Compact subgrade conforming to CW 3110-R17.
  - (ii) Install and compact the base course material conforming to CW 3110-R17.

##### E28.4.2 Assembly of Gabions

- (a) Gabions shall be installed in the locations and to the line, grade, and dimensions specified in the Contract Documents.
- (b) Gabions shall be assembled according to the manufacturer's instructions and as specified in the Contract Documents.
- (c) Gabions shall be assembled so that wire ends do not project outside the units on any exposed surface.
- (d) Gabion stones shall be placed in a manner as not to damage the wire mesh or the PVC coating on the wire or cause deformation of the gabion. Gabion stones shall be placed to minimize the voids between the stones. When specified in the Contract Documents, the front face of exposed wall surfaces shall be hand placed gabion stone to ensure a uniform appearance.
- (e) Prior to securing the lids on the gabion baskets, the gabion basket shall be slightly overfilled by 25 to 50 mm of gabion stone in order to allow for settlement of the stone within the units.

##### E28.4.3 Placing of Internal Connecting Wires

- (a) Internal connecting wires shall be installed according to the manufacturer's recommendations. Where gabions are used as a channelling revetment, internal connecting wires are not necessary.

##### E28.4.4 Securing Lids

- (a) When the gabion has been filled, the gabion lid shall be bent over until all lid edges coincide with the front and side edges of the gabion and shall be secured to the front and sides by wire according to manufacturer's instructions.

##### E28.4.5 Geotextile

- (a) Geotextile shall be placed uniformly, free of tears, in accordance with CW 3130-R4 and to the limits shown on the Drawings. Geotextile shall be fixed to prevent movement during installation.

#### E28.5 Method of Measurement and Basis of Payment

- (a) The supply and installation of all crushed limestone base, geotextile, gabion baskets and stone fill as shown on the Drawings will not be measured and paid for at the Contract Lump Sum Price for the "Supply and Installation of Gabions" which price shall be payment in full for supplying all materials and 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. CHAIN LINK FENCE**

E29.1 Further to CW 3550 – Chain Link Fencing

- (a) The chain link fencing shall be installed adjacent to the gabion basket wall as detailed on the Plans. All work and materials associated with installing the chain link fencing as shown on the Plans shall be considered incidental to the Contract Unit Price for Chain Link Fence 1.22 m Height.

**E30. TEMPORARY ASPHALT PAVING**

E30.1 Description

- (a) This Specification shall cover supply, placing, maintenance and removal of a temporary asphalt paving surface.
- (b) The temporary asphalt paving surface will be installed at the end of the winter stage of construction (i.e. Stage 1) prior to re-opening the bridge to vehicular and pedestrian traffic.
- (c) The temporary asphalt paving shall transition vehicular and pedestrian traffic between the existing road or sidewalk surface to the roadway transition slab and reinforced sidewalk surfaces cast during Stage 1.
- (d) The temporary asphalt paving shall be provided after the end of Stage 1, and until such a time that the final road and sidewalk surfaces are established during Stage 2 of construction.

E30.2 Materials and Production

- (a) The Contractor shall supply and deliver cold mix asphalt in accordance with the requirements hereinafter specified.
- (b) The following products are the only approved products that shall be used in the production of cold mix asphalt:

<b>Modified cut-back asphalts</b>	<b>Known Suppliers</b>
QPR 2000	QPR (Mississauga, ON)
I.A.R. Liquid	Innovative Building Products (Ajax, ON)
Perma Patch	McAsphalt Ind. (Winnipeg, MB)
Matrex Permanent Cold Patch	Matrex Company (Locust Hill, ON)
EZ Street Cold Asphalt	The EZ Street Company (Miami, FL).

E30.2.1 Aggregates

- (a) Cold Mix Modified Cutbacks:
- (b) The aggregates to be used for cold mix modified cutback shall be crushed limestone meeting the following gradation requirements prior to the introduction of the modified cutback asphalt.

<b>Metric Sieve</b>	<b>% Dry Weight Passing</b>
10,000	100
5,000	50-70
2,500	5-25
1,250	4-10
315	0-6

80	0-4
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- (c) The limestone when subjected to the abrasion test shall have a loss of not more than thirty (30%) percent. The method of testing shall be in accordance with American Society for Testing and Materials - ASTM Standard C131, Test for Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.
- (d) The limestone retained on the No. 5000 sieve shall contain not less than one hundred (100%) percent crushed aggregate as determined by actual particle count. Crushed aggregate shall be considered as that aggregate having at least two freshly fractured faces.

E30.2.2 The cold mix asphalt shall consist of aggregates (as described in this specification) and a minimum 5.0% modified cutback asphalt, by weight of total mix at time of mixing.

E30.2.3 Mixing temperature of mix shall be in accordance with the Modified Cutback Manufacturer's recommendations.

E30.2.4 The Contractor must ensure thorough coating of all aggregate with asphalt at time of mixing. Should any cold mix delivered by the Contractor not be thoroughly coated with oil to the satisfaction of the Contract Administrator, the load may be rejected and no payment made for same. The Contract Administrator's decision of thoroughness of coating shall be final.

### E30.3 Equipment for Temporary Asphalt Paving

- (a) Equipment shall be a type approved by the Contract Administrator, capable of compacting cold-mix asphalt to provide a smooth transition between existing and new pavement surfaces.

### E30.4 Construction Methods

#### E30.4.1 Supply and Place

- (a) The Contractor will be responsible for supplying and placing the temporary asphalt pavement in accordance with the Drawings and to the satisfaction of the Contract Administrator.

#### E30.4.2 Maintenance

- (a) The Contractor will be responsible for maintaining the temporary asphalt pavement in good working order to the satisfaction of the Contract Administrator. Cold-mix asphalt required for maintenance works will be supplied by the City of Winnipeg as described in this Specification.

#### E30.4.3 Removal

- (a) When the temporary asphalt paving is no longer required, the Contractor shall remove and dispose all temporary asphalt paving.

### E30.5 Measurement and Payment

- (a) The supplying, placing, maintenance and removal of temporary asphalt paving will not be measured and paid at the Contract Lump Sum Price for "Temporary Asphalt Paving" which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E31. SALT TOLERANT GRASS SEEDING

### E31.1 Description

- (a) Further to CW 3520 and CW3540, this specification shall cover sub-grade preparation and the supply and placement of Salt Tolerant Grass Seed with or without hydro mulch.
- (b) Hydro mulch shall be applied with seeding in the following areas:
  - (i) surfaces steeper than 6:1 slope, and
  - (ii) areas directed by the Contract Administrator

## E31.2 Materials

### E31.2.1 Salt Tolerant Grass Seed

- (a) Salt Tolerant Grass Seed for regional and collector boulevards, medians and interchange areas shall be a mixture composed of:
  - (i) Seventy percent (70%) Fulfs or Nuttals Alkaligrass (*Puccinellia* spp.), twenty percent (20%) Audubon or Aberdeen Creeping Red Fescue and ten percent (10%) Perennial Ryegrass.

### E31.2.2 Hydro Mulch

- (a) As per CW 3520 Clause 5.6.

## E31.3 Equipment

- (a) 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.

## E31.4 Construction Methods

### E31.4.1 Preparation of Existing Grade

- (a) Prior to placing topsoil, in areas to be seeded greater in width than 600 mm, prepare the existing sub-grade by scarifying to a minimum depth of 75 mm and to a maximum depth of 100 mm 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).

### E31.4.2 Salt Tolerant Grass Seeding

- (a) Salt Tolerant Grass Seed shall be sown at a rate of 2.2 kg per 100 m<sup>2</sup>.

### E31.4.3 Hydro Mulch

- (a) As per CW 3520 Clause 9.5 and 9.6.

## E31.5 Measurement and Payment

E31.5.1 Supply, placement and maintenance of Salt Tolerant Grass Seed will be paid for at the Contract Unit Price per square metre for "Salt Tolerant Grass Seeding", measured as specified herein, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification. Payment for Salt Tolerant Grass Seed shall be in accordance with the following:

- (a) Sixty five (65%) percent of quantity following supply and placement.
- (b) Remaining thirty five (35%) percent of quantity following termination of the Maintenance Period.

E31.5.2 Supply, placement and maintenance of Salt Tolerant Grass Seed with Hydro Mulch will be paid for at the Contract Unit Price per square metre for "Salt Tolerant Grass Seed with Hydro Mulch", measured as specified herein, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification. Payment for Salt Tolerant Grass Seed with Hydro Mulch shall be in accordance with the following:



- (a) Sixty five (65%) percent of quantity following supply and placement.
- (b) Remaining thirty five (35%) percent of quantity following termination of the Maintenance Period.

**E32. MATCHING EXISTING GRADES**

E32.1 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.

**E33. SITE CLEAN UP**

E33.1 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.

E33.2 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.

E33.3 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.

E33.4 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.