



**THE CITY OF WINNIPEG**

# **TENDER**

**TENDER NO. 810-2020**

**NAIRN AVENUE OVERPASS DECK REHABILITATION**

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## **PART B - BIDDING PROCEDURES**

### **B1. CONTRACT TITLE**

B1.1 NAIRN AVENUE OVERPASS DECK REHABILITATION

### **B2. SUBMISSION DEADLINE**

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, March 10, 2021.

B2.2 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. ENQUIRIES**

B3.1 All enquiries shall be directed to the Contract Administrator identified in D5.1.

B3.2 If the Bidder finds errors, discrepancies or omissions in the Tender, 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.

B3.3 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Tender will be provided by the Contract Administrator to all Bidders by issuing an addendum.

B3.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Tender will be provided by the Contract Administrator only to the Bidder who made the enquiry.

B3.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B3 unless that response or interpretation is provided by the Contract Administrator in writing.

B3.6 Any enquiries concerning submitting through MERX should be addressed to:  
MERX Customer Support  
Phone: 1-800-964-6379  
Email: merx@merx.com

### **B4. CONFIDENTIALITY**

B4.1 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.

B4.2 The Bidder shall not make any statement of fact or opinion regarding any aspect of the Tender to the media or any member of the public without the prior written authorization of the Contract Administrator.

### **B5. ADDENDA**

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

- B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.
- B5.3 Addenda will be available on the MERX website at [www.merx.com](http://www.merx.com).
- B5.4 The Bidder is responsible for ensuring that he/she has received all addenda and is advised to check the MERX website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.
- B5.5 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid/Proposal. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.
- B5.6 Notwithstanding B3, enquiries related to an Addendum may be directed to the Contract Administrator indicated in D5.

## **B6. SUBSTITUTES**

- B6.1 The Work is based on the Plant, Materials and methods specified in the Tender.
- B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.
- B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.
- B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:
- (a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;
  - (b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;
  - (c) identify any anticipated cost or time savings that may be associated with the substitute;
  - (d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;
  - (e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.
- B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his/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.
- B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, to the Bidder who requested approval of the substitute.
- B6.6.1 The Contract Administrator will issue an Addendum, disclosing the approved materials, equipment, methods and products to all potential Bidders. The Bidder requesting and obtaining the approval of a substitute shall be responsible for disseminating information regarding the approval to any person or persons he/she wishes to inform.

- B6.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.
- B6.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base his/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 B17.
- B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

## **B7. BID COMPONENTS**

- B7.1 The Bid shall consist of the following components:
- (a) Form A: Bid/Proposal;
  - (b) Form B: Prices;
  - (c) Form G1: Bid Bond and Agreement to Bond.
- B7.2 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.
- B7.3 The Bid shall be submitted electronically through MERX at [www.merx.com](http://www.merx.com).
- B7.3.1 Bids will **only** be accepted electronically through MERX.
- B7.4 Bidders are advised that inclusion of terms and conditions inconsistent with the Tender document, including the General Conditions, will be evaluated in accordance with B17.1(a).

## **B8. BID**

- B8.1 The Bidder shall complete Form A: Bid/Proposal, making all required entries.
- B8.2 Paragraph 2 of Form A: Bid/Proposal 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.
- B8.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B8.2.
- B8.3 In Paragraph 3 of Form A: Bid/Proposal, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.
- B8.4 Paragraph 13 of Form A: Bid/Proposal 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;

- (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.

B8.4.1 The name and official capacity of all individuals signing Form A: Bid/Proposal should be entered below such signatures.

B8.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid and the Contract, when awarded, shall be both joint and several.

## **B9. PRICES**

B9.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

B9.1.1 Prices stated on Form B: Prices shall not include any costs which may be incurred by the Contractor with respect to any applicable funding agreement obligations as outlined in D27. Any such costs shall be determined in accordance with D27.

B9.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.

B9.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.

B9.4 Payments to Non-Resident Contractors are subject to Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).

B9.5 The Bidder shall enter the Total Bid Price from Form B: Prices into the Total Bid Price field in MERX.

B9.5.1 Bidders are advised that the calculation indicated in B17.4 will prevail over the Total Bid Price entered in MERX.

## **B10. DISCLOSURE**

B10.1 Various Persons provided information or services with respect to this Work. In the City's opinion, this relationship or association does not create a conflict of interest because of this full disclosure. Where applicable, additional material available as a result of contact with these Persons is listed below.

B10.2 The Persons are:

- (a) N/A

## **B11. CONFLICT OF INTEREST AND GOOD FAITH**

B11.1 Further to C3.2, Bidders, by responding to this Tender, declare that no Conflict of Interest currently exists, or is reasonably expected to exist in the future.

B11.2 Conflict of Interest means any situation or circumstance where a Bidder or employee of the Bidder proposed for the Work has:

- (a) other commitments;
- (b) relationships;
- (c) financial interests; or
- (d) involvement in ongoing litigation;

that could or would be seen to:

- (i) exercise an improper influence over the objective, unbiased and impartial exercise of the independent judgment of the City with respect to the evaluation of Bids or award of the Contract; or
- (ii) compromise, impair or be incompatible with the effective performance of a Bidder's obligations under the Contract;
- (e) has contractual or other obligations to the City that could or would be seen to have been compromised or impaired as a result of its participation in the Tender process or the Work; or
- (f) has knowledge of confidential information (other than confidential information disclosed by the City in the normal course of the Tender process) of strategic and/or material relevance to the Tender process or to the Work that is not available to other bidders and that could or would be seen to give that Bidder an unfair competitive advantage.

B11.3 In connection with its Bid, each entity identified in B11.2 shall:

- (a) avoid any perceived, potential or actual Conflict of Interest in relation to the procurement process and the Work;
- (b) upon discovering any perceived, potential or actual Conflict of Interest at any time during the Tender process, promptly disclose a detailed description of the Conflict of Interest to the City in a written statement to the Contract Administrator; and
- (c) provide the City with the proposed means to avoid or mitigate, to the greatest extent practicable, any perceived, potential or actual Conflict of Interest and shall submit any additional information to the City that the City considers necessary to properly assess the perceived, potential or actual Conflict of Interest.

B11.4 Without limiting B11.3, the City may, in its sole discretion, waive any and all perceived, potential or actual Conflicts of Interest. The City's waiver may be based upon such terms and conditions as the City, in its sole discretion, requires to satisfy itself that the Conflict of Interest has been appropriately avoided or mitigated, including requiring the Bidder to put into place such policies, procedures, measures and other safeguards as may be required by and be acceptable to the City, in its sole discretion, to avoid or mitigate the impact of such Conflict of Interest.

B11.5 Without limiting B11.3, and in addition to all contractual or other rights or rights at law or in equity or legislation that may be available to the City, the City may, in its sole discretion:

- (a) disqualify a Bidder that fails to disclose a perceived, potential or actual Conflict of Interest of the Bidder or any of its employees proposed for the Work;
- (b) require the removal or replacement of any employees proposed for the Work that has a perceived, actual or potential Conflict of Interest that the City, in its sole discretion, determines cannot be avoided or mitigated;
- (c) disqualify a Bidder or employees proposed for the Work that fails to comply with any requirements prescribed by the City pursuant to B11.4 to avoid or mitigate a Conflict of Interest; and
- (d) disqualify a Bidder if the Bidder, or one of its employees proposed for the Work, has a perceived, potential or actual Conflict of Interest that, in the City's sole discretion, cannot be avoided or mitigated, or otherwise resolved.

B11.6 The final determination of whether a perceived, potential or actual Conflict of Interest exists shall be made by the City, in its sole discretion.

## **B12. QUALIFICATION**

B12.1 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.

B12.2 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 <https://www.winnipeg.ca/matmgt/Templates/files/debar.pdf>

B12.3 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);

B12.4 Further to B12.3(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) Written confirmation of a safety and health certification meeting SAFE Work Manitoba's SAFE Work Certified Standard (e.g., COR™ and SECOR™) in the form of:
  - (i) a copy of their valid Manitoba COR certificate and Letter of Good Standing (or Manitoba equivalency) as issued 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
  - (ii) a copy of their valid Manitoba SECOR™ certificate and Letter of Good Standing (or Manitoba equivalency) as issued under the Small Employer Certificate of Recognition Program (SECOR™) 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/>).

B12.5 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.

B12.6 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.

### **B13. BID SECURITY**

B13.1 The Bidder shall include in its Bid Submission bid security in the form of a digital bid bond, in the amount of at least ten percent (10%) of the Total Bid Price, and agreement to bond of a company registered to conduct the business of a surety in Manitoba, in Form G1: Bid Bond and Agreement to Bond, available on The City of Winnipeg, Corporate Finance, Materials Management Division website at <https://www.winnipeg.ca/MatMgt/templates/files/eBidsecurity.pdf>.

B13.2 Bid security shall be submitted in a digital format meeting the following criteria:

- (a) The version submitted by the Bidder must have valid digital signatures and seals;
- (b) The version submitted by the Bidder must be verifiable by the City with respect to the totality and wholeness of the bond form, including: the content; all digital signatures and digital seals; with the surety company, or an approved verification service provider of the surety company.
- (c) The version submitted must be viewable, printable and storable in standard electronic file formats compatible with the City, and in a single file. Allowable formats include pdf.
- (d) The verification may be conducted by the City immediately or at any time during the life of the bond and at the discretion of the City with no requirement for passwords or fees.
- (e) The results of the verification must provide a clear, immediate and printable indication of pass or fail regarding B13.2(b).

B13.3 Bonds failing the verification process will not be considered to be valid and the bid shall be determined to be non-responsive in accordance with B17.1(a).

B13.4 Bonds passing the verification process will be treated as original and authentic.

B13.4.1 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.

B13.5 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 formed with the successful Bidder and the contract securities are furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

B13.6 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 Tender.

#### **B14. OPENING OF BIDS AND RELEASE OF INFORMATION**

B14.1 Bids will not be opened publicly.

B14.2 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 MERX website at [www.merx.com](http://www.merx.com).

B14.3 After award of Contract, the name(s) of the successful Bidder(s) and their Contract amount(s) will be available on the MERX website at [www.merx.com](http://www.merx.com).

B14.4 The Bidder is advised that any information contained in any Bid may be released if required by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law or by City policy or procedures (which may include access by members of City Council).

B14.4.1 To the extent permitted, the City shall treat as confidential information, those aspects of a Bid Submission identified by the Bidder as such in accordance with and by reference to Part 2, Section 17 or Section 18 or Section 26 of The Freedom of Information and Protection of Privacy Act (Manitoba), as amended.

#### **B15. IRREVOCABLE BID**

B15.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid/Proposal.

B15.2 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 formed and the contract securities have been

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/Proposal.

**B16. WITHDRAWAL OF BIDS**

B16.1 A Bidder may withdraw his/her Bid without penalty at any time prior to the Submission Deadline.

**B17. EVALUATION OF BIDS**

B17.1 Award of the Contract shall be based on the following bid evaluation criteria:

- (a) compliance by the Bidder with the requirements of the Tender, or acceptable deviation there from (pass/fail);
- (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B12 (pass/fail);
- (c) Total Bid Price;
- (d) economic analysis of any approved alternative pursuant to B6.

B17.2 Further to B17.1(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.

B17.3 Further to B17.1(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 qualified.

B17.4 Further to B17.1(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.

B17.4.1 Further to B17.1(a), in the event that a unit price is not provided on Form B: Prices, the City may determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

B17.4.2 Bidders are advised that the calculation indicated in B17.4 will prevail over the Total Bid Price entered in MERX.

**B18. AWARD OF CONTRACT**

B18.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B18.2 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 qualified, and the Bids are determined to be responsive.

B18.2.1 Without limiting the generality of B18.2, 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.

B18.3 If funding for the Work is provided to the City of Winnipeg by the Government of Manitoba and/or the Government of Canada, Bidders are advised that the terms of D27 shall immediately take effect upon confirmation of such funding, regardless of when funding is confirmed.

- B18.4 Where an award of Contract is made by the City, the award shall be made to the qualified Bidder submitting the lowest evaluated responsive Bid, in accordance with B17.
- B18.4.1 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.

## **PART C - GENERAL CONDITIONS**

### **C0. GENERAL CONDITIONS**

- C0.1 The *General Conditions for Construction* (Revision 2020 01 31) 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 Tender 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. FORM OF CONTRACT DOCUMENTS

D2.1 Notwithstanding C4.1(c) and C4.4, the Contract Documents will be provided to the Contractor electronically and there will be no requirement for execution and return to the City by the Contractor. Accordingly, the provisions under C4.4(a) and C4.4(b) are no longer applicable.

#### D3. SCOPE OF WORK

D3.1 The Work to be done under the Contract shall consist of a bridge deck rehabilitation of Nairn Avenue Overpass over CPR Lac du Bonnet subdivision.

D3.2 The major components of the Work are as follows:

- (a) Construction of 100 mm concrete sidewalk north of the overpass;
- (b) Construct temporary asphalt median crossovers;
- (c) Diamond grinding of the bridge deck;
- (d) Bridge deck concrete repairs;
- (e) Supply and placement of stainless steel reinforcing;
- (f) Zinc Anode supply and installation;
- (g) Supply and installation of pier expansion joints;
- (h) Supply and placement of structural concrete;
- (i) Bridge deck drain modifications;
- (j) Waterproofing and asphalt overlay of the bridge deck;
- (k) Healer-sealer application on sidewalk and approach slabs;
- (l) Remove temporary asphalt median crossover; and
- (m) Construct monolithic concrete median slab.

#### D4. DEFINITIONS

D4.1 When used in this Tender:

- (a) "**Diamond Grinding**" means the process of using gang-mounted saw blades to remove a thin layer of existing concrete as part of the process for roadway repair works.

#### D5. CONTRACT ADMINISTRATOR

D5.1 The Contract Administrator is Morrison Hershfield Limited, represented by:

Bill Ebenspanger, P.Eng.  
Senior Bridge Engineer

Telephone No. 204-977-8370

Email Address [bebenspanger@morrisonhershfield.com](mailto:bebenspanger@morrisonhershfield.com)

D5.2 At the pre-construction meeting, Bill Ebenspanger will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

## **D6. CONTRACTOR'S SUPERVISOR**

- D6.1 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.

## **D7. NOTICES**

- D7.1 Except as provided for in C22.4, 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/Proposal.
- 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 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator identified in D5.
- D7.3 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 'issued for construction' Contract Documents electronically, including Drawings in PDF format only.

## **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 Documents, if applicable.
- 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>
- D10.3 Notwithstanding B12.4 at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated COR Certificate or Annual Letter of good Standing. A Contractor, who fails to provide a satisfactory COR Certificate or Annual Letter of good Standing, will not be permitted to continue to perform any Work.

## **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 two million dollars (\$2,000,000.00) 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 and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;
- (b) 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) all risks course of construction insurance in the amount of one hundred percent (100%) of the total Contract Price, written in the name of the Contractor and The City of Winnipeg, at all times during the performance of the Work and until the date of Total Performance.
- (d) Property insurance for the field office, contractor's equipment, portable toilets and any other property left on Site.

D11.2 The Contractor shall ensure that any sub-contractors hired in connection with the works provide comparable insurances to that as outlined in D11.1(a) and D11.1(b).

D11.3 Deductibles shall be borne by the Contractor.

D11.4 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 Documents, as applicable.

D11.5 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. CONTRACT SECURITY**

D12.1 The Contractor shall provide and maintain the performance bond and the labour and material payment bond 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; and
- (b) a labour and material payment bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H2: Labour and Material Payment Bond), in an amount equal to fifty percent (50%) of the Contract Price.

D12.1.1 Where the contract security is a performance bond, it may be submitted in hard copy or digital format. If submitted in digital format the contract security must meet the following criteria:

- (a) the version submitted by the Contractor must have valid digital signatures and seals;
- (b) the version submitted by the Contractor must be verifiable by the City with respect to the totality and wholeness of the bond form, including: the content; all digital signatures and digital seals; with the surety company, or an approved verification service provider of the surety company.
- (c) the version submitted must be viewable, printable and storable in standard electronic file formats compatible with the City, and in a single file. Allowable formats include pdf.



- (d) the verification may be conducted by the City immediately or at any time during the life of the bond and at the discretion of the City with no requirement for passwords or fees.
- (e) the results of the verification must provide a clear, immediate and printable indication of pass or fail regarding D12.1(b).

D12.1.2 Digital bonds failing the verification process will not be considered to be valid and may be determined to be an event of default in accordance with C18.1. If a digital bond fails the verification process, the Contractor may provide a replacement bond (in hard copy or digital format) within seven (7) Calendar Days of the City's request or within such greater period of time as the City in its discretion, exercised reasonably, allows.

D12.1.3 Digital bonds passing the verification process will be treated as original and authentic.

D12.2 The Contractor shall provide the City Solicitor with the required performance and labour and material payment bonds within seven (7) Calendar Days of notification of the award of the Contract by way of an award letter 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 Documents, if applicable.

D12.3 The Contractor shall, as soon as practicable after entering into a contract with a Subcontractor:

- (a) give the Subcontractor written notice of the existence of the labour and material payment bond in D12.1(b); and
- (b) post a notice of the bond and/or a copy of that bond in a conspicuous location at the Site of the Work.

### **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 C4.1 for the return of the executed Contract Documents, if applicable.

### **D14. EQUIPMENT LIST**

D14.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment List) at 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 C4.1 for the return of the executed Contract Documents, if applicable.

### **D15. DETAILED WORK SCHEDULE**

D15.1 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 C4.1 for the return of the executed Contract Documents if applicable.

D15.2 The detailed work schedule shall consist of the following:

- (a) a Gantt chart for the Work acceptable to the Contract Administrator.

D15.3 Further to D15.2(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.

## **SCHEDULE OF WORK**

### **D16. COMMENCEMENT**

- D16.1 The Contractor shall not commence any Work until he/she is in receipt of an award letter from the Award Authority authorizing the commencement of the Work.
- D16.2 The Contractor shall not commence any Work on the Site until:
- (a) the Contract Administrator has confirmed receipt and approval of:
    - (i) evidence of authority to carry on business specified in 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 contract security specified in D12;
    - (vi) the Subcontractor list specified in D13;
    - (vii) the equipment list specified in D14; and
    - (viii) the detailed work schedule specified in D15.
  - (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.
- D16.3 The Contractor shall not commence the Work on the Site before June 1, 2021.
- D16.4 The City intends to award this Contract by April 2, 2021.
- D16.4.1 If the actual date of award is later than the intended date, the dates specified for Commencement, Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

### **D17. SUBSTANTIAL PERFORMANCE**

- D17.1 The Contractor shall achieve Substantial Performance by September 3, 2021.
- D17.2 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.
- D17.3 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.

### **D18. TOTAL PERFORMANCE**

- D18.1 The Contractor shall achieve Total Performance by September 17, 2021.
- D18.2 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.
- D18.3 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.

## **D19. LIQUIDATED DAMAGES**

- D19.1 If the Contractor fails to achieve Substantial Performance in accordance with the Contract by the day fixed herein for Substantial Performance, the Contractor shall pay the City one thousand dollars (\$1,000) per Calendar Day for each and every Calendar Day following the day fixed herein for Substantial Performance during which such failure continues.
- D19.2 The amount specified for liquidated damages in D19.1 is based on a genuine pre-estimate of the City's damages in the event that the Contractor does not achieve Substantial Performance by the day fixed herein for same.
- D19.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

## **D20. COVID-19 SCHEDULE DELAYS**

- D20.1 The City acknowledges that the schedule for this Contract may be impacted by the COVID-19 pandemic. Commencement and progress of the Work shall be performed by the Contractor with due consideration to the health and safety of workers and the public, directives from health authorities and various levels of government and in close consultation with the Contract Administrator.
- D20.2 If the Contractor is delayed in the performance of the Work by reason of the COVID-19 pandemic, the Work schedule may be adjusted by a period of time equal to the time lost due to such delay and costs related to such delay will be determined as identified herein.
- D20.3 A minimum of seven (7) Calendar Days prior to the commencement of Work, the Contractor shall declare whether COVID-19 will affect the start date. The Contractor shall provide sufficient evidence that the delay is directly related to COVID-19, including but not limited to evidence related to availability of staff, availability of Material or work by others.
- D20.4 For any delay related to COVID-19 and identified after Work has commenced, the Contractor shall within seven (7) Calendar Days of becoming aware of the anticipated delay declare the additional delay and shall provide sufficient evidence as indicated in D20.3. Failure to provide this notice will result in no additional time delays being considered by the City.
- D20.5 The Work schedule, including the durations identified in D17 to D18 where applicable, will be adjusted to reflect delays accepted by the Contract Administrator. No additional payment will be made for adjustment of schedules except where seasonal work, not previously identified in the Contract, is carried over to the following construction season.
- D20.6 Where Work not previously identified is being carried over solely as a result of delays related to COVID-19, as confirmed by the Contract Administrator, the cost of temporary works to maintain the Work in a safe manner until Work recommences, will be considered by the Contract Administrator. Where the Work is carried over only partially due to COVID-19, a partial consideration of the cost of temporary works will be considered by the Contract Administrator.
- D20.7 Any time or cost implications as a result of COVID-19 and in accordance with the above, as confirmed by the Contract Administrator, shall be documented in accordance with C7.

## **D21. SCHEDULED MAINTENANCE**

- D21.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:
- (a) Reflective Crack Maintenance during two (2) year maintenance warranty period as specified in CW 3250.
- D21.2 Determination of Substantial Performance and Total Performance shall be exclusive of scheduled maintenance identified herein. All scheduled maintenance shall be completed prior to the expiration of the warranty period. Where the scheduled maintenance cannot be

completed during the warranty period, the warranty period shall be extended for such period of time as it takes the Contractor to complete the scheduled maintenance.

## **CONTROL OF WORK**

### **D22. JOB MEETINGS**

- D22.1 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.
- D22.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he/she deems it necessary.

### **D23. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)**

- D23.1 Further to C6.26, 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).

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

- D24.1 Further to B12.4, the Contractor/Subcontractor must, throughout the term of the Contract, have a Workplace Safety and Health Program meeting the requirements of The Workplace Safety and Health Act (Manitoba). At any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require updated proof of compliance, as set out in B12.4.

## **MEASUREMENT AND PAYMENT**

### **D25. PAYMENT**

- D25.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

## **WARRANTY**

### **D26. WARRANTY**

- D26.1 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.
- D26.2 Notwithstanding C13.2 or D26.1, the Contract Administrator may permit the warranty period for a portion or portions of the Work to begin prior to the date of Total Performance if:
- (a) a portion of the Work cannot be completed because of unseasonable weather or other conditions reasonably beyond the control of the Contractor but that portion does not prevent the balance of the Work from being put to its intended use.
- D26.2.1 In such case, the date specified by the Contract Administrator for the warranty period to begin shall be substituted for the date specified in C13.2 for the warranty period to begin.
- D26.3 Notwithstanding C13.2 or D26.1, the warranty period on the expansion joints fabrication shall expire five (5) years from the date of issuance of the Certificate of Acceptance (refer to E21.7 and E21.8).

## THIRD PARTY AGREEMENTS

### D27. FUNDING AND/OR CONTRIBUTION AGREEMENT OBLIGATIONS

- D27.1 In the event that funding for the Work of the Contract is provided to the City of Winnipeg by the Government of Manitoba and/or the Government of Canada, the following terms and conditions shall apply, as required by the applicable funding agreements.
- D27.2 Further to D27.1, in the event that the obligations in D27 apply, actual costs legitimately incurred by the Contractor as a direct result of these obligations ("Funding Costs") shall be determined by the actual cost to the Contractor and not by the valuation method(s) outlined in C7.4. In all other respects Funding Costs will be processed in accordance with Changes in Work under C7.
- D27.3 For the purposes of D27:
- (a) "**Government of Canada**" includes the authorized officials, auditors, and representatives of the Government of Canada; and
  - (b) "**Government of Manitoba**" includes the authorized officials, auditors, and representatives of the Government of Manitoba.
- D27.4 Modified Insurance Requirements
- D27.4.1 If not already required under the insurance requirements identified in D11, the Contractor will be required to provide wrap-up liability insurance in an amount of no less than two million dollars (\$2,000,000) inclusive per occurrence. Such policy will be written in the joint names of the City, Contractor, Consultants and all sub-contractors and sub-consultants and include twelve (12) months completed operations. The Government of Manitoba and its Ministers, officers, employees, and agents shall be added as additional insureds.
- D27.4.2 If not already required under the insurance requirements identified in D11, the Contractor will be required to provide builders' risk insurance (including boiler and machinery insurance, as applicable) providing all risks coverage at full replacement cost, or such lower level of insurance that the City may identify on a case-by-case basis, such as an installation floater.
- D27.4.3 The Contractor shall obtain and maintain third party liability insurance with minimum coverage of two million dollars (\$2,000,000.00) per occurrence on all licensed vehicles operated at the Site. In the event that this requirement conflicts with another licensed vehicle insurance requirement in this Contract, then the requirement that provides the higher level of insurance shall apply.
- D27.4.4 Further to D11.4, insurers shall provide satisfactory Certificates of Insurance to the Government of Manitoba prior to commencement of Work as written evidence of the insurance required. The Certificates of Insurance must provide for a minimum of thirty (30) days' prior written notice to the Government of Manitoba in case of insurance cancellation.
- D27.4.5 All policies must be taken out with insurers licensed to carry on business in the Province of Manitoba.
- D27.5 Indemnification By Contractor
- D27.5.1 In addition to the indemnity obligations outlined in C17 of the General Conditions for Construction, the Contractor agrees to indemnify and save harmless the Government of Canada and the Government of Manitoba and each of their respective Ministers, officers, servants, employees, and agents from and against all claims and demands, losses, costs, damages, actions, suit or other proceedings brought or pursued in any manner in respect of any matter caused by the Contractor or arising from this Contract or the Work, or from the goods or services provided or required to be provided by the Contractor, except those resulting from the negligence of any of the Government of Canada's or the Government of Manitoba's Ministers, officers, servants, employees, or agents, as the case may be.

## D27.6 Records Retention and Audits

D27.6.1 The Contractor shall maintain and preserve accurate and complete records in respect of this Contract and the Work, including all accounting records, financial documents, copies of contracts with other parties and other records relating to this Contract and the Work during the term of the Contract and for at least six (6) years after Total Performance. Those records bearing original signatures or professional seals or stamps must be preserved in paper form; other records may be retained in electronic form.

D27.6.2 In addition to the record keeping and inspection obligations outlined in C6 of the General Conditions for Construction, the Contractor shall keep available for inspection and audit at all reasonable times while this Contract is in effect and until at least six (6) years after Total Performance, all records, documents, and contracts referred to in D27.6.1 for inspection, copying and audit by the City of Winnipeg, the Government of Manitoba and/or the Government of Canada and their respective representatives and auditors, and to produce them on demand; to provide reasonable facilities for such inspections, copying and audits, to provide copies of and extracts from such records, documents, or contracts upon request by the City of Winnipeg, the Government of Manitoba, and/or the Government of Canada and their respective representatives and auditors, and to promptly provide such other information and explanations as may be reasonably requested by the City of Winnipeg, the Government of Manitoba, and/or the Government of Canada from time-to-time.

## D27.7 Other Obligations

D27.7.1 The Contractor consents to the City providing a copy of the Contract Documents to the Government of Manitoba and/or the Government of Canada upon request from either entity.

D27.7.2 If the Lobbyists Registration Act (Manitoba) applies to the Contractor, the Contractor represents and warrants that it has filed a return and is registered and in full compliance with the obligations of that Act, and covenants that it will continue to comply for the duration of this Contract.

D27.7.3 The Contractor shall comply with all applicable legislation and standards, whether federal, provincial, or municipal, including (without limitation) labour, environmental, and human rights laws, in the course of providing the Work.

D27.7.4 The Contractor shall properly account for the Work provided under this Contract and payment received in this respect, prepared in accordance with generally accepted accounting principles in effect in Canada, including those principles and standards approved or recommended from time-to-time by the Chartered Professional Accountants of Canada or the Public Sector Accounting Board, as applicable, applied on a consistent basis.

D27.7.5 The Contractor represents and warrants that no current or former public servant or public office holder, to whom the Value and Ethics Code for the Public Sector, the Policy on Conflict of Interest and Post Employment, or the Conflict of Interest Act applies, shall derive direct benefit from this Contract, including any employment, payments, or gifts, unless the provision or receipt of such benefits is in compliance with such codes and the legislation.

D27.7.6 The Contractor represents and warrants that no member of the House of Commons or of the Senate of Canada or of the Legislative Assembly of Manitoba is a shareholder, director or officer of the Contractor or of a Subcontractor, and that no such member is entitled to any benefits arising from this Contract or from a contract with the Contractor or a Subcontractor concerning the Work.

**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

TENDER NO. 810-2020

NAIRN AVENUE OVERPASS DECK REHABILITATION

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: LABOUR AND MATERIAL PAYMENT BOND**  
(See D12)

KNOW ALL MEN BY THESE PRESENTS THAT

\_\_\_\_\_  
his/its heirs, executors, administrators, successors or assigns (hereinafter called the "Principal"), and

\_\_\_\_\_  
his/its heirs, executors, administrators, successors or assigns (hereinafter called the "Surety"), are held and firmly bound unto **THE CITY OF WINNIPEG** (hereinafter called the "Obligee"), for the use and benefit of claimants as herein below defined, in the amount of

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

of lawful money of Canada, for the payment whereof we, the Principal and the Surety jointly and severally bind ourselves firmly by these presents.

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

TENDER NO. 810-2020

NAIRN AVENUE OVERPASS DECK REHABILITATION

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 promptly make payment to all claimants as hereinafter defined, for all labour, service and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void, otherwise it shall remain in full force and effect subject, however, to the following conditions:

- (a) A claimant is defined as one having a direct contract with the Principal for labour, service and material, or any of them, used or reasonably required for use in the performance of the contract, labour, service and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment (but excluding rent of equipment where the rent pursuant to an agreement is to be applied towards the purchase price thereof) directly applicable to the Contract;
- (b) The above-named Principal and Surety hereby jointly and severally agree with the Obligee that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work, labour or service was done or performed, or materials were furnished by such claimant, may sue on this bond, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon;
- (c) No suit or action shall be commenced hereunder by any claimant
  - (i) unless claimant shall have given written notice to the Principal and the Surety above-named, within one hundred and twenty (120) days after such claimant did or performed the last of the work, labour or service, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work, labour or service was done or performed. Such notice shall be served by mailing the same by registered mail to the Principal, and Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the Province of Manitoba;

- (ii) after the expiration of one (1) year following the date on which Principal ceased work on said Contract; including work performed under the guarantees provided in the Contract;
  - (iii) other than in a court of competent jurisdiction in the Province of Manitoba.
- (d) The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.
- (e) The Surety shall not be liable for a greater sum than the specified penalty of this bond.

The Principal and Surety hereby agree that The Guarantors' Liability Act (Manitoba) shall apply to this Bond.

IN TESTIMONY WHEREOF, the Principal has hereunto set its hand affixed its seal, and the Surety has caused these presents to be sealed and with its corporate seal duly attested by the authorized signature of its signing authority this

\_\_\_\_\_ 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 K: EQUIPMENT**  
(See D14)

**NAIRN AVENUE OVERPASS DECK REHABILITATION**

<p>1. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>2. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>3. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

**FORM K: EQUIPMENT**  
(See D14)

**NAIRN AVENUE OVERPASS DECK REHABILITATION**

<p><b>4. Category/type:</b></p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p><b>5. Category/type:</b></p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p><b>6. Category/type:</b></p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

## 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 Tender shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.3 Bidders are reminded that requests for approval of substitutes as an approved equal or an approved alternative shall be made in accordance with B6. In every instance where a brand name or design specification is used, the City will also consider approved equals and/or approved alternatives in accordance with B6.
- E1.4 The following are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
B-121-21-01	Cover Sheet- Location Plan & Drawing List
B-121-21-02	Construction Stage 1- Scope of Work
B-121-21-03	Construction Stage 2- Scope of Work
B-121-21-04	Profile- Westbound Lanes
B-121-21-05	Profile- Eastbound Lanes
B-121-21-06	Structural Details
B-121-21-07	Pier Expansion Joint Details 1 of 3
B-121-21-08	Pier Expansion Joint Details 2 of 3
B-121-21-09	Pier Expansion Joint Details 3 of 3
B-121-21-10	Deck Drain Modifications 1 of 2
B-121-21-11	Deck Drain Modifications 2 of 2
B-121-21-12	Bill of Reinforcing

### GENERAL REQUIREMENTS

#### E2. MOBILIZATION AND DEMOBILIZATION

- E2.1 Description

- (a) This Specification covers all items relating to the mobilization and demobilization of the Contractor to the Site, as specified herein.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

#### E2.2 Scope of Work

- (a) The Work under this Specification shall include but not be limited to:
  - (i) the submission of a site layout plan;
  - (ii) mobilizing and demobilizing on site work facilities; and
  - (iii) installing, maintaining and removing any access roadway.

#### E2.3 References

- (a) CW 1120 – Existing Services, Utilities and Structures; and
- (b) CW 1130 – Site Requirements.

#### E2.4 Submittals

- (a) The Contractor shall submit the following to the Contract Administrator seven (7) Calendar Days prior to mobilization on Site:
  - (i) A plan 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.

#### E2.5 Materials and Equipment

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.
- (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.
- (c) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

#### E2.6 Construction Methods

- (a) Site Inspection
  - (i) Inspect the Site with the Contract Administrator to verify existing conditions prior to mobilizing on Site.
  - (ii) Inspect the Site with the Contract Administrator soon after demobilizing off Site, confirming the Site has been restored to its original condition prior to initiation of Work.
- (b) Layout of On-Site Work Facilities
  - (i) The Contractor shall mobilize all on Site Work and other temporary facilities.
  - (ii) Upon completion of construction activities, the Contractor shall remove all on Site Work and other temporary facilities.
- (c) Access Roadway
  - (i) The Contractor shall maintain any access roadway they install.
  - (ii) The access road shall be maintained on a regular basis to provide continual unrestricted site access, to the satisfaction of the Contract Administrator.
  - (iii) Upon completion of the Work, the area shall be restored to its original condition.
- (d) Restoration of Existing Facilities

- (i) Upon completion of the Work and demobilization, the Contractor shall restore existing facilities to their original condition, to the approval of the Contract Administrator.

#### E2.7 Measurement and Payment

- (a) Mobilization and Demobilization will not be measured and will be paid for at the Contract Lump Sum Price for "Mobilization and Demobilization" 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.
- (b) Mobilization and Demobilization will be paid for at a percentage of the Contract Lump Sum Price, as specified herein:
  - (i) When Contract Administrator is satisfied that construction has commenced at the Site: 30%
  - (ii) During construction, percentage distributed equally on a monthly basis at the discretion of the Contract Administrator: 60%
  - (iii) Upon completion of the project: 10%

### E3. OFFICE FACILITIES

E3.1 The Contractor shall supply office facilities for shared use with the Contract Administrator meeting the following requirements:

- (a) The building shall be conveniently located near the site of the Work.
- (b) The building shall have a minimum floor area of 25 m<sup>2</sup>, a height of 2.4 m with a window and a door entrance with a suitable lock.
- (c) 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 either 16 to 18°C or 24 to 25°C.
- (d) The building shall be adequately lighted with fluorescent fixtures and have a minimum of three (3) wall outlets.
- (e) The building shall be furnished with one (1) desk exclusively for use by the Contract Administrator, one (1) 3 m x 1.2 m drafting table, one (1) stool and a minimum of twelve (12) chairs.
- (f) A portable toilet shall be located near the field office building. The toilet shall have a locking door and be for the exclusive use of the Contract Administrator and other personnel from the City.
- (g) 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.

E3.2 The Contractor shall be responsible for all installation and removal costs, all operating costs and the general maintenance of the office facilities.

E3.3 The office facilities will be provided from the date of the commencement of the Work to the date of Total Performance.

E3.4 No separate measurement or payment will be made for the supply of office facilities as described in this Specification.

### E4. TRAFFIC CONTROL

E4.1 Further to clauses 3.6, 3.7 and 3.8 of CW 1130:

- (a) Where directed by the Contract Administrator, the Contractor shall construct and maintain temporary asphalt ramps to alleviate vertical pavement obstructions such as manholes and planing drop-offs to the satisfaction of the Contract Administrator. Payment shall be in accordance with CW3410.



- (b) In accordance with the Manual of Temporary Traffic Control on City Streets (MTTC), the Contractor ("Construction Agency" in the manual) shall be responsible for placing, maintaining and removing the appropriate temporary traffic control devices as specified by the MTTC or by the Traffic Management Branch of the City of Winnipeg Public Works Department. The Contractor shall bear all costs associated with the placement of temporary traffic control devices by their own forces or subcontractor.

E4.2 Notwithstanding E4.1, in accordance with the MTTC, the Contract Administrator shall make arrangements with the **Traffic Services Branch of the City of Winnipeg** to place, maintain, and remove all **regulatory signs** and traffic control devices authorized and/or required by the Traffic Management Branch in the following situations:

- (a) Parking restrictions,
- (b) Stopping restrictions,
- (c) Turn restrictions,
- (d) Diamond lane removal,
- (e) Full or directional closures on a Regional Street,
- (f) Traffic routed across a median,
- (g) Full or directional closure of a non-regional street where there is a requirement for regulatory signs (turn restrictions, bus stop relocations, etc.) to implement the closure.

E4.2.1 An exception to E4.2 is the 'KEEP RIGHT/KEEP LEFT' sign (RB-25 / RB-25L) which shall be supplied, installed, and maintained by the Contractor at their own expense.

E4.2.2 Further to E4.2, where the Contract Administrator has determined that the services of the Traffic Services Branch are required, the City shall bear the costs associated with the placement of temporary traffic control devices by the Traffic Services Branch of the City of Winnipeg in connection with the works undertaken by the Contractor.

E4.2.3 Further to E4.2, the Contractor shall supply all required barricades and polyposts (traffic control devices) and the Traffic Services Branch of the City of Winnipeg will place and maintain them.

## **E5. TRAFFIC MANAGEMENT**

E5.1 Further to clause 3.7 of CW 1130:

E5.1.1 Maintain a minimum of one lane in each direction at all times during construction including during paving and milling operations.

E5.1.2 Intersecting local streets, median openings and private approach access shall be maintained at all times.

E5.1.3 Should the Contractor be unable to maintain pedestrian or vehicular access to a residence or business, the Contractor shall review the planned disruption with the business or residence and the Contract Administrator and take reasonable measures to minimize the impact. The Contractor shall provide a minimum of twenty-four (24) hours notification to the affected residence or business and the Contract Administrator prior to disruption of access.

E5.1.4 The proposed concrete sidewalk connection located north of the overpass, as shown on the Drawings, shall be constructed prior to any planned closure of the overpass sidewalk (north side). Pedestrian access on the overpass (north side sidewalk) shall be maintained where deemed safe to do so by the Contract Administrator.

E5.1.5 Ambulance/emergency vehicle access must be maintained at all times.

E5.2 Construction Methods

E5.2.1 The Contractor shall advise the Contract Administrator five (5) days in advance of any new or change in lane closure;

- E5.2.2 Erect and maintain all applicable traffic control devices (including, but not limited to, warning signs, barrels, tall cones and chevrons) as specified by MTTC, the Traffic Management Branch, the Contract Administrator.
- E5.2.3 The Contractor shall take all other safety measures necessary to cope with any peculiar or unusual circumstances that have not been set out in the MTTC and shall, at all times, ensure that maximum protection is afforded to the road-user and that his/her operations in no way interfere with the safe operation of traffic, cyclists or pedestrians.
- E5.2.4 Improper signing will be sufficient reason for the Contract Administrator to order the Works to cease on Site.
- E5.2.5 During the hours when the Contractor is not working, equipment and stockpiled materials shall be left in such a location so as not to interfere with or present a hazard to motorists, cyclists or pedestrians.
- E5.3 Measurement and Payment
- E5.3.1 Traffic Control and Traffic management will not be measured and will be paid for at a percentage of the Contract Lump Sum Price for "Traffic and Pedestrian Control" 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.
- (ii) When Contract Administrator is satisfied that construction has commenced at the Site: 30%
  - (iii) During construction, percentage distributed equally on a monthly basis at the discretion of the Contract Administrator: 60%
  - (iv) Upon completion of the project: 10%

## **E6. LAYDOWN AREA**

- E6.1 Description
- E6.1.1 This Specification covers all items relating to the laydown area for use by the Contractor, as specified herein.
- E6.1.2 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 Works as hereinafter specified.
- E5.2 Scope of Work
- (a) The Work under this Specification shall include but not be limited to:
    - (i) The submission of a site layout plan as specified in E2.
- E6.2 References
- (a) E2 – Mobilization and Demobilization.
- E6.3 Construction Methods
- (a) The Contractor shall be responsible for ensuring the laydown area(s) are kept clean and organized.
  - (b) Equipment storage may be permitted in the closed lanes during Stage 1 and Stage 2.
  - (c) The Contractor shall also be responsible to ensure the laydown area(s) do not interfere with road users or pedestrians and that road users and pedestrians are sufficiently protected from objects in the laydown area(s) that may pose a hazard. Placement of large, fixed objects adjacent to live lanes of traffic pose a hazard to users. Should the Contractor desire to use these areas for laydown the Contractor shall submit a plan for adequately protecting the roadside hazard. The plan is to be sealed by an Engineer registered to practice in the Province of Manitoba.

E6.4 Measurement and Payment

E6.5 The laydown area(s) shall be considered incidental to the Work and no separate measurement or payment will be made.

**E7. PROTECTION OF EXISTING TREES**

E7.1 As identified in E6– Laydown Area, the vegetated area in the southeast corner of the bridge provides a possible location for the Contractor’s laydown area. The Contractor is advised that if any facilities, equipment and/or materials are placed in this area, the existing trees shall be protected as specified herein.

E7.2 The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing trees within the limits of the construction area:

- (a) the Contractor shall not stockpile materials and soil or park vehicles and equipment within 2 m of trees;
- (b) trees identified to be at risk by the Contract Administrator are to be strapped with
- (c) 25 mm X 100 mm X 2,400 mm wood planks, or suitably protected as approved by the Contract Administrator;
- (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; and
- (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.

E7.3 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.

E7.4 Elm trees shall not be pruned at any time between April 1 and July 31.

E7.5 Measurement and Payment

E7.5.1 The protection of existing trees shall be considered incidental to the Work and no separate measurement or payment will be made.

**E8. PROTECTION OF EXISTING UTILITIES**

E8.1 In accordance with and further to CW 1120, the Contractor shall protect and maintain all existing utilities that may be affected by the Work. The Contractor shall identify and locate utilities, and select appropriate construction methods to complete the work while avoiding harm to any utilities.

E8.2 References

- (a) CW 1120 – Existing Services, Utilities and Structures

E8.3 Measurement and Payment

E8.4 The protection of existing utilities shall be considered incidental to the Work and no separate measurement or payment will be made.

## **E9. WATER OBTAINED FROM THE CITY**

- E9.1 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.

## **E10. SHOP DRAWINGS**

### **E10.1 Description**

- (a) This Specification provides instructions for the preparation and submission of Shop Drawings.
- (b) 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.

### **E10.2 Shop Drawings**

- (a) Original Shop 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.
- (b) Shop Drawings are required for the following components:
  - (i) Expansion Joints; and
  - (ii) Deck Drain Modifications.

### **E10.3 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) 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 show on all submissions for Contract Administrator review.
- (e) Notify Contract Administrator, in writing at time of submission, of deviations from requirements of Contract Documents.
- (f) 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.
- (g) Responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- (h) 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.
- (i) After Contract Administrator's review and return of copies, distribute copies to Subcontractors and others as appropriate.
- (j) 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.

### **E10.4 Submission Requirements**

- (a) Schedule submissions at least seven (7) Calendar Days before dates reviewed submissions will be needed, and allow for a seven (7) 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 one (1) electronic (PDF) copy of Shop Drawings.
- (c) Accompany submissions with transmittal letter containing:
  - (i) Date;
  - (ii) Project title and Tender document 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; and,
  - (vii) Other pertinent data.
- (d) Submissions shall include:
  - (i) Date and revision dates;
  - (ii) Project title and Tender document number;
  - (iii) Name of:
    - + Contractor;
    - + Subcontractor;
    - + Supplier;
    - + Manufacturer; and
    - + 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; and
  - (ix) Contractor's stamp, initialed or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.

#### E10.5 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.

#### E10.6 Measurement and Payment

- (a) Shop Drawings shall be considered incidental to the Work and no separate measurement or payment will be made.

### E11. CONCRETE SCARIFICATION

#### E11.1 Description

- (a) This Specification covers concrete scarification, particularly by the Diamond Grinding method, of existing concrete pavement including the epoxy wearing surface in the locations and to the depths specified on the Drawings.

#### E11.2 References

- (a) E9 - Water Obtained from the City.

#### E11.3 Equipment

##### (a) Grinding Machine

- (i) The grinding machine shall be self-propelled complete with a mounted grinding head with diamond blades capable of grinding a minimum width of 1.2 m designed for grinding and texturing pavement. The machine shall have a minimum total weight of 15,876 kg (including the grinding head) and an effective wheel base of no less than 3.65 m.
- (ii) The grinding machine shall have a positive means of vacuuming the grinding slurry residue from the pavement surface, leaving the pavement surface in a clean, near-dry condition.
- (iii) All equipment shall be maintained to ensure it is in proper working order. The "roundness" of the match and depth control wheels of the grinding machine shall be regularly monitored; any wheels found to be out of round shall be immediately replaced.
- (iv) Any equipment that causes ravelling, aggregate fractures or disturbance to the pavement joints shall not be permitted.

#### E11.4 Construction Methods

##### (a) Diamond Grinding

- (i) The pavement grinding shall be scheduled and completed on the mainline pavement lanes in a manner that produces a neat, uniform finished surface.
- (ii) Care must be taken in areas of low cover to terminate the diamond grinding before contact is made with the existing reinforcing steel.
- (iii) The pavement shall be ground in the longitudinal direction parallel to the pavement center line.
- (iv) Mainline grinding shall be completed to within 150 mm of the face of barriers.
- (v) Removals to the edge of barriers are required by other means, such as chipping hammer or walk-behind scarifier, if the mainline grinding is unable to cut to the edge of barriers. Removal of the top 15 mm of concrete is required to the inside face of barriers and extending to within the area of proposed headers of the through lanes as shown on the Drawings. The vertical face shall be a clean vertical surface flush with the face of barriers.
- (vi) Grinding shall be completed in a manner that removes joint or crack faults and maintains lateral drainage and constant cross slope. The maximum allowable difference between the adjacent sides of joints and cracks shall be 2 mm.
- (vii) The maximum grinding depth shall not exceed 5mm beyond the specified scarification depth, with the exception of headers, if this method is chosen to be used in these areas.
- (viii) The Contractor shall be responsible for arranging and supplying all water required for the project. Water obtained for the City of Winnipeg shall be in accordance with E9 - Water Obtained from the City.

##### (b) Final Surface Finish

- (i) The grinding process shall produce a pavement surface that is true in grade and uniform in appearance with a smooth finish. If the grinding head does not permit a completely smooth finish a longitudinal line-type texture shall be applied with a maximum height between ridges of 1.5 mm. The finished grooves shall be evenly spaced 2 to 3 mm apart. Surface preparation type shall be to ICRI Guideline No. 310.2 up to CSP 6 or as acceptable by the Contract Administrator.

- (ii) The Contractor shall be responsible for the selection of the number and type of blades to be used to provide the proper surface finish for the aggregate type and waterproofing membrane requirements. Unbroken fins shall be removed to the satisfaction of the Contract Administrator.
  - (iii) The Contractor shall be responsible to determine the proper sequence of operations to meet the Specification. Multiple passes may be required to meet the Specifications.
  - (iv) Localized depressed pavement areas and areas of spalling will be exempt from texture and smoothness requirements. Additional grinding of these areas may be required and will be as directed by the Contract Administrator.
- (c) Slurry Removal
- (i) The Contractor shall remove and dispose of all grinding slurry in a manner and at a location to satisfy environmental regulations.
  - (ii) All slurry removal operations shall be approved by the Contract Administrator.
  - (iii) No grinding slurry shall be allowed to flow across lanes occupied by traffic or enter into closed drainage systems.
- (d) Slurry Handling and Disposal
- (i) The grinding slurry to be removed from the site shall be collected in water-tight haul units and transported to an appropriate disposal facility.
  - (ii) At completion of the grinding disposal operations, the Contractor shall clean up the Site to the satisfaction of the Contract Administrator.
  - (iii) The site clean-up shall include removal of excess water and removal of remaining grinding solids of the Site to original condition prior to commencement of the grinding disposal operations.

#### E11.5 Measurement and Payment

- (a) Concrete scarification will not be measured. This item of Work will be paid for at the Contract Lump Sum Price for "Scarification of Bridge Deck." The payment will be considered full compensation for performing all operations herein described or shown on the Drawings and all other items incidental to the Work.
- (b) No additional payment will be made if multiple passes of the grinding equipment are required to meet the smoothness requirements. The area of the pavement ground will only be considered for payment once, unless regrinding is directed by the Contract Administrator for reasons other than inadequate smoothness. No additional payment will be provided for testing to meet the smoothness requirements of this Contract.
- (c) No additional payment will be provided for concrete removals by other means to the edge of barriers.

### **E12. CONCRETE REMOVAL**

#### E12.1 Description

- (a) This Specification shall cover all operations relating to the removal and disposal of existing concrete, as specified herein and as shown on the Drawings. This Specification shall cover concrete removal Works, including all necessary staging, demolition, removal, salvaging, transporting, unloading, stockpiling and disposal of applicable materials.
- (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 Scope of Work

- (a) The Work under this Specification shall generally include the following items, to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator.

- (i) Concrete removal to a depth of 140 mm at the concrete tie-ins at both the north and south ends of the bridge;
  - (ii) Concrete removal to a minimum depth of 170 mm in the location of the proposed bridge deck concrete headers adjacent the pier expansion joints;
  - (iii) Concrete removal at the pier sidewalk and curb expansion joints; and
  - (iv) Concrete removal shall include removal of reinforcing steel as shown on the Drawings.
- (b) Removing concrete with appropriate equipment satisfactory to the Contract Administrator. No demolition products shall find their way into the watercourse. No demolition products shall find their way onto the sidewalk or roadway lanes which are open to traffic. Limits of demolition shall be saw-cut to provide a clean edge at the extent of demolition. Repair any over demolition and damaged reinforcing steel to the satisfaction of the Contract Administrator, at no additional cost.
- (c) All concrete removal materials not identified for salvage shall revert to the Contractor for off-site disposal.

#### E12.3 References

- (a) ICRI No. 310.2 – Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers and Polymer Overlays.

#### E12.4 Submittals

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least five (5) Business Days prior to the commencement of any Work on Site, a detailed plan and schedule, clearly illustrating the method and sequence by which the Contractor proposes to perform the concrete removals, including a description of the measures that will be implemented to meet any applicable environmental requirements. The demolition procedure shall include a description of the following:
  - (i) Type and capacity of equipment;
  - (ii) Sequence of operations; and
  - (iii) Design of demolition products protection of traffic lanes.

#### E12.5 Materials

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

#### E12.6 Equipment

- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- (b) The use of explosives is prohibited.

#### E12.7 Sequence of Structural Removals

- (a) Sequencing of all structural removals shall take place as shown on the Drawings unless otherwise approved to in writing by the Contract Administrator.

#### E12.8 Demolition Barriers

- (a) The Contractor shall provide all necessary temporary barriers to protect the general public from the products of the demolition process. The barriers shall not impede the concrete removals process or associated inspection of all Works by the Contract Administrator.



## E12.9 Construction Methods

### (a) General

- (i) Concrete removals shall be deemed to include all the items of work as listed under Clause E12.2 of this Specification and to the limits as shown on the Contract Drawings or otherwise directed by the Contract Administrator.
- (ii) The Contractor shall prevent damage and destructive vibrations to: existing structures to remain, services, expansion joints, and adjacent roadways. If safety measures are not followed, or if existing structures to remain and/or services appear to be endangered, the Contractor shall cease operations and notify the Contract Administrator immediately.
- (iii) All removed material shall become the responsibility of the Contractor except as otherwise indicated herein.
- (iv) The Contractor shall promptly haul all removed materials indicated for disposal, off and away from the site. No storage of any materials on Site will be allowed without written approval of the Contract Administrator. It shall be the Contractor's responsibility to find suitable disposal areas away from the Site.
- (v) The Contractor shall take all necessary precautions to ensure that materials do not fall onto any neighbouring roadways or sidewalks during removal operations.
- (vi) The Contractor shall visit the Site to become familiar with the existing conditions and scope of work prior to bid submission. No allowance for extras will be made for any concrete removals, not foreseen by the Contractor, required to complete the scope of Work.
- (vii) The details and dimensions of the existing structures shown on the Drawings are for assisting the Contractor in establishing methods and limits of removal and for determining the cost of the Work. All available Drawings for the existing bridge structure and modifications are available for viewing with the Contract Administrator. No guarantee for the accuracy of the information is given. No allowance for extras will be given for information on the Drawings that does not represent existing conditions.
- (viii) In no case will the Contractor be permitted to use removal equipment, or other equipment or methods which may cause damage to any remaining structural elements or to any new construction. In the event that any element is damaged, the Contractor shall repair such element at his own expense to the satisfaction of the Contract Administrator.
- (ix) The Contractor shall provide all necessary access to facilitate concrete removals and subsequent inspection of all the Works by the Contract Administrator.
- (x) The Contractor shall be fully responsible for ensuring the public safety in all areas, and will be held responsible for any loss or damage caused due to neglect by the Contractor or his employees.
- (xi) The Contractor shall only use methods of concrete removal that will not damage the existing structure to remain or new structures. Limits of demolition shall be straight and saw-cut to provide a clean edge at the extent of demolition.
- (xii) Following the initial removal of concrete, the Contract Administrator will conduct a delamination survey to determine if any additional concrete removal will be required. These areas will be clearly marked out by the Contract Administrator for the Contractor's completion of delamination repairs.
- (xiii) In the case that reinforcing is exposed during the concrete removal operations the following shall be adhered to:
- (xiv) Any reinforcing steel that is severed shall be replaced, with appropriate lap lengths, by the Contractor to the satisfaction of the Contract Administrator at no additional cost to the City.
- (xv) Any reinforcing steel that exhibits minor cross sectional loss or other loss of epoxy coating shall receive a coat of one hundred percent (100%) solids, non-conductive epoxy installed as per the manufacturer's specifications.

- (xvi) The Contractor shall only use methods of concrete removal that will not damage existing reinforcing steel to remain or new structures.
- (b) Removal of Header Concrete
  - (i) Removal of concrete at proposed bridge deck headers shall take place in areas adjacent to the existing pier expansion joints as shown in the Drawings. Nominal removal depths shall not be exceeded by 10 mm.
  - (ii) All of the existing reinforcing steel is to remain in place. The Contractor shall ensure that the reinforcing steel is not damaged.
- (c) Bridge Deck Surface Preparation Works for Concrete Overlay
  - (i) The final surface preparation of the Bridge Deck at locations of concrete overlay shall be conducted by water jet unless otherwise approved by the Contract Administrator. The resulting surface shall achieve the required grades, while being roughened to the following requirements:
    - + Concrete shall be removed by water jet to a medium scarification profile in accordance with the ICRI Guideline No.310.2 CSP 6.
  - (ii) The Contractor shall take all necessary precautions to ensure that no sound concrete located below the required depth of removal is damaged or removed. Any damage caused to sound concrete or reinforcing steel beyond the required limit of removal or excessive removal of concrete beyond the required depth of removal by the Contractor during any demolition procedure will be repaired by the Contractor at the Contractor's own expense to the satisfaction of the Contract Administrator.
  - (iii) Upon completion of the concrete removals of each section of the concrete deck, the Contractor shall remove all cuttings, slurry containing the products of the removal method, and all other debris from the resulting concrete surface so as to produce a thoroughly clean surface. Cleaning of each section shall be done before debris and water are allowed to dry on the deck surface and prior to the placement of any cathodic protection (if applicable).
  - (iv) All exposed reinforcing steel which is left unsupported by the concrete removal process shall be adequately supported and protected from all equipment. All reinforcing steel damaged or dislodged by these operations, as deemed by the Contract Administrator, shall be replaced with new reinforcing of the same size at the expense of the Contractor.

#### E12.10 Quality Control

- (a) Inspection
  - (i) 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.
  - (ii) 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.
- (b) Access
  - (i) 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.

#### E12.11 Measurement and Payment

- (a) Removal of the existing concrete will not be measured. This item of Work will be paid for at the Contract Lump Sum Price for "Bridge Deck Concrete Removals." The payment will be considered full compensation for performing all operations herein described or shown on the drawings and all other items incidental to the Work.

## **E13. STRUCTURAL CONCRETE**

### **E13.1 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.

### **E13.2 Referenced Specifications and Drawings**

- (a) The latest edition and subsequent revisions of the following:
  - (i) American Concrete Publication SP4 – Formwork for Concrete;
  - (ii) ASTM A1035 – Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement;
  - (iii) ASTM B418 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes;
  - (iv) ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete;
  - (v) ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete;
  - (vi) ASTM C494 – Standard Specification for Chemical Admixtures for Concrete;
  - (vii) ASTM C881- Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete;
  - (viii) ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete;
  - (ix) ASTM C1059 – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete;
  - (x) ASTM C1609 – Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam with Third Point Loading);
  - (xi) ASTM C1876 – Standard Test Method for Bulk Electrical Resistivity or Bulk Conductivity of Concrete;
  - (xii) CSA A23.1 – Concrete Materials and Methods of Concrete Construction;
  - (xiii) CSA-A3001 – Cementitious Materials for Use in Concrete; and
  - (xiv) CSA O121 – Douglas Fir Plywood.

### **E13.3 Scope of Work**

- (a) Supplying and placing concrete for headers; and
- (b) Supplying and placing concrete for bridge deck concrete tie-ins.

### **E13.4 Submittals**

- (a) General
  - (i) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
  - (ii) The contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any Work on Site, the proposed materials to be used.
- (b) Concrete Mix Design Requirements
  - (i) 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.).

- (ii) The Supplier shall submit directly, in confidence, to the City of Winnipeg, the concrete mix designs for each of the concrete types specified herein. The purpose of this confidential submission will be for record keeping purposes only. The concrete mix design shall contain a description of the constituents and proportions, and at the minimum the following:
    - + Cementitious content in kilograms per cubic metre or equivalent units, and type of cementitious materials;
    - + Designated size, or sizes, of aggregates, and the gradation;
    - + Aggregate source location(s);
    - + Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis;
    - + Maximum allowable water content in kilograms per cubic metre or equivalent units and the water/cementitious ratio;
    - + The limits for slump;
    - + The limits for air content; and
    - + Quantity of other admixtures.
  - (iii) The concrete mix design statements must be received by the Contract Administrator a minimum of ten (10) Business Days prior to the scheduled commencement of concrete placement for each of the concrete types. The concrete mix designs must be received by the City of Winnipeg a minimum of five (5) Business Days prior to the scheduled commencement of concrete placement for each of the concrete types.
  - (iv) 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 A23.1-19 Clause 4.3.2.3.2.
  - (v) 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.
- (c) Concrete Mix Design Test Data
- (i) Concrete
    - + The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the scheduled commencement of concrete placement, test data showing that the concrete to be supplied will meet the performance criteria stated in this Specification for each concrete type.
    - + 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 fibre dispersion in accordance with the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6-19, Section 16, Fibre Reinforced Structures, Clause 16.6.
    - + Testing for post-cracking residual strength index (Ri) of FRC shall be conducted at the Contractor's expense as follows: one set of five (5) concrete beam specimens, 100 mm X 100 mm X 350 mm long, shall be tested at seven (7) Calendar Days in accordance with the latest addition of ASTM C1609. The initial cracking load of the concrete

(Pp) and the post-cracking residual strength (Pcr), which shall be taken as the average of loads corresponding to deflection values of 0.5 mm, 0.75mm, 1.0mm, and 1.25 mm, shall be tabulated for each of the specimens. The Ri for each specimen, which shall be taken as the ratio of Pcr over Pp, shall be tabulated. Tests conducted in accordance with ASTM C1609 will be considered invalid if the initial crack in the specimen has occurred after 0.2 mm deflection. The Ri shall be taken as the average of the Ri values from a minimum of five (5) valid specimens. The Contractor shall submit a report as specified in ASTM C1609, including a summary of the results of all post-cracking residual strength index tests and all load deflection curves.

- + All tests shall be based on the concrete samples taken from the point of discharge into the formwork. For example, at the concrete chute from the delivery truck if being placed by buggies, or at the end of the pump line should the Contractor choose to pump the concrete into place.
- + Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C-19, "Sampling Plastic Concrete".

(ii) Aggregates

- + The Contractor shall furnish, in writing to the Contract Administrator for review and approval, at least ten (10) 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.
- + 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.
- + 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.
- + 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.
- + 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 one hundred (100) to one hundred and twenty (120). 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.
- + 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.

(iii) The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

(d) Notification of Ready Mix Supplier

(i) 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 ten (10) 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.

E13.5 Materials

(a) General

(i) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.

(b) Testing and Approval

(i) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the testing laboratory designated by the Contract Administrator. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.

(ii) All materials shall be approved by the Contract Administrator at least seven (7) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such materials shall be rejected by the Contract Administrator and replaced by the Contractor at their own expense.

(c) Adhesive Agent

(i) Adhesive agent for bonding steel reinforcing or dowels to concrete shall conform to the requirements of ASTM C881, Type V, Grade 3, Class A, B and C, except linear shrinkage. An acceptable product would be Hilti Hit-RE 500 V3, or equivalent.

(d) Concrete Strength and Workability

(i) Structural Concrete

+ Proportioning of fine aggregate, coarse aggregate, cement, water, and air-entraining agent shall be such as to yield concrete having the required strength and workability, as follows:

Concrete Type	Location	Exposure Class	Nominal Compressive Strength	Maximum Aggregate Size	Air Content Category	Special Requirements
1	Bridge Deck Headers and tie-ins	C-XL	50 MPa @ 56 days	20 mm	1	Synthetic Fibres Ri = 0.15

(e) Concrete Aggregate

(i) Fine Aggregate

+ Fine aggregate shall consist of sand having clean, hard, strong,

durable, uncoated grains; free from injurious amounts of dust, soft or flaking particles, shale, alkali, organic matter, load or other deleterious substance.

- + Fine aggregate shall be well-graded throughout and shall conform to the following gradation requirements:

Sieve Size	Percent of Total Dry Weight Passing Each Sieve
10 mm	100%
5 mm	95 - 100%
2.5 mm	80 - 100%
1.25 mm	50 - 90%
630 µm	25 - 65%
315 µm	10 - 35%
160 µm	2 - 10%
80 µm	0 - 3%

- (ii) Coarse Aggregate (20 mm Nominal) Coarse aggregate shall be clean and free from alkali, organic, or other deleterious matter, shall have an absorption not exceeding three percent (3%), and shall conform to the following gradation requirements:

Sieve Size	Percent of Total Dry Weight Passing Each Sieve
28 mm	100%
20 mm	85 - 100%
14 mm	50 - 90%
10 mm	25 - 60%
5 mm	0 - 10%
2.5 mm	0 - 5%

(f) Cementitious Materials

- (i) Cementitious materials shall conform to the requirements of CSA-A3001 and shall be free from lumps.
- (ii) Should the Contractor choose to include a silica fume admixture in the concrete mix design, the substitution of silica fume shall not exceed eight percent (8%) by mass of cement.
- (iii) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class C1 or F and the substitution shall not exceed thirty percent (30%) by mass of cement.
- (iv) 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.

(g) Water

- (i) 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 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.

(h) Admixtures

- (i) Air-entraining admixtures shall conform to the requirements of ASTM C260.
- (ii) Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.
- (iii) 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.

- (i) Synthetic Fibres
  - (i) The synthetic fibres shall consist of one hundred percent (100%) virgin polypropylene as accepted by the Contract Administrator. The dosage shall be designed by the Contractor to meet the requirements for post-cracking residual strength index (Ri) and fibre dispersion in accordance to the CHBDC CSA-S6-19, Fibre-Reinforced Structures, Clause 16.6. Notwithstanding CHBDC Section 16, Clause 16.6, testing for post-cracking residual strength index (Ri) of concrete shall be completed in accordance with E13.4(c)(i).
- (j) Bonding Agents
  - (i) Latex Bonding Agent
    - + Latex bonding agents to bond new concrete to existing concrete shall conform to the requirements of ASTM C1059, Type II. Polyvinyl acetate- based latexes will not be permitted. An acceptable product would be SikaCem 810, or equivalent. An acceptable product for concrete greater than twenty-eight (28) days in age would be Planicrete AC by MAPEI, or equivalent.
  - (ii) Epoxy Bonding Agent
    - + Epoxy bonding agents to bond new concrete to existing concrete shall be SikaTop Armatec-110 EpoCem, or equivalent as approved by the Contract Administrator, in accordance with B7.
- (k) Bonding Grout
  - (i) For latex bonding grouts, the grout for bonding the new concrete to the existing concrete shall be mixed in accordance with manufacturer's specifications.
  - (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.
- (l) Curing Compound
  - (i) Curing compounds shall be liquid membrane-forming and conform to the requirements of ASTM C309. Curing compounds shall be resin-based and white-pigmented. An acceptable product would be WR Meadows 1215 WHITE Pigmented Curing Compound, or other equivalent product as approved by the Contract Administrator, in accordance with B7.
- (m) Curing Blankets
  - (i) Curing blankets for wet curing shall be one hundred percent (100%) polyester, 3 mm thick and white in colour. Alternately, a ten (10) ounces burlap, five (5) mil polyethylene, curing blanket white in colour shall be used. An acceptable product would be Curelap together with a second layer of burlap, or other equivalent product as approved by the Contract Administrator, in accordance with B7.
- (n) Patching Mortar
  - (i) 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 one (1) part cement to two (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.
- (o) Formwork
  - (i) Formwork materials shall conform to CSA Standard A23.1, and American Concrete Publication SP4, "Formwork for Concrete."
  - (ii) 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 O121, a minimum of twenty (20) millimetres thick.



- (iii) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CSA O121.
  - (iv) Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.
  - (v) 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 beyond 50 mm must be made from a non-rusting material and shall not stain, blemish, or spall the concrete surface for the life of the concrete.
  - (vi) Forms for exposed surfaces that do not require a form liner may be either new plywood or steel as authorized by the Contract Administrator.
  - (vii) 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.
  - (viii) Whalers 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 mm X 150 mm.
  - (ix) Stay-in-place formwork or falsework is not acceptable and shall not be used by the Contractor unless specifically shown on the Drawings.
- (p) Form Coating
- (i) Form coating shall not stain the surface of the concrete.
- (q) Permeable Formwork Liner
- (i) Permeable formwork liner shall be a draining synthetic lining finished with two (2) different surfaces. The side in contact with the concrete shall be smooth and perform as a filter to prevent the leaching of fine cement particles when the formwork is in place. The other side shall be fibrous and act as a draining element to help evacuate the water and the excess air at the surface. An acceptable product would be Texel Drainform. This formwork liner shall be used on all barrier repair types and transition barrier repairs.

#### E13.6 Equipment

- (a) General
- (i) All equipment shall be of a type accepted by the Contract Administrator. The equipment shall be kept in good working order, kept free from hardened concrete or foreign materials, and shall be cleaned at frequent intervals.
- (b) Vibrators
- (i) 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.
  - (ii) The Contractor shall use rubber coated vibrators for consolidating concrete containing epoxy-coated reinforcing steel.
  - (iii) The Contractor shall have standby vibrators available at all times during the pour.
- (c) Supply of Structural Concrete
- (i) 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.
  - (ii) All mixing of concrete must meet the provisions of CSA A23.1-19, Clause 5.2, Production of Concrete.
  - (iii) Time of Hauling
    - + 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 one hundred and twenty (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 ninety (90) minutes.

- + 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 one hundred and twenty (120) and/or ninety (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.
- + 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.
- + Unless otherwise noted, no retarders shall be used.
- + 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.
- + 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.

(iv) Delivery of Concrete

- + The Contractor shall confirm 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.

(v) Concrete Placement Schedule

- + The Contractor shall submit to the Contract Administrator the proposed concrete placement schedule for all concrete placements for review and approval.
- + The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

(d) Preparation for Concreting Against Hardened Concrete

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

- + 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 by water jet to remove latent cement and miscellaneous debris.
- + All existing surfaces and exposed reinforcing steel are to be sandblasted to reveal a clean substrate and kept clean until concrete placement. Surface preparation type shall be to ICRI Guideline No. 310.2 CSP 6 (Medium Scarification). Sand-blasting or shot-blasting shall be followed by a high pressure water wash to remove all residues.
- + 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.
- + Immediately after the blasting is complete and before signs of flash rusting appears on the steel surface, all exposed bars are

to be recoated with an approved epoxy coating.

(e) Placing Structural Concrete

(i) General

- + 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, and related Works. No concrete pour shall be scheduled without the prior written approval of the Contract Administrator.

(ii) Placing Structural Concrete

- + Placement of deck concrete shall not be permitted when the surface moisture evaporation exceeds  $0.75 \text{ kg/m}^2/\text{h}$ . Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator.
- + The nomograph, Figure D1, Annex D of CSA Standard A23.1-19 shall be used to estimate surface moisture evaporation rates.
- + 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.
- + 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.
- + Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.
- + 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.
- + Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.
- + 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.
- + Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.
- + 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.
- + 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 seven thousand (7,000) revolutions per minute immersed.
- + 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 (five (5) to fifteen (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.

- + 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.

(f) Finishing of Concrete Surfaces

(i) Finishing Operations for Unformed Surfaces

- + 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 one hundred and twenty (120) minute discharge time limit during the delay, while the finishing operations catch up, shall be rejected.

(ii) Type 1 Finish – Unformed Surfaces

- + All unformed concrete surfaces, shall be finished as outlined hereinafter.
- + 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.
- + 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.
- + 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.
- + For riding surfaces, after final floating, the slab surface shall receive coarse transverse scored texture by drawing a steel tined broom uniformly across the slab surface, to the satisfaction of the Contract Administrator.

E13.7 Construction Methods

(a) Debris Containment

- (i) The Contractor shall ensure that all debris including, but not limited to: concrete debris, concrete cutting fluids, formwork debris, and repair materials do not enter the waterway in any way including by the bridge or adjacent roadway drainage system.

(b) Construction Joints

- (i) Construction joints shall be located only where shown on the Drawings or as otherwise approved in writing by the Contract Administrator. Construction joints shall be at right angles to the main reinforcing steel. All reinforcing steel shall be continuous across the joints.
- (ii) In lieu of forming shear keys at construction joints, the Contractor may roughen the surface as follows. The surface shall be rough, with minimum amplitude of 6 mm. Acceptable procedures to obtain this rough surface are as follows:
  - + By removing the mortar between the larger aggregate particles with a water jet and soft brush when the concrete is in a semi-hardened state (green-cut); and,

- + By first applying a chemical retarder to the surface and then removing mortar from the larger aggregate particles with a water jet and soft brush.
  - (iii) The face of joints shall be cleaned of all laitance and dirt, after which the cementitious grout or an approved bonding agent shall be applied. Forms shall be retightened, and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.
- (c) General Curing
- (i) Hot weather curing shall be in accordance with CSA A23.1, refer to (f) for hot weather curing requirements.
  - (ii) Unformed concrete surfaces shall be covered and kept moist by means of wet polyester blankets for seven (7) consecutive days immediately following finishing operations or otherwise approved by the Contract Administrator and shall be maintained at above 10°C for at least seven (7) consecutive days. Construction joints shall only be covered and kept saturated by means of wet polyester curing blankets for the curing period.
  - (iii) The use of curing compound shall not be allowed on concrete areas that are to receive additional concrete, a waterproofing membrane, or an asphalt overlay.
  - (iv) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, or running water, vibration, and mechanical shock. Concrete shall be protected from freezing until at least twenty-four (24) hours after the end of the curing period.
  - (v) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3°C in any one hour period or 20°C in any twenty-four (24) hour period.
  - (vi) 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.
- (d) Form Removal
- (i) All forms for concrete repairs shall remain in place for a minimum of three (3) days. The Contract Administrator must be notified at least twenty-four (24) hours prior to any form removal. The Contractor must receive approval from the Contract Administrator prior to beginning Work.
  - (ii) The minimum strength of concrete and mortar in place for safe removal of soffit forms for horizontal or inclined members, as well as vertical forms shall be 20 MPa, with the added provisions that the member shall be of sufficient strength to carry safely its own weight, together with superimposed construction loads.
  - (iii) Field-cured test specimens, representative of the in-place concrete being stripped, may be tested to verify the concrete strength.
- (e) Patching of Formed Surfaces
- (i) Immediately after forms have been removed, but before any repairing or surface finishing is started, the concrete surface shall be inspected by the Contract Administrator. Any repair or surface finishing started before this inspection may be rejected and required to be removed.
  - (ii) All formed concrete surfaces shall have bolts, ties, struts, and all other timber or metal parts not specifically required for construction purposes cut back fifty (50) mm from the surface before patching.
  - (iii) Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter, and voids left by strutting, and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched and then applying patching mortar. A slurry grout consisting of water and cement shall be thoroughly brushed onto the area to be patched. When the slurry grout begins to lose the water sheen, the patching mortar shall be applied. It shall be struck-off

slightly higher than the adjacent surface and left for one (1) hour before final finishing to permit initial shrinkage of the patching mortar and it shall be touched up until it is satisfactory to the Contract Administrator. The patch shall be cured as specified in this Specification, and the final colour shall match the surrounding concrete.

- (iv) All objectionable fins, projections, offsets, streaks, or other surface imperfections shall be removed by approved means to the Contract Administrator's satisfaction. Cement washes of any kind shall not be used.
  - (v) Concrete shall be cast against forms that will produce plane surfaces with no bulges, indentations, or protuberances other than those shown on the Drawings. The arrangement of panel joints shall be kept to a minimum. Panels containing worn edges, patches, or other defects that will impair the texture of concrete surfaces shall not be used. All fins on the concrete surfaces shall be removed.
- (f) Hot Weather Concreting
- (i) General
    - + The requirements of this section shall be applied during hot weather; i.e., air temperatures above 25°C during placing.
    - + Concrete shall be placed at as low a temperature as possible, preferably below 15°C, but not above 22°C. Aggregate stockpiles may be cooled by watersprays and sunshades.
    - + Ice may be substituted for a portion of the mixing water; providing it has melted by the time mixing is completed.
    - + 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 watersprays.
    - + Sunshades and wind breaks shall be used as required during placing and finishing.
    - + Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints."
    - + The Contract Administrator's approval is necessary before the Contractor may use admixtures, such as retardants, to delay setting or water-reducing agents to maintain workability and strength, and these must then appear in the Mix Design Statement submitted to the Contract Administrator.
    - + Curing shall follow immediately after the finishing operations.
  - (ii) Hot-Weather Curing
    - + When the air temperature is at or above 25°C, curing shall be accomplished by water spray or by using saturated absorptive fabric, in order to achieve cooling by evaporation.
  - (ii) Job Preparation
    - + When the air temperature is at or above 25°C, or when there is a probability of it rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, as defined in CSA A23.1 the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by fogging and evaporation.
  - (iii) Concrete Temperature
    - + The temperature of the concrete as placed shall be as low as practicable and in no case greater than that shown below for the indicated size of the concrete section.

Thickness of Section (m)	Temperatures, °C	
	Minimum	Maximum

Less than 0.3	10	27
0.3 to 1.0	10	27
1.0 to 2.0	5	25

(g) Cleanup

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

E13.8 Measurement and Payment

(a) Bridge Structural Concrete

- (i) Supplying and placing Concrete Type 1 for the Bridge Deck Headers and tie-ins will be measured on a volume basis and paid for at the Contract Unit Price per cubic meter for "Supply and Place High Performance Concrete", repaired in accordance with this Specification and accepted by the Contract Administrator.

**E14. CONCRETE REPAIRS**

E14.1 Description

- (a) This Specification shall cover all concrete repairs to the bridge deck surface.
- (b) The Work to be done under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E14.2 Scope of Work

- (a) The Work under this Specification shall involve the preparation and repair of concrete and reinforcing steel for:
- (i) Supplying and placing structural concrete for bridge deck delamination repairs.

E14.3 Materials

(a) General

- (i) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in the Specification. All materials shall be new and within the recommended shelf-life, as approved by the Contract Administrator.

(b) Testing and Approval

- (i) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.
- (ii) All materials shall be accepted by the Contract Administrator at least five (5) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

(c) Material for Concrete Repair

(i) Structural Concrete

- + The Contractor shall be responsible for supplying Concrete supplied as per Specification E13 "Structural Concrete".

(d) Curing

- (i) All cementitious patches shall be wet cured for seven (7) Calendar Days unless otherwise approved by the Contract Administrator as per E13.7(c).

(e) Quality Control

- (i) 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 hereto notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

#### E14.4 Equipment

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

#### E14.5 Construction Methods

##### (a) General

- (i) The Contractor shall ensure that existing concrete to remain is not be damaged.

##### (b) Debris and Cleanup

- (i) The Contractor shall be required to pick up and remove from the Site all debris created by the repair procedures to the satisfaction of the Contract Administrator.

##### (c) Preparation

- (i) The Contract Administrator will mark out areas requiring concrete repair. Additional areas may be added as the Work proceeds.
- (ii) The resulting surface from concrete removals is to be roughened as per Specification E12 "Concrete Removal".
- (iii) Limits of the repair areas are to be saw-cut per the Drawings to provide a well-defined interface and bonding surface with the existing sound concrete.
- (iv) All corroded steel shall be sand blasted to remove all corrosion and bars recoated with an approved epoxy coating to the Contract Administrators satisfaction.

##### (d) Bridge Deck Delamination Repair

- (i) Concrete shall be removed from around and behind all rebar in the area to be repaired accordance with good concrete repair practice such as ACRA guideline HB84-2006, Section 6. Rebar shall be exposed to up to the middle of the exposed rebar for Type 1 Repair and concrete shall be removed to 25 mm below the lower bars for a Type 2 Repair. Exposed reinforcing steel should be cleaned to remove all residual rust and concrete residue and recoated with an approved epoxy coating to the satisfaction of the Contract Administrator.
- (ii) The Contractor is responsible to create a bond between the new mortar/concrete and the existing substrates.
- (iii) Repair areas shall be filled with Structural Concrete as per specification E13 "Structural Concrete" to elevation of diamond grinding or a height of 10 mm above the existing concrete, whichever is greater.
- (iv) Positive deck drainage, greater than one percent (1%) slope, must be maintained throughout the deck and all patched areas.
- (v) If the concrete patch is required to rise above the elevation of diamond grinding the edges of the new concrete shall taper down flush to the edges of the patch.
- (vi) The Contract Administrator shall inspect all repaired areas for bond using a hammer "sounding" method following cure.
- (vii) Cure in accordance with 13.7(c).

#### E14.6 Measurement and Payment

##### (a) Bridge Deck Delamination Repair

- (i) The delamination repairs on the bridge deck will be measured on an area basis and paid for at the Contract Unit Price per square meter for "The Items of Work", listed here below which price shall be paid in full for supplying all materials and



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

Items of Work:

- (b) Bridge Deck Delamination Repair:
  - (i) Type 1
  - (ii) Type 2

## **E15. RUBBERIZED ASPHALT WATERPROOFING**

### **E15.1 Description**

- (a) This Specification shall cover all operations relating to the supply of labour, equipment, tools and material necessary for the application of the surface condition and the hot poured rubberized asphalt waterproofing to the bridge deck as specified herein and as shown on the Drawings.

### **E15.2 Scope of Work**

- (a) The Scope of Work under this Specification shall involve:
  - (i) Preparing the surface of the bridge deck;
  - (ii) Supplying and applying primer;
  - (iii) Supplying and applying the hot poured rubberized asphalt waterproofing system to the bridge deck;
  - (iv) Supplying and installing of wick drains and PVC down spouts; and
  - (v) Supplying and applying polyester fabric and protection board.

### **E15.3 References**

- (a) ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

### **E15.4 Submittals**

- (a) 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; and
  - (iii) Manufacturer's Material Safety Data Sheets (MSDS) for all materials used.

### **E15.5 Materials**

- (a) General
  - (i) All materials in this section supplied under this Specification shall be subject to inspection by the Contract Administrator.
  - (ii) 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.
- (b) Primer
  - (i) The proposed concrete surface to be waterproofed shall receive a prime coat of CGSB37-GP-Ma, 930-18 (BAKOR) or accepted equivalent by the Contract Administrator, at an application rate in accordance with the Manufacturer's recommendations.
- (c) Hot Poured Rubberized Asphalt Waterproofing (Two (2) Layers)

- (i) Hot Poured Rubberized asphalt waterproofing shall be Bemalastic 1213 BDM by Bemac products or 790-11 by BAKOR or an approved equivalent as accepted by the Contract Administrator.
- (ii) 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) 2 to 3 mm thick layers. Discontinuities in the waterproofing membrane shall be avoided and joints lapped a minimum of 150 mm.
- (d) Polyester Fabric
  - (i) The intermediate reinforcing layer shall be spun-bonded polyester fabric such as BAKOR Polyester Fabric Reinforcing Sheet or Reemay BP-16 Fabric Reinforcement or approved equivalent as accepted by the Contract Administrator.
- (e) Protection Board
  - (i) The protection board shall be BAKOR Asphalt Protection Board or approved 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.
- (f) Wick Drains and PVC Down Spouts
  - (i) Wick drains shall consist of composite polypropylene with a total thickness of 3.6 mm supplied in 100 mm widths. The puncture strength shall be a minimum of 45N measured in accordance with ASTM D4833. An approved product is AMERDRAIN 407 or approved equivalent as accepted by the Contract Administrator. Downspouts shall be fabricated of PVC pipe and secured with stainless steel accessories per Drawings.
- (g) Cement
  - (i) Cement shall be normal Portland Cement.
- (h) Surface Conditioner
  - (i) Surface conditioner, to be applied to the concrete surfaces of the bridge deck, shall conform to the requirements of the Manufacturer of the rubberized asphalt waterproofing.
- (i) Melting On-Site
  - (i) 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.
  - (ii) The temperature of the rubberized asphalt waterproofing shall not exceed 218°C at any time during the entire melting procedure.

#### E15.6 Equipment

##### (a) General

- (i) All equipment shall be kept in good working order.

#### E15.7 Construction Methods

##### (a) Concrete Preparation

- (i) Following the completion of the diamond grinding, the Contractor shall conduct a final survey on the top of the concrete and submit elevations to the Contract Administrator.
- (ii) The Contract Administrator shall finalize and provide elevations for the top of the asphalt overlay. The Contract Administrator shall provide these elevations for the Contractor within five (5) Business Days from receipt of the final survey.
- (iii) The concrete deck surface, onto which the rubberized asphalt waterproofing is to be placed shall be roughened as per ICRI Guideline No. 310.2 up to CSP 6 or as acceptable by the Contract Administrator.

- (iv) The time interval between the surface preparation and the placing of the rubberized asphalt waterproofing shall be kept to a minimum, and utmost care shall be taken to keep the prepared surfaces clean during the interval.
  - (v) Immediately before proceeding with rubberized asphalt waterproofing placement, the prepared surface shall be inspected for dirt and other deleterious materials that may have been deposited after the completion of cleaning. All such dirt and deleterious material shall be cleaned off in a manner and by satisfactory procedures.
  - (vi) 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.
  - (vii) Rubberized asphalt waterproofing shall not be placed on the concrete deck surface until the moisture content of the concrete is acceptable per the Manufacturer's recommendations for the application of the rubberized asphalt waterproofing.
- (b) Application
- (i) After the deck slab has been cleaned and meets all manufacturers' requirements, the entire concrete bridge deck except concrete header shall be covered with primer.
  - (ii) 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.
  - (iii) 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.
  - (iv) The application of the rubberized asphalt waterproofing shall be carried out under the supervision of experienced personnel.
  - (v) The Contractor shall apply the rubberized asphalt waterproofing membrane over the entire deck area except the concrete header, along the vertical face of the barrier and the vertical face of the header concrete, to the required height (proposed elevation) of the bituminous pavement.
  - (vi) The hot poured rubberized asphalt waterproofing membrane shall be a two (2) 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.
  - (vii) The intermediate reinforcing shall be set into the first layer of waterproofing membrane to achieve a minimum of fifty percent (50%) bleed through. There should not be any dry sheet-to-sheet overlap and a maximum overlap or gap between sheets of 5 mm.
  - (viii) The wick drains and PVC down spouts shall be installed per the Drawings.
  - (ix) 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.
  - (x) 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.
  - (xi) 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 wick drains. 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.

## E15.8 Quality Control

### (a) Inspection

- (i) 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.
- (ii) 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. All materials or Works, which are not in accordance with the requirements of this Specification shall be rejected.

### (b) Access

- (i) 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/her inspector for testing purposes as required.

## E15.9 Measurement and Payment

- (a) Rubberized Asphalt Waterproofing will not be measured and will be paid for at the Contract Lump Sum Price for "Hot-Poured Rubberized Waterproofing Membrane Complete with Protection Board" 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. SUPPLY AND PLACEMENT OF HEALER/ SEALER**

### E16.1 Description

- (a) This Specification shall cover all operations dating to the supply of labour, equipment, tools and materials necessary for the requirements for the application of the concrete healer/ sealer to concrete in the following locations:
  - (i) Bridge deck sidewalk walking surfaces; and
  - (ii) Approach slabs.

### E16.2 References

- (a) ASTM C672/C672M - Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to De-icing Chemicals.
- (b) ICRI Guideline No. 310.2, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

### E16.3 Submittals

- (a) The Contractor is to provide Pre-Construction Field Adhesion Testing reports: these are to be comprised of written results of field tests, including summary of joint preparation, surface preparation, products used and installation techniques.

### E16.4 Delivery, Storage and Handling

- (a) Deliver, handle, store and protect materials of this section in accordance with manufacturer's recommendations.
- (b) Protect products from freezing.

### E16.5 Site Conditions

#### (a) Site Environmental Requirements

- (i) Ensure substrate temperature at time of installation is in accordance with manufacturer's printed instructions.
- (ii) Apply coating during dry weather. Concrete surface shall be completely dry before application of Healer/Sealer. Allow surfaces to dry minimum of three (3) consecutive days after rainfall or cleaning before applying further coats.

- (iii) Protect plants and vegetation which might be damaged by water repellents.
- (iv) Protect surfaces not intended to have application of water repellents.

#### E16.6 Precautions

- (a) Concrete sealers contain flammable solvents. Extra precautions shall be taken in confined areas. Do not allow open flame or sparks in areas where the sealer is being used. Adequate ventilation must be provided when applying.
- (b) Wear protective clothing and prevent direct contact with skin. The special precautions recommended by the manufacturer shall be rigidly followed where hazardous materials are included.
- (c) The solvent is flammable; do not allow open lights, flames, sparking motors or pilot lights in the vicinity. Smoking near the solvent is to be forbidden.

#### E16.7 Materials

- (a) The Healer/Sealer employed shall be one of the following products:
  - (i) T-78 Crack Sealer, low viscosity methyl methacrylate resin system. (Transpo Industries, Inc.) or approved equal in accordance with B7; or
  - (ii) MasterSeal® 630, Reactive methacrylate resin for sealing cracks and concrete decks (Master Builders Solutions by BASF) or approved equal in accordance with B7.

E16.8 Should the Contractor wish to use an alternative product the Contractor shall submit to the Contract Administrator as part of the bid package, in writing, the sealer to be employed coupled with manufacturer's printed product literature, specifications, and application instructions. Any alternative should either meet or exceed the specification of the products listed above.

E16.9 The sealers shall be delivered to the job site in the manufacturer's original unopened containers.

E16.10 Containers shall include manufacturer's labels indicating; the supplier, name of material, formula or specification number (if applicable), date of manufacture and shelf life.

#### E16.11 Manufacturer's Instructions

- (a) Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions and data sheets.

#### E16.12 Preparation

- (a) All concrete surfaces to which a water repellent is to be applied are to be prepared by shot-blasting. Follow surface preparation procedures outlined under the manufacturer's specification.
- (b) Areas which exhibit delamination, spalling, or scaling shall be repaired by removing the deteriorated concrete to the depth required to obtain a sound surface. Complete repairs in accordance with E14.
- (c) Within twenty-four (24) hours prior to application of the sealer pressure wash all surfaces to remove contaminants, laitance, curing compounds or other surface defects to clean and texture substrate which will reduce the bond of the overlay.
- (d) The substrate surface shall have a profile designation of ICRI Guideline No. 310.2 CSP 3 as defined by the International Concrete Repair Institute or as accepted by the Contract Administrator.
- (e) No traffic (vehicular or pedestrian) shall be allowed on the prepared surface.
- (f) The surface of the concrete must be allowed to dry continuously following a heavy rainfall for at least seventy-two (72) hours at a minimum of 10°C.

- (g) If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- (h) Service life of the sealer is primarily dependent upon good service preparation, therefore preparation is of the utmost importance.

#### E16.13 Application

##### (a) General

- (i) Protect adjacent work areas and finish surfaces from damage during sealer application.
- (ii) Slab temperature to be obtained immediately prior to sealer application, to confirm that the slab temperature is within allowable range as dictated by manufacturer's specifications.
- (iii) Remove all oils, grease, dirt and wax solutions from surface, using a non-solvent degreaser/detergent. Remove all debris from working surface. Prepare components as per manufacturer's instructions.
- (iv) Manufacturer's representative must be on site during initial applications, and provide written acceptance of methods and equipment employed.
- (v) Adequate cure time must be allocated to new concrete prior to installation of the sealer.
- (vi) Consult manufacturer for specified concrete cure period.
- (vii) Allow Contract Administrator to view empty sealer containers after every application process. Do not discard containers without prior authorization from Contract Administrator.
- (viii) The system manufacturer/Contractor shall assume responsibility for performance of the sealer.
- (ix) Coverages rates where shown will vary depending on surface profile and porosity. Dilution of the products is strictly forbidden. Unless otherwise specified they are provided in a factory blended state ready for installation. The introduction of thinners will not be allowed and will jeopardize performance.

##### (b) T-78 Crack Sealer

- (i) Mixing T-78 must be mixed with the appropriate amount of powder hardener just prior to application. Air/substrate temperature determines the Application amount of powder hardener used. The appropriate amount of powder hardener to be added to one gallon of T-78 resin as per the manufacturer's guidelines. Using clean, dry plastic buckets and scoops; add powder hardener to T-78 and mix until dissolved (approximately one (1) minute). A drill-mounted paddle mixer should be used for larger batches. Mixed T-78 must be used immediately.
  - + T-78 is applied in a gravity-fed process. The rate of application of T-78 resin should be approximately 100 to 150 ft<sup>2</sup>/gal (2.5 – 3.75 m<sup>2</sup>/L). However, this will vary depending on the surface porosity, size and quantity of cracks present in the area being treated.
  - + Apply the Healer/Sealer as many times as required to fill cracks to surface level allowing for settlement between applications. Pre-treatment application of Healer/Sealer in cracks along length of medium to wide cracks may be required to ensure adequate penetration.
  - + During application the concrete surface should be flooded with the resin, allowing sufficient time for penetration into the surface and complete filling of all cracks. Excess material should be redistributed using squeegees or brooms within five minute after application. The quantity of T-78 resin mixed at one time should be limited to five gallons.

##### (c) MasterSeal® 630

- (i) Mixing

- + MasterSeal® 630 must be mixed with the appropriate amount of Master Top SRS 100HD just prior to application. Air/substrate temperature determines the amount as per the manufacturer's guidelines.

(ii) Application

- + MasterSeal® 630 is applied as a flood coat in a gravity-fed process by broom or roller.
- + Apply the Healer/Sealer as many times as required to fill cracks to surface level allowing for settlement between applications. Pre-treatment application of Healer/Sealer in cracks along length of medium to wide cracks may be required to ensure adequate penetration.
- + The contents of the mixed batch should be immediately poured onto the substrate and worked into cracks by distributing with 1/2" to 3/4" (13 to 20 mm) nap solvent grade rollers or broom. Do not allow material to pond. Application rate is 100 ft<sup>2</sup>/gal (2.5 m<sup>2</sup>/L).
- + Do not allow the mixed batch to remain in the mixing vessel. It is advisable to randomly broadcast a 30 mesh (600 µm), dry aggregate into the wet, uncured resin at the rate of approximately 4 lb/100 ft<sup>2</sup> (200 g/m<sup>2</sup>).
- + Working time for MasterSeal® 630 is between ten (10) and fifteen (15) minutes once it has been applied to the substrate. Full cure to specification will be between forty-five (45) minutes and one (1) hour.

(d) Cleaning

- (i) Use manufacturer recommended cleaning solvent. Clean equipment immediately after use.
- (ii) Remove temporary coverings and protection of adjacent work areas. Remove over spray coating from windows or areas not intended to be coated with hot soapy water solution or a mild detergent cleaner.
- (iii) Remove construction debris resulting from work in this section.
- (iv) Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

E16.14 Measurement and Payment

- (a) The supply and placement of Sealer/Healer shall be measured on an area basis and paid for at the Contract Unit Price per square meter for "Supply and Placement of Sealer/Healer". The area to be paid for will be the total number of square meters of Sealer/Healer applied in accordance with the specification, accepted and measured by the Contract Administrator.

**E17. CONSTRUCTION OF ASPHALTIC CONCRETE PAVEMENTS**

E17.1 Description

- (a) This Specification shall cover all construction of asphaltic concrete pavements as required.
- (b) The Work to be done under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E17.2 References

- (a) ASTM E-950 – Standard Test Method for Measuring the Longitudinal Profile of Traveled Surface with an Accelerometer-Established Inertial Profiling Reference.

E17.3 Scope of Work

E17.4 Further to CW 3410-R12, the Contractor shall apply two separate nominal 40 mm lifts of asphalt in accordance with the joint pattern specified herein except as noted in the Drawings.

E17.5 Testing

(a) Testing of asphaltic concrete pavement shall be carried out as per CW3410-R12.

E17.6 General

(a) Remove surplus material from surface of previously laid strip.

(b) Do not deposit on surface of freshly laid strip.

(c) Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated on the Drawings.

(d) Only static rolling will be allowed on the bridge. Contractor is responsible for the level of the rolling effort to ensure densities are meeting Specifications. Contractor to carry out intermittent density testing as required.

(e) The bottom lift should be given an adequate time to cool so as to provide a firm surface for the rolling of the top lift.

E17.7 Transverse joints

(a) Offset transverse joint in succeeding lifts by at least 600 mm.

(b) Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.

(c) Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

E17.8 Longitudinal joints:

(a) Offset longitudinal joints in succeeding lifts by at least 150 mm.

(b) Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100°C prior to paving of adjacent lane.

(c) If cold joint cannot be avoided, cut back by saw-cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane. Saw-cut shall not damage waterproofing membrane.

(d) Overlap previously laid strip with spreader by 25 to 50 mm.

(e) Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.

(f) Roll longitudinal joints directly behind paving operation.

(g) When rolling with static rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

E17.9 Measurement and Payment

(a) The Construction of Asphaltic Concrete Pavements will be measured by weight and paid for at the Contract Unit Price per tonne for "Construction of Asphalt Concrete Overlay" 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. VERIFICATION OF WEIGHTS**

E18.1 All material which is paid for on a weight basis shall be weighed on a scale certified by Consumer and Corporate Affairs, Canada.



- E18.2 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.
- E18.3 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 and 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; and
  - (d) Checking tare weights shown on delivery tickets against a current tare.
- E18.4 No charge shall be made to the City for any delays or loss of production caused by such inspection and verification.
- E18.5 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.
- E18.6 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); and
  - (d) The time and date of weighing.
- E18.7 Measurement and Payment
- (a) No separate measurement or payment will be made for performing all operations herein described and all other items incidental to the Work described.
  - (b) Verification of Weights will not be measured and is considered incidental to Construction of Asphaltic Concrete Pavements.

## **E19. DISCRETE GALVANIC PROTECTION SYSTEM**

### **E19.1 Description**

- (a) The Work under this section consists of designing, supplying, installing and energizing a zinc-based galvanic corrosion control system consisting primarily of embedded zinc anodes, including required electrical connections, materials, testing and ensuring continuity of the reinforcing steel to all elements as outlined in 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 Works as hereinafter specified.

### **E19.1.2 References**

- (a) ACI/ICRI 1999 Concrete Repair Manual
- (b) ACI Guideline No. 222 – Corrosion of Metals in Concrete
- (c) ACI 562-13 Code Requirements for Evaluation, Repair and Rehabilitation of Concrete Buildings
- (d) ACI Repair Application Procedure (RAP) Bulletin 8 – Installation of Embedded Galvanic Anodes (2010)
- (e) ICRI Guideline 310.1R-2008 Guide for Surface Preparation for the Repair of Deteriorated Concrete resulting from Reinforcing Steel Corrosion

(f) ASTM B418-12 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes

E19.2 Submittals

- (a) Shop drawings showing typical galvanic corrosion control system installation details, such as distributed anode installation locations, type and location of anode standoff spacers, reinforcing connections shall be prepared by the Contractor and submitted for approval prior to any field installations. The shop drawings shall clearly illustrate the layout of the anodes as applies to the abutments on this project, in both elevation and section views.

E19.3 Materials

E19.3.1 Embedded Galvanic Anodes

- (a) Discrete galvanic units shall be alkali-activated zinc meant to be embedded into concrete repairs and for corrosion prevention only. Nominal dimensions shall be 125 mm x 25 mm x 25 mm or as approved. The anodes shall be pre-manufactured with a nominal 60 grams of zinc in compliance with ASTM B418 Type II cast around a pair of uncoated, non-galvanized steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14 or greater.
- (b) The galvanic anodes shall be alkali-activated and shall contain no intentionally added chloride, bromide or other constituents that are corrosive to reinforcing steel as per ACT 562-13. Anode units shall be supplied with integral unspliced wires for directly tying to the reinforcing steel. Embedded galvanic anodes shall be Galvashield® XPT available from Vector Corrosion Technologies ([www.vector-corrosion.com](http://www.vector-corrosion.com)) USA (813) 830-7566, Canada (204) 489-9611 or approved equal.
- (c) Application for approved equals shall be requested in writing two weeks before submission of project bids. Application for galvanic anode approved equals shall include verification of the following information:
- (i) The zinc anode is alkali-activated with an alkaline cementitious shell with a pH of 14 or greater.
  - (ii) The galvanic anode shall contain no intentionally added constituents corrosive to reinforcing steel, e.g. chloride, bromide, etc.
  - (iii) The anode manufacturer shall provide documented test results from field installations showing that the anodes have achieved a minimum of 10 years in service.
  - (iv) The galvanic anode shall have been used in a minimum of ten projects of similar size and application.
  - (v) The galvanic anode units shall be supplied with solid zinc core (ASTM B418) cast around uncoated, non-galvanized, non-spliced steel tie wires for wrapping around the reinforcing steel and twisting to provide a durable steel to steel connection between the tie wire and the reinforcing steel.
  - (vi) The anode manufacturer shall provide third party product evaluation, such as from Concrete Innovations Appraisal Service, BBA, etc.

E19.3.2 Repair Materials

- (a) Repair mortars, concrete, and bonding agents shall be portland cement-based materials with suitable electrical resistivity less than 15,000 ohm-cm. Non-conductive repair materials such as epoxy, urethane, or magnesium phosphate shall not be permitted. Repair materials with significant polymer modification and/or silica fume content may have high resistivity. Insulating materials such as epoxy bonding agents shall not be used unless otherwise called for in the design.

E19.3.3 Storage

- (a) Deliver, store, and handle all materials in accordance with manufacturer's instructions. Anode units shall be stored in dry conditions in the original unopened containers in a manner to avoid exposure to extremes of temperature and humidity.

## E19.4 Construction Methods

### E19.4.1 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 50 mm of clear concrete cover over the anode units. For deck area the concrete clear cover under the membrane and asphalt topping can be 25 mm.

### E19.4.2 Manufacturer Corrosion Technician

- (a) The Contractor will enlist and pay for a technical representative employed by the galvanic anode manufacturer to provide training and on-site technical assistance during the initial installation of the galvanic anodes. The technical representative shall be a NACE-qualified corrosion technician (Cathodic Protection Technician-CP2 or higher).
- (b) The qualified corrosion technician shall have verifiable experience in the installation and testing of embedded galvanic protection systems for reinforced concrete structures.
- (c) The contractor shall coordinate its work with the designated corrosion technician to allow for site support during project startup and initial anode installation. The corrosion technician shall provide contractor training and support for development of application procedures, verification of electrical continuity, and project documentation.

### E19.4.3 Concrete Removal

- (a) Remove loose or delaminated concrete.
- (b) Undercut all exposed reinforcing steel by removing concrete from the full circumference of the steel as per ICRI R310.1R to the limits indicated on the Drawings or as per the Contract Administrator.
- (c) Concrete removal shall continue along the reinforcing steel until no further delamination, cracking, or significant rebar corrosion exists and the reinforcing steel is well bonded to the surrounding concrete as per ICRI R310.1R.

### E19.4.4 Cleaning and Repair of Reinforcing Steel

- (a) Clean exposed reinforcing steel of rust, mortar, epoxy coating, etc. to provide sufficient electrical connection and mechanical bond.
- (b) If significant reduction in the cross section of the reinforcing steel has occurred, replace or install supplemental reinforcement as directed by the Contract Administrator.
- (c) Secure loose reinforcing steel by tying tightly to other bars with steel tie wire.
- (d) Verify electrical continuity of all reinforcing steel, including supplemental steel, as per Section E19.4.6(f).

### E19.4.5 Edge and Surface Conditioning of Concrete

- (a) Concrete patches shall be square or rectangular in shape with squared corners per ICRI Guideline 310.1R-2008.
- (b) Saw cut the patch boundary as per the Drawings or as directed by the Contract Administrator.
- (c) Create a clean, sound substrate by removing bond-inhibiting materials from the concrete substrate by high pressure water blasting or abrasive blasting.

### E19.4.6 Galvanic Anode Installation

- (a) Install anode units and repair material immediately following preparation and cleaning of the steel reinforcement.

- (b) Anode spacing shall be such to provide full protection for the entire patch perimeter. Anode spacing is dependent on the reinforcing steel density. Maximum anode spacing shall be as per the manufacturer's guidelines to provide a 20 year service life.
- (c) Place the galvanic anodes as close as possible to the patch edge while still providing sufficient clearance between anodes and substrate to allow the repair material to fully encase the anode with a minimum concrete or mortar cover over the anode of 25mm. If necessary, increase the size of the repair cavity to accommodate the anodes.
  - (i) Place the anode such that the preformed BarFit™ groove fits along a single bar or at the intersection between two bars and secure to each clean bar.
  - (ii) If less than 25 mm of concrete cover is expected, place anode beneath the bar and secure to clean reinforcing steel.
- (d) The tie wires shall be wrapped around the cleaned reinforcing steel at least one full turn in opposite directions and then twisted tight to create a secure electrical connection and allow no anode movement during concrete placement.
- (e) Repair materials with resistivity greater than 15,000 ohm-cm are not to be used.
- (f) Electrical Continuity
  - (i) Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm  $\Omega$ ) or DC potential (mV) with a multi-meter.
  - (ii) Electrical connection is acceptable if the DC resistance measured with the multi-meter is 1  $\Omega$  or less or the DC potential is 1 mV or less.
  - (iii) Confirm electrical continuity of the exposed reinforcing steel within the repair area. If necessary, electrical continuity shall be established by tying discontinuous steel to continuous steel using steel tie wire.
  - (iv) Electrical continuity between test areas is acceptable if the DC resistance measured with multi-meter is 1  $\Omega$  or less or the potential is 1 mV or less.

#### E19.4.7 Concrete or Mortar Replacement

- (a) If the repair procedures require the concrete surface to be saturated with water, do not damage the anode nor allow the anode units to be soaked for greater than 20 minutes.
- (b) Complete the repair with the repair material, taking care not to damage, loosen or leave voids around the anode

#### E19.5 Measurement and Payment

##### E19.5.1 Discrete Galvanic Anode System

- (a) The supply and installation of Discrete Galvanic Protection System as shown on the Drawings will be measured on a Unit Basis. This work shall be paid for at the Contract Unit Price Per Unit for "Discrete 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

## E20. DRILLING AND PLACING DOWELS

### E20.1 Description

- (a) This Specification shall cover all operations related to drilling and preparation of dowel holes, supply and placing epoxy grout and installation of the applicable anchorages.
- (b) Dowels shall include the following post-installed anchorages and reinforcing bars:
  - (i) Dowels for headers
  - (ii) Dowels for anchoring bridge barriers

### E20.2 Materials

- (a) Epoxy grout shall be Hilti HIT-RE 500-V3 or equivalent as approved by the Contract Administrator. The epoxy grout shall be suitable for horizontal, vertical or overhead dowel grouting application as required.

#### E20.3 Construction Methods

- (a) In bridge deck and pier columns, the Contractor shall core or drill holes and place dowels at the locations and in accordance with the details as shown on the Drawings. Holes for dowels shall be drilled or cored.
- (b) The Contractor shall predetermine the locations of existing steel bars prior to drilling or coring, using an effective reinforcing steel bar locator. Dowel hole locations as shown on the Drawings, shall be relocated as required to avoid conflicts with existing reinforcing steel bars as approved by the Contract Administrator.
- (c) Dowel hole diameters shall be in accordance with the recommendations of the epoxy adhesive grout manufacturer.
- (d) All holes shall be thoroughly cleaned prior to the installation of grout and dowels.
- (e) The epoxy adhesive grout shall be prepared, placed and cured in accordance with the recommendations of the epoxy adhesive grout manufacturer.

#### E20.4 Measurement and Payment

#### E20.5 Drilling and Placing Dowels

- (a) Drilling and placing dowels will not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for "Drilling and Placing Dowels", 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) The supply of reinforcing steel for the dowels will be measured and paid for in accordance with E20.

### **E21. EXPANSION JOINTS**

#### E21.1 Description

- (a) This Specification shall cover the supply and installation of expansion joints and miscellaneous steel items, as specified herein and shown on the Drawings.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all other things necessary for and incidental to the satisfactory performance and completion of all Work hereinafter specified.

#### E21.1 Referenced Specifications and Drawings

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

- (x) CAN/CSA G164-M92 – Hot Dip Galvanizing of Irregularly Shaped Articles; and
- (xi) Ontario Provincial Standard Specification OPSS 1210 – Material Specification for Deck Joint Assemblies.

#### E21.2 Scope of Work

- (a) The Work under this Specification shall involve:
  - (i) Supplying and installing expansion joints at the piers;
  - (ii) Supplying and installing the expansion joint seals;
  - (iii) Completing a watertight verification of the expansion joint seals; and
  - (iv) Supply and installing the expansion joint cover plates and other miscellaneous steel items.

#### E21.3 Submittals

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of any fabrication, the proposed Shop Drawings showing all fabrication details and any proposed field splice details of the steel components of the expansion joints. The complete expansion joint shop fabrication and installation shall be done by or under the direct supervision of a trained factory representative, who shall also be responsible for the expansion joint installation procedure.
- (c) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any Work on Site, the proposed approved materials to be used.

#### E21.4 Materials

##### E21.4.1 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.

##### E21.4.2 Handling and Storage of Materials

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

##### E21.4.3 Expansion Joints

- (a) Pier Expansion joints shall be System “SE-500” strip seal system as specified in the Drawings, or equal as accepted by the Contract Administrator, in accordance with B6.
- (b) Expansion joints shall have fabricated cover plates and slider plates as shown on the Drawings.
- (c) The seals at each joint shall be made out of neoprene, as accepted by the Contract Administrator and shall be supplied in one continuous piece, separate from the steel extrusions or joint. No shop or field splicing will be allowed in the seals.

##### E21.4.4 Steel

- (a) Steel supplied for the fabrication of the expansion joints shall conform to the requirements of CAN/CSA G40.21, Grade 300W, or equal as accepted by the

Contract Administrator, in accordance with B6. They shall be galvanized after shop fabrication in accordance with CAN/CSA G164-M92 to a minimum net retention of 610 g/m<sup>2</sup>.

E21.4.5 Steel Extrusions

- (a) Steel for the extrusions shall conform to the requirements of CAN/CSA G40.21, Grade 230G minimum.

E21.4.6 Anchor Studs

- (a) Anchor studs shall conform to the requirements of ASTM A108, Grade Designation 1020 and shall be galvanized.

E21.4.7 Miscellaneous Steel Items

- (a) Rods, cover plates, brackets and washer plates, slider plates, and all other associated steel items shown on the Drawings shall be fabricated from steel conforming to the requirements of CAN/CSA G40.21, Grade 300W and shall be galvanized in accordance with CAN/CSA G164 M92 to a minimum net retention of 610 g/m<sup>2</sup>.
- (b) The sidewalk cover plates shall be coated with an approved non-slip grit paint.

E21.4.8 Galvanizing Touch-up and Field Applied Galvanizing

- (a) Field-applied galvanizing, to touch-up damaged hot-dip galvanizing, metallizing, or field welds, shall be done with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780.
- (b) Approved products are:
  - (i) Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California; and
  - (ii) Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161 York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

E21.4.9 Welding

- (a) Welding shall be of a low oxygen classification. Manual electrodes shall be E7016 or E7018. All welding shall be in accordance with CAN/CSA W59.

E21.4.10 Preformed Neoprene Joint Seals

- (a) Further to E21.4.3(b) and E21.4.3(c), the preformed neoprene expansion joint seals shall be manufactured from a vulcanized elastomeric compound using crystallization resistant polychloroprene (neoprene) as the only polymer.
- (b) The preformed neoprene expansion joint seals shall meet the requirements of the latest edition and all subsequent revisions of Ontario Provincial Standard Specification (OPSS) 1210 "Material Specification for Preformed Neoprene Joint Seals", and as amended herein. All tests will be made on specimens prepared from the extruded seals.

E21.4.11 Epoxy Adhesive

- (a) Epoxy adhesive for concrete to steel bonding shall be one of the following approved products: Sternson ST432 or ST433, Dural Duralbond, Capper Capbond E, Sikadur 32 Hi-bond, Concessive 1001 LPL, Meadows Rezi-Weld 1000, or equal as accepted by the Contract Administrator, in accordance with B6.

E21.4.12 Epoxy Grout

- (a) Where epoxy grout is used, it shall be Sternson Talygrout 100, Sika Sikadur 42, CPD Epoxy Grout by Specialty Construction Products, Meadows Rezi-Weld EG-96, Duralcrete, Dural 103 Gel, or equal as accepted by the Contract Administrator, in accordance with B6. 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 B6. The minimum compressive strength of the grout at 28 days shall be 40 MPa

#### E21.4.13 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 B6. The minimum compressive strength of the grout at 28 days shall be 40 MPa

#### E21.5 Equipment

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

#### E21.6 Construction Methods

##### E21.6.1 Fabrication

- (a) The Contractor shall verify all field dimensions and ensure Shop Drawings are prepared accordingly.
- (b) No fabrication shall commence until acceptance of the Shop Drawings from the Contract Administrator has been obtained.
- (c) Care shall be taken to ensure that all members are straight and flat and free from twists, bends, and distortions due to welding. The units shall be shop assembled and checked for matching of sliding surfaces, correct cross-fall and skew, as well as accurate positioning and alignment of supporting brackets. The Contractor shall exercise care in the handling of all units during shipping and loading operations prevent twists, bends, and warping.
- (d) Matching expansion joint assemblies shall be assembled and bolted together for shipping.
- (e) Expansion joint assemblies shall be shop checked for fit and match marked.
- (f) 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, and pickling prior to galvanizing. Heavy deposits of oil and grease shall be removed with solvents prior to blasting and pickling.
- (g) In no case shall weldments be substituted for extrusion shapes.
- (h) The zinc coating shall be adherent, continuous, and reasonably smooth. It shall be free from imperfections such as blisters; gritty or uncoated areas; acid, black spots, or dross particle adhering to the coating; or other imperfections inconsistent with good commercial galvanizing practice. Globules of zinc that will interfere with the intended use of the material will not be permitted.
- (i) The colour of the galvanizing shall be consistent and continuous.

##### E21.6.2 Installation

- (a) The Contractor shall install expansion joints as shown on the Drawings and shall be responsible for the correct matching and seating of parts. The expansion joints shall be checked for accurate matching of sliding plates with the bridge deck expansion joints installed at the specified skews and crossfalls. One field splice in the length of the expansion joint is permitted.
- (b) The edges of the expansion joint cover plates shall be seal welded to the expansion joint cover plates as shown on the Drawings.

##### E21.6.3 Galvanizing Touch-up Prior to Placement of Concrete

- (a) Any areas of damaged galvanizing and field welds are to receive field applied galvanizing.



- (b) Surfaces to receive field-applied galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Field-applied galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.
- (c) The process is to be repeated as required to achieve a thickness comparable to original galvanizing, as approved by the Contract Administrator.

#### E21.6.4 Placement of Concrete at Expansion Joints

- (a) The expansion joint assemblies shall be set in position, and secured rigidly in place, such that they will remain true to line and elevation during and after concreting, in accordance with approved details as shown on the Shop Drawings.
- (b) Care shall be taken during consolidation of the concrete to ensure that there are no voids in the concrete under and around the expansion joint components and associated reinforcing steel.
- (c) Before concreting, the expansion joint opening shall be set to give the correct width for the mean concrete temperature of the deck. The gap width shall be obtained from the Temperature Width Adjustment Table provided on the Drawings, as approved on-site by the Contract Administrator immediately prior to the start of concrete placement.
- (d) Immediately in front of concrete placement at the expansion joints, all metal contact surfaces between the expansion joint and concrete shall be coated with epoxy adhesive.
- (e) After the concrete has set for seventy-two (72) hours, and after the removal of the Manufacturer's temporary clamping channels, epoxy grout shall be used to fill any associated bolt holes

#### E21.6.5 Field Welding and Touch-Up Galvanizing

- (a) Prior to installation of the seals, the flange of the expansion joint edge members shall be vulcanized or seal welded to the corner plates, as shown on the Drawings, to provide watertight joints.
- (b) Any areas of damaged galvanizing or metallizing on miscellaneous steel items shall receive field-applied touch-up galvanizing, in accordance with ASTM A780.
- (c) Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants. Preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Field-applied galvanizing shall be blended into existing galvanizing of surrounding surfaces and shall be buffed and polished if required to match the surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

#### E21.6.6 Installation of Seal

- (a) A permanent seal at each expansion joint unit shall be installed as one continuous piece after completion of all concreting operations, to the satisfaction of the Contract Administrator.
- (b) Only upon completion of all concrete cleanup operations shall the Contractor open up the seating areas and prepare them for the installation of the seals.
- (c) The installation of the expansion joint seal will be completed according to the construction phasing, as detailed on the Drawings.

#### E21.6.7 Watertight Verification of Joint Seal

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

#### E21.6.8 Watertight Verification of Expansion Joint and Concrete Blockouts

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

#### E21.6.9 Installation of Expansion Joint Cover Plates

- (a) Perform cutting, drilling, and fitting required for installation of expansion joint cover assemblies. Touch-up galvanizing shall be completed in accordance with E21.6.5, "Field Welding and Touch-Up Galvanizing".
- (b) Install joint cover assemblies in true alignment and proper relationship to the opening of the expansion joint and adjoining finished surfaces measured from the established lines and levels.
- (c) Allow for thermal expansion and contraction of metal to avoid buckling.
- (d) Set floor covers at elevations flush with adjacent finished floor materials unless otherwise shown.
- (e) Locate wall, ceiling, and overhang covers in continuous contact with adjacent surfaces. Securely attach in place using required accessories. Make allowances for change in joint size due for installation.
- (f) Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.

#### E21.7 Fabrication Warranty

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

## E21.8 Installation Warranty

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

## E21.9 Quality Control

### E21.9.1 General

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

### E21.9.2 Access

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

### E21.9.3 Expansion Joint Seal Markings

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

### E21.9.4 Joint Seal Samples and Testing Procedures

- (a) The Contractor shall supply seal sample material at no charge to The City for quality control testing purposes. The samples will each be 1.5 m long. Each sample will represent not more than three expansion joint seals of the same size, lot, and make and shall be continuous with same until sampled by the Contract Administrator. As soon as the seals to be used in the joint assemblies have been manufactured, they shall be available to the Contract Administrator for sampling.
- (b) Testing procedures will be in accordance with the latest revisions of the methods indicated in the table below.
- (c) All materials failing to meet the Specification requirements will be rejected.
- (d) Lots rejected may be culled by the supplier and, upon satisfactory evidence of compliance with the Specifications, will be accepted.

## Physical Requirements

Property	Physical Requirements	Test Procedure*
1. Tensile Strength	Minimum 13.5 MPa	ASTM D412 OPSS 1210.07.03.01.02
2. Elongation at Break	Minimum 250%	ASTM D412 OPSS 1210.07.03.01.02
3. Hardness, Type A Durometer	55: +7 Points -5 Points	ASTM D2240 OPSS 120.07.03.01.03
4. Oven aging Test 70 Hours at 100°C Reduction in Tensile Strength Reduction in Elongation Increase in Hardness	Maximum 20% Maximum 20% Maximum 10 Points	ASTM D573
5. Permanent Set at Break	Maximum 10%	ASTM D412
6. Low Temperature Stiffening Hardness, Type A Durometer	Maximum 15 Points	ASTM D2240 OPSS 1210.07.03.01.03
7. Oil Swell, ASTM Oil No. 3 70 H at 40°C (wipe with toluene to remove surface contamination)	45 max	ASTM D471
8. Ozone Resistance	No Cracks	ASTM D1149
9. **Safe Compressibility Test (Z min.) Bridge Seal - < 63.5 mm > 63.5 mm	Minimum 50% Minimum 55%	OPSS 1210.07.03.01.04
10. **Pressure Generation at 15% Deflection	Minimum 20 kPa	OPSS 1210.07.03.01.04
11. **Recovery 22 h at -28°C 70 h at -10°C 70 h at + 100°C	Minimum 80% No Cracking Minimum 88% Splitting or Minimum 85% Sticking	OPSS 1210.07.03.01.05

\* ASTM - American Society for Testing and Materials OPSS - Ontario Provincial Standard Specification

\*\* This physical requirement not applicable to lock-in type joint seals

## E21.10 Measurement and Payment

### E21.10.1 Expansion Joints

- (a) Supplying and installing expansion joints shall be measured at a unit basis. This Item of Work shall be paid for at the Contract Unit Price Per Unit for the "Items of Work" listed here below, which price shall be paid in full for supplying all materials and performing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator.
- (b) Items of Work:
- (c) Supply and Install Expansion Joints:
  - (i) Eastbound

(ii) Westbound

**E22. SUPPLYING AND PLACING REINFORCING STEEL**

E22.1 Description

- (a) This Specification shall cover all operations relating to the supply, fabrication, delivery, and placement of 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.

E22.2 Scope of Work

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

E22.3 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) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
  - (iv) CAN/CSA G30.18-M92 – Billet Steel Bars for Concrete Reinforcement;
  - (v) ACI 315R – Manual of Engineering and Placing Drawings for Reinforced Concrete Structures; and,
  - (vi) Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.

E22.4 Submittals

E22.4.1 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.

E22.5 Contractor to submit Quality Control Testing Program to the Contract Administrator in accordance with E22.8.3.

E22.6 Materials

E22.6.1 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.

**E22.6.2 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.

**E22.6.3 Reinforcing Steel**

- (a) Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) Stainless steel reinforcing as shown on the Drawings shall meet or exceed the minimum requirements of ASTM A955M, 300 Series, minimum Grade 420, of the Types listed below in Table E15.1, "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.
- (c) 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.

<b>TABLE 15.1 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	Duplex 2304	S32304

**E22.6.4 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) Stainless steel, fully annealed 1.6 mm diameter wire, Type 316 or 316L for stainless steel reinforcing.

- (f) 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.

## E22.7 Construction Methods

### E22.7.1 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) 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 pickling 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.

### E22.7.2 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.

## E22.8 Quality Control

### E22.8.1 Inspection

- (a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final

acceptance of the specified Work. 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.

**E22.8.2 Access**

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

**E22.8.3 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.

**E22.9 Measurement and Payment**

- (a) Reinforcing steel bars will be paid for on a weight basis and paid for at the Contract Unit Price per kilogram for "Supply and Place Reinforcing Steel", 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 and measured by the Contract Administrator.

**E23. SUPPLY, FABRICATION AND ERECTION OF MISCELLANEOUS METAL**

**E23.1 Description**

**E23.1.1 General**

- (a) This Specification covers all operations relating to the following:
- (i) Supply, fabrication, and erection of miscellaneous metal as shown or described on the Drawings and in this Specification. Miscellaneous metal includes:  
Galvanized Steel:
    - Deck drains riser assemblies;
    - Re-galvanizing existing drain grates; and
    - Solid link chain.
  - (ii) Quality control of materials and fabrication.
  - (iii) Galvanizing of all miscellaneous metal.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

**E23.2 References**

**E23.2.1 References and Related Specifications**

- (a) All related Specifications shall be current issued or latest revision at the first date of tender advertisement.
- (b) CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- (c) CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding
- (d) CSA W59, Welded Steel Construction (Metal Arc Welding)
- (e) CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles



- (f) CSA W47.1, Certification of Companies for Fusion Welding of Steel
- (g) ASTM A36, Standard Specification for Carbon Structural Steel
- (h) ASTM A53, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
- (i) ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- (j) ASTM A123, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
- (k) ASTM A276, Standard Specification for Standard Specification for Stainless Steel Bars and Shapes
- (l) ASTM A320, Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
- (m) ASTM F3125, High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength
- (n) ASTM A404, Standard Specification for General Requirements for Stainless Steel Bars, Billets and Forgings
- (o) ASTM A449, Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
- (p) ASTM A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
- (q) ASTM A500, Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- (r) ASTM A514, Standard Specification for High- Yield- Strength, Clenched and Tempered Alloy Steel Plate, Suitable for Welding
- (s) ASTM A516, Standard Specification for Pressure Vessel Plates, Carbon Steel, For Moderate and Low Temperature Service
- (t) ASTM A517, Standard Specification for Pressure Vessel Plates, Alloy Steel, High Strength, Quenched and Tempered
- (u) ASTM A615, Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement
- (v) ASTM B22, Standard Specification for Bronze Castings for Bridges and Turntables
- (w) ASTM B29, Standard Specification for Refined Lead
- (x) ASTM B100, Standard Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use
- (y) ANSI B46.1, Surface Texture (Surface Roughness, Waviness, and Lay)
- (z) AASHTO/AWS D1.5M/D1.5, Bridge Welding Code
- (aa) AWS D1.1, Structural Welding Code – Steel

### E23.3 Submittals

E23.3.1 The Contractor shall submit the following to the Contract Administrator:

- (a) copies of Mill Test Certificates showing chemical analysis and physical tests of all miscellaneous metal prior to commencement of fabrication. Miscellaneous metal without this certification will be rejected;
- (b) certification of chemical analysis and physical tests for all materials;
- (c) a complete set of Shop Drawings prior to commencement of fabrication. The Contractor shall indicate on the Shop Drawings all the necessary material specifications for the materials to be used and identify the components in accordance with the Drawings and Specifications. Applicable welding procedures, stamped as approved by the Canadian Welding Bureau, shall be attached to the Shop Drawings.

In no case will the Contractor be relieved of responsibility for errors or omissions in the Shop Drawings; and,

- (d) manufacturer's test reports of mechanical tests on high strength bolts, if requested by the Contract Administrator.

#### E23.4 Materials

##### E23.4.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- (b) 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.

##### E23.4.2 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.

##### E23.4.3 Deck Drain Assemblies

- (a) Steel for deck drain assemblies shall be in accordance with latest edition of CAN/CSA G40.21, Grade 300W.
- (b) All deck drain assemblies shall be hot-dip galvanized in accordance with ASTM A123 and CSA G164 to a minimum net retention of 610 g/m<sup>2</sup>, after fabrication.

##### E23.4.4 Hardware

- (a) Solid link chain, hot-dip galvanized.

#### E23.5 Construction Methods

##### E23.5.1 Fabrication

- (a) General
  - (i) The workmanship shall meet established practice in modern shops. Special emphasis shall be placed in prevention of cracks, notch-like flaws and bruises that may lower the structure's resistance to fatigue and brittle fracture.
  - (ii) The punching of identification marks on members will not be allowed unless authorized in writing by the Contract Administrator.
  - (iii) If damage occurs to the miscellaneous metal during fabrication, the Contract Administrator shall be notified immediately to facilitate the implementation of remedial measures. Remedial repair measures are subject to the approval of the Contract Administrator.
  - (iv) Dimensions and fabrication that control field matching of parts shall receive careful attention in order to avoid field adjustments.
  - (v) Field high-tensile bolted connections shall have all holes drilled or sub-punched and reamed using steel templates. Templates shall be located with utmost care as to position and angle and firmly bolted in place.
  - (vi) Cutting shall be in accordance with AWS D1.1 and CSA W59.
- (b) Clean Material
  - (i) The material shall be clean, free from rust, mill scale, and other foreign matter before being worked in the shop. Material shall be cleaned by wheelabrating, sandblasting or other methods subject to the Contract Administrator's approval.
- (c) Finish
  - (i) All portions of the Work shall be neatly finished. Shearing, cutting, chipping and machining shall be done neatly and accurately. Finished members shall be true to line and free from twists, bends, open joints, and sharp corners and edges.
- (d) Machining

- (i) General
  - Machining shall be carried out as indicated on the Drawings and in these Specifications in accordance with established machine shop practice. All machined surfaces shall be free of flaws, cracks and machining ridges and shall present a polished appearance.
- (ii) Care shall be taken that the completed surfaces are protected from damage from the time of machining until the installation in a structure.
- (iii) Grinding
  - Final grinding and machining of the surface of all tension members shall be done parallel to the tensile forces that will occur in the assembled member.
- (iv) Butting Joints
  - Butting joints in compression members shall be faced and brought to an even bearing by milling or other methods meeting the Contract Administrator's approval.
- (v) Bored Holes
  - Bored holes shall be true to specified diameter, smooth and straight, at right angles with the axis of the member and parallel with each other, unless otherwise required. The final surface shall be produced by a finished cut. Boring of holes in built-up members shall be done after assembly is complete.
- (vi) Flat Machined Surfaces
  - Where called for on the Drawings, flat machined surfaces shall be obtained by planing or machine grinding, or other methods meeting the Contract Administrator's approval. The direction of machining and the extent of the areas to be machined shall be as indicated on the Drawings or as directed by the Contract Administrator. Flat machined surfaces shall be straight, true and smooth.
- (vii) Curved Machined Surfaces
  - Curved surfaces shall be machined carefully in accordance with Drawings and Specifications in order to ensure correct fit of mating parts.
- (e) Bending
  - (i) When bending is necessary in order to meet the requirements of the design, it shall be done with care and by methods subject to the approval of the Contract Administrator. The bend line shall be at right angles to the direction of rolling. The internal radius of bend of load carrying sections shall not be less than twice the thickness of the bend section when bent cold, and if a smaller radius of bend is essential, the material shall be bent hot and later annealed. Before bending, the edges of the section in the region of the bend shall be smoothed and rounded to a radius of 2 mm.
- (f) Stress Relieving
  - (i) Stress relieving of the structure or any component parts attached to the structure shall be done only if called for on the Drawings or in the Special Provisions. If stress relieving is called for, it shall conform to the requirements of AWS D1.1 and CSA W59.
- (g) Holes
  - (i) General
    - Except where a specific method of holing materials is shown on the Drawings or required in the Special Provisions, all holes shall be either drilled or sub-punched and reamed with the exception of the holes and slots in the rectangular steel guardrail which may be punched. Poor matching holes will be cause for rejection.
  - (ii) Punched Holes and Slots
    - For holes and slots punched full size, the diameter or size of the die shall not exceed that of the punch by more than 2 mm. All holes and

slots which are punched shall have burrs and sharp edges removed. All holes shall be clean-cut without torn or ragged edges. The punching shall not distort the structural member. If required by the Contract Administrator, a sample of the punching operation shall be carried out to the satisfaction of the Contract Administrator prior to the start of fabrication.

- (iii) Drilled Holes
  - Drilling shall be done with twist drills or core drills, and all burrs and sharp edges shall be removed carefully. Care shall be taken to centre the drill accurately and to ensure that the hole is perpendicular to the member. Holes shall be clean-cut, without torn or ragged edges.
- (iv) Sub-Punched and Reamed Holes
  - All holes shall be sub-punched or sub-drilled to a diameter 5 mm smaller than the nominal hole diameter, and enlarged by reaming to the correct diameter. The diameter of the die shall not exceed the diameter of the punch by more than 2 mm. Holes shall be clean-cut without torn or ragged edges. Reamed holes shall be truly cylindrical and perpendicular to the member and all burrs shall be removed carefully. All reaming shall be done with twist reamers which shall be directed by mechanical means.
- (v) Allowable Tolerance for Holes
  - All matching holes for bolts shall register with each other so that a gauge 2 mm less in diameter than the hole shall pass freely through the assembled members in a direction at right angles to such members. Finished holes shall be not more than 2 mm in diameter larger than the diameter of the bolt passing through them unless otherwise specified by the Contract Administrator. The centre-to-centre distance between any two holes of a group of holes shall not vary by more than 1 mm from the dimensioned distance between such holes. Mispunched or misdrilled members shall not be corrected by welding.
- (h) Welding
  - (i) Specifications
    - Welding shall conform to the requirements of the Structural Welding Code - Steel of the American Welding Society AWS D1.1 and addendum and CSA W59 Welded Steel Construction.
  - (ii) Welding Operator Qualification
    - Welding operators shall be qualified in accordance with the requirements of C.W.B. at the time of fabrication for the processes that will be required as part of the Work. Qualification shall have been issued within 2 years of commencement of fabrication.
    - The reports of the results of the qualification tests shall bear the welding operator's name, the identification mark he/she will use and all pertinent data of the tests. Evidence that the welding operators have been executing satisfactory welding in the required processes within the six (6) month period immediately prior to commencement of fabrication shall also be provided to the Contract Administrator. The Contractor shall bear the whole cost and be fully responsible for the qualification of all welding operators.
  - (iii) Welding Procedures, Specifications and Qualification
    - Welding procedures that conform in all respects to the approved procedures of AWS D1.1 and CSA W59 shall be deemed as pre-qualified and are exempt from tests or qualifications.
    - Welding procedures that do not conform to approved procedures in AWS D1.1 and CSA W59 shall be qualified by tests carried out in accordance with AWS D1.1. The Contract Administrator may accept previous qualifications of the welding procedure.
  - (iv) Welding Materials

- All electrodes for manual shielded metal arc welding shall conform to the low-hydrogen classification requirements of the latest edition of the American Welding Society's Filler Metal Specification AWS A5.1 or AWS A5.5 and the CAN/CSA W48 Specification and be capable of producing weld metal having an impact strength of at least 27 J (Charpy V-Notch) at -18°C. All bare electrodes and flux used in combination for submerged arc welding, the electrode and gas shielding used in combination for gas metal-arc welding, or the electrode and shielding medium used in combination for flux cored arc welding of steels shall conform to the requirements in the latest edition of the American Welding Society AWS A5.17, A5.18 or A5.20 and CAN/CSA W48 and be capable of producing weld metal having a minimum impact strength of 27 J (Charpy V Notch) at -18°C or shall be capable of producing low alloy weld metal having the mechanical properties listed in Table 4.1.1 of AWS D1.1.
- Low alloy weld properties shall be determined from a multiple pass weld made in accordance with the requirements of the latest edition of the applicable Specification (AWS A5.17, A5.18, or A5.20) or the welding procedure specification.
- Every user shall demonstrate that each combination of electrode and shielding medium will produce weld metal having the above mechanical properties until the applicable AWS Filler Metal Specification is issued. At that time, the AWS Filler Metal Specification will control. The test assembly for Grades E100XX and E110XX shall be made using CAN/CSA G40.21M 700Q or ASTM A514/A517 steel.
- The Contract Administrator may accept evidence of record of a combination that has been satisfactory tested in lieu of the test required, provided the same welding procedure is used.
- Electrodes conforming to AWS A5.1 shall be purchased & delivered in hermetically sealed containers or shall be dried for at least two (2) hours between 230°C and 260°C before they are used. Electrodes conforming to AWS A5.5 shall be purchased & delivered in hermetically sealed containers or shall be dried 1 hour + 15 min. at a temperature of 425°C + 15°C before being used. All electrodes for use in welding ASTM A514/A517 and CSA 700 Q. steel having a strength lower than that of the E100XX classification shall be dried for 1 hour + 15 min. at a temperature of 425°C + 15°C before being used.
- Electrodes shall be dried prior to use if the hermetically sealed container shows evidence of damage. Immediately after removal from hermetically sealed containers or from drying ovens, electrodes shall be stored in ovens held at a temperature of at least 120°C. E70XX electrodes that are not used within four (4) hours, E80XX within 2 hours, E90XX within one (1) hour, and E100XX and E110XX within 0.5 hours after removal from hermetically sealed containers or removal from a drying or storage oven shall be re-dried before use. In humid atmospheres, these time limits will be reduced as directed by the Contract Administrator. Electrodes that have been wet shall not be used. Electrodes shall be re-dried no more than once.
- Flux used for submerged arc welding shall be non-hygroscopic, dry and free of contamination from dirt, mill-scale, or other foreign material. All flux shall be purchased in moisture-proof packages capable of being stored under normal conditions for at least six (6) months without such storage affecting its welding characteristics or weld properties.
- Flux from packages damaged in transit or handling shall be discarded or shall be dried before use at a minimum temperature of 120°C for 1 hour. Flux shall be placed in the dispensing system immediately upon opening a package. If flux is used from an open package or an open hopper that has been inoperative for four (4) hours or more, the top 25

mm shall be discarded. Flux that has been wet shall not be used. Flux fused in welding shall not be reused.

- (v) Preheat and Interpass Temperature
  - The minimum preheat and interpass temperatures for welding miscellaneous metal shall conform to AWS D1.1 and CSA W59.
- (vi) Welding Processes
  - Welding processes which do not conform to the provisions of AWS D1.1 or CSA W59 shall not be used without the written approval of the Contract Administrator.

BASE METAL	WELDING PROCESS					BASE METAL
	SMAW		GMAW	FCAW	SAW	
CSA G40.21M	CSA W48.1 AWS A.5.1	CSA W48.3 AWS A5.5	CSA W48.4 AWS A5.18.5.28	CSA W48.5 AWS A5.20	CSA W48.6 AWS A5.17.5.23	ASTM
230G 260W,260T	E60XX E70XX		E70S-X E70U-X	E60T-X E70T-X	F6X-XXX F7X-XXXX	A53 Gr B A500 Gr A A516Gr55.60
300W 300T	E70XX or E60XX	E70XX	E70S-X E70U-X	E70T-X <sup>a</sup> or F60T-X	F7X-XXXX or F6X-XXXX	A36 A441>4" A550GrB A501 A529 A570Gr D,E A572Gr42,45 A607Gr45
350R <sup>b,c</sup> 350A <sup>b,c</sup>  400A <sup>b,c</sup>	E70XX	E70XX	E70S-X E70U-X	E70T-X <sup>a</sup>	F7X-XXXX	A242 <sup>c</sup> A441#4" A516Gr65,70 A570Gr50,55 588 <sup>c</sup> A606 A607Gr50,55 A618 A633Gr,A,B,C,D
400G <sup>d</sup> ,400W 400T		E80XX	GrE80S	GrE80T	GrF80	A572Gr60,65
480W 480T		E90XX	GrE90S	Gr390T	GrF90	
480A <sup>b,d</sup> 700Q <sup>d</sup>		E100XX E110XX	GrE100S GrE110S	GrE100T Gr3110T	GrF100 GrF110	A514 A517

Footnotes for Matching of Base Metal and Electrode Combinations

- a) Exclusive of E70T-2, E70T-3, E70T0-G
- b) When steels of Types R and A are used in the exposed, bare, unpainted condition, the electrodes suggested or others producing a similar alloy composition in the deposited metal should be used. For applications where the material is not boldly exposed, where a colour match is not important, for all but capping passes in multipass welds and for narrow single pass welds, the electrodes suggested for Grades 300T, 400T and 480T may be used (See CAN/CSA G40.21M).
- c) See Clauses 5.2.1.4 and 5.2.1.5 and Table 5-2 of CSA W59.
- d) See Mfg. Specifications.

Use of the same-type filler metal having the next higher mechanical properties as listed in the AWS or CSA Specifications is permitted:

- 1 In joints involving base metals of different yield points or strength, filler metal applicable to the lower strength base metal may be used subject to the Contract Administrator's approval.
- 2 When welds are to be stress relieved, the deposited weld metal shall not exceed 0.05% vanadium.
- 3 See AWS D1.1 article 4.20 for Electroslag and Electrode gas weld metal requirements. Appendix C Impact Requirements are mandatory.
- 4 Lower strength filler metal may be used for fillet welds and partial penetration groove welds when indicated on the plans or in the special provisions.

- (vii) Distortion and Shrinkage Stresses

- Distortion and shrinkage stresses shall be kept to a minimum by the use of jigs and fixtures, utilizing heat distribution and a welding sequence. Areas contiguous to welding operations shall be preheated to a maximum temperature of 120°C, if necessary in the estimation of the Contract Administrator to prevent distortion or weld cracking. The provisions of AWS D1.1 and CSA W59 shall be followed in the control of distortion and shrinkage stresses.
- (viii) Tack Welding
- All tack welds shall be a minimum of 10 mm in length and made with low hydrogen electrodes and shall not be incorporated in the final structure without specific written authorization by the Contract Administrator.
- (ix) Stud Shear Connectors
- The accessories, equipment and welding procedures for the installation of the shear connectors shall be in accordance with AWS D1.1 and CSA W59. Welding by hand will not be allowed.
- (x) Hot-Dip Galvanizing
- Galvanizing, when called for on the Drawings, shall be done in accordance with ASTM A123 and CSA G164;
  - All metal surfaces to be galvanized shall be cleaned thoroughly of rust, rust scale, mill scale, dirt, paint and other foreign material to SSPC – SP 6 (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 to SSPC – SP 1.

#### E23.5.2 Handling, Delivery and Storage of Materials

- (a) Precautionary measures shall be taken to avoid damage to miscellaneous metal during handling, transit, stockpiling and erecting. Pinholes, or other field connection holes shall not be used for lifting purposes. Special attention is directed to the shipping and storing of miscellaneous metal. Damaged parts shall not be installed in the structure and may be rejected at the discretion of the Contract Administrator.
- (b) 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.

#### E23.5.3 Erection

- (a) Layout
- (i) 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.

#### E23.5.4 Workmanship

- (a) 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.
- (b) Hammering which will injure or distort the member is not permitted.

#### E23.5.5 Misfits and Field Fitting

- (a) 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.

E23.5.6 Field Welding

- (a) All field welding shall be electric arc welding, and shall be carried out in accordance with the Drawings, AWS D1.1 and CSA W59.

E23.5.7 Final Cleaning

- (a) All metal surfaces shall be left free of dirt, dried concrete, debris or foreign matter to the satisfaction of the Contract Administrator.

E23.6 Quality Control

E23.6.1 The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Work. All miscellaneous metal shall be free of surface imperfections, pipes, porosity, laps, laminations and other defects.

(a) Welding

- (i) All welding may be subject to inspection by Non-Destructive Testing. This inspection shall be carried out in a manner approved of the Contract Administrator.
- (ii) The Contractor shall provide sufficient access and shop area to permit the performance of the tests.
- (iii) 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.
- (iv) All defects revealed shall be repaired by the Contractor at their own expense and to the approval of the Contract Administrator.

E23.7 Quality Assurance

E23.7.1 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.

E23.7.2 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.

E23.7.3 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.

E23.8 Measurement and Payment

E23.8.1 Supply, Fabrication and Erection of Miscellaneous Metal will be measured on a weight basis and paid for at the Contract Unit Price per kilogram 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 and measured by the Contract Administrator.

E23.8.2 The removal, cleaning, re-galvanizing and reinstallation of existing drain grates is considered to be incidental to the Work and no separate measurement or payment will be made.