



**THE CITY OF WINNIPEG**

# **BID OPPORTUNITY**

**BID OPPORTUNITY NO. 202-2015**

**NAIRN AVENUE OVERPASS - CONCRETE GIRDER AND PIER REPAIRS**

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## **PART B - BIDDING PROCEDURES**

### **B1. CONTRACT TITLE**

B1.1 NAIRN AVENUE OVERPASS - CONCRETE GIRDER AND PIER REPAIRS

### **B2. SUBMISSION DEADLINE**

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, May 7, 2015.

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

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

### **B3. SITE INVESTIGATION**

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

B3.2 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

### **B4. ENQUIRIES**

B4.1 All enquiries shall be directed to the Contract Administrator identified in D3.1.

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

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

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

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

### **B5. CONFIDENTIALITY**

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

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

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

## **B6. ADDENDA**

- B6.1 The Contract Administrator may, at any time prior to the Submission Deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.
- B6.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.
- B6.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/bidopp.asp>
- B6.2.2 The Bidder is responsible for ensuring that he/she has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.
- B6.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

## **B7. SUBSTITUTES**

- B7.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.
- B7.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.
- B7.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.
- B7.4 The Bidder shall ensure that any and all requests for approval of a substitute:
- (a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;
  - (b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;
  - (c) identify any anticipated cost or time savings that may be associated with the substitute;
  - (d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;
  - (e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.
- B7.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his/her sole discretion grant approval for the use of a substitute as an "approved equal" or as an "approved alternative", or may refuse to grant approval of the substitute.
- B7.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, to the Bidder who requested approval of the substitute.

- B7.6.1 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.
- B7.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.
- B7.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base his/her Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B17.
- B7.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.
- B7.10 Notwithstanding B7.2 to B7.9, and in accordance with B8.6 deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B17.1(a).

## **B8. BID COMPONENTS**

- B8.1 The Bid shall consist of the following components:
- (a) Form A: Bid;
  - (b) Form B: Prices;
  - (c) Bid Security
    - (i) Form G1: Bid Bond and Agreement to Bond, or  
Form G2: Irrevocable Standby Letter of Credit and Undertaking, or  
a certified cheque or draft;
- B8.2 Further to B8.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B7.
- B8.3 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Bid.
- B8.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.
- B8.4.1 Samples or other components of the Bid which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder's Bid.
- B8.5 Bidders are advised not to include any information/literature except as requested in accordance with B8.1.
- B8.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, will be evaluated in accordance with B17.1(a).
- B8.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.
- B8.8 Bids shall be submitted to:
- The City of Winnipeg  
Corporate Finance Department, Materials Management Division  
185 King Street, Main Floor  
Winnipeg MB R3B 1J1

## **B9. BID**

- B9.1 The Bidder shall complete Form A: Bid, making all required entries.
- B9.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:
- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, his/her name shall be inserted;
  - (b) if the Bidder is a partnership, the full name of the partnership shall be inserted;
  - (c) if the Bidder is a corporation, the full name of the corporation shall be inserted;
  - (d) if the Bidder is carrying on business under a name other than his/her own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.
- B9.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B9.2.
- B9.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.
- B9.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:
- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, it shall be signed by the Bidder;
  - (b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;
  - (c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;
  - (d) if the Bidder is carrying on business under a name other than his/her own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.
- B9.4.1 The name and official capacity of all individuals signing Form A: Bid should be printed below such signatures.
- B9.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid and the Contract, when awarded, shall be both joint and several.

## **B10. PRICES**

- B10.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.
- B10.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.
- B10.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.
- B10.4 Payments to Non-Resident Contractors are subject to Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).

## **B11. DISCLOSURE**

- B11.1 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.

- B11.2 The Persons are:
- (a) Vector Corrosion Technologies

B11.3 Additional Material: Not Applicable

## **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 at <http://www.winnipeg.ca/matmgt/debar.stm>

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) 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
- (b) 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
- (c) 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 provide bid security in the form of:

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

B13.1.1 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

B13.1.2 All signatures on bid securities shall be original.

B13.1.3 The Bidder shall sign the Bid Bond.

B13.1.4 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.

B13.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

B13.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B13.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B13.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B13.3 The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

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

B14.1 Bids will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Division, or in such other office as may be designated by the Manager of Materials.

B14.1.1 Bidders or their representatives may attend.

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 Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/default.stm>

B14.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/default.stm>

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

### **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.

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 executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

### **B16. WITHDRAWAL OF BIDS**

B16.1 A Bidder may withdraw his/her Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B16.1.1 Notwithstanding C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B16.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

B16.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:

- (a) retain the Bid until after the Submission Deadline has elapsed;
- (b) open the Bid to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and
- (c) if the notice has been given by any one of the persons specified in B16.1.3(b), declare the Bid withdrawn.

B16.2 A Bidder who withdraws his/her Bid after the Submission Deadline but before his/her Bid has been released or has lapsed as provided for in B15.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

### **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 Bid Opportunity, 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 B7.

- 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 responsible and 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 will determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

## **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 responsible and 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 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid, in accordance with B17.
- B18.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his/her Bid upon written request to the Contract Administrator.

## PART C - GENERAL CONDITIONS

### C0. GENERAL CONDITIONS

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

## **PART D - SUPPLEMENTAL CONDITIONS**

### **GENERAL**

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

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

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

D2.1 The Work to be done under the Contract shall consist of concrete girder and concrete pier repair works.

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

- (a) Pier column repair
- (b) Pier cap repair
- (c) Girder end repair
- (d) End diaphragm repair
- (e) Bearing repair
- (f) Drainage modifications

#### **D3. CONTRACT ADMINISTRATOR**

D3.1 The Contract Administrator is:

Bill Ebenspanger, P.Eng.  
Sr. Structural Engineer  
1-59 Scurfield Boulevard  
Winnipeg, Manitoba R3Y 1V2  
Telephone No. 204-977-8370  
Cell No. 204-293-4520  
Facsimile No. 204-487-7470

D3.2 At the pre-construction meeting, the Contract Administrator will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

#### **D4. CONTRACTOR'S SUPERVISOR**

D4.1 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.

#### **D5. OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON DISCLOSURE**

D5.1 The Contract, all deliverables produced or developed, and information provided to or acquired by the Contractor are the property of the City and shall not be appropriated for the Contractors own use, or for the use of any third party.

D5.2 The Contractor shall not make any public announcements or press releases regarding the Contract, without the prior written authorization of the Contract Administrator.

D5.3 The following shall be confidential and shall not be disclosed by the Contractor to the media or any member of the public without the prior written authorization of the Contract Administrator;

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

D5.4 A Contractor who violates any provision of D5 may be determined to be in breach of Contract.

## **D6. NOTICES**

D6.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D6.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.3, D6.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the facsimile number identified in D3.1.

D6.3 Notwithstanding C21., all notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following facsimile number:

The City of Winnipeg  
Chief Financial Officer

Facsimile No.: 204 949-1174

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

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

## **D7. FURNISHING OF DOCUMENTS**

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

## **SUBMISSIONS**

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

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

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

D9.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D9.2 The Safe Work Plan 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>

- D9.3 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.

## **D10. INSURANCE**

- D10.1 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, rip and tear, 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) if applicable, Automobile Liability Insurance covering all motor vehicles, owned and operated and used or to be used by the Contractor directly or indirectly in the performance of the Work. The Limit of Liability shall not be less than \$2,000,000 inclusive for loss or damage including personal injuries and death resulting from any one accident or occurrence.
  - (c) 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.
- D10.2 Deductibles shall be borne by the Contractor.
- D10.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in C4.1 for the return of the executed Contract.
- D10.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least thirty (30) Calendar Days prior written notice to the Contract Administrator.

## **D11. PERFORMANCE SECURITY**

- D11.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:
- (a) a performance bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H1: Performance Bond), in the amount of fifty percent (50%) of the Contract Price; or
  - (b) an irrevocable standby letter of credit issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form attached to these Supplemental Conditions (Form H2: Irrevocable Standby Letter of Credit), in the amount of fifty percent (50%) of the Contract Price; or
  - (c) a certified cheque or draft payable to "The City of Winnipeg", drawn on a bank or other financial institution registered to conduct business in Manitoba, in the amount of fifty percent (50%) of the Contract Price.
- D11.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.
- D11.2 The Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent

and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

#### **D12. SUBCONTRACTOR LIST**

D12.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at 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.

#### **D13. EQUIPMENT LIST**

D13.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment List) at 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.

#### **D14. DETAILED WORK SCHEDULE**

D14.1 The Contractor shall provide the Contract Administrator with a detailed work schedule at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D14.2 The detailed work schedule shall consist of the following:

- (a) a critical path method (C.P.M.) schedule for the Work;
- (b) a Gantt chart for the Work based on the C.P.M. schedule;

all acceptable to the Contract Administrator.

D14.3 Further to D14.2(a), the C.P.M. schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:

D14.4 Further to D14.2(b), 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**

#### **D15. COMMENCEMENT**

D15.1 The Contractor shall not commence any Work until he/she is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D15.2 The Contractor shall not commence any Work on the Site until:

- (a) the Contract Administrator has confirmed receipt and approval of:
  - (i) evidence of authority to carry on business specified in D8;
  - (ii) evidence of the workers compensation coverage specified in C6.15;
  - (iii) the Safe Work Plan specified in D9;
  - (iv) evidence of the insurance specified in D10;
  - (v) the performance security specified in D11;
  - (vi) the Subcontractor list specified in D12;
  - (vii) the equipment list specified in D13; and
  - (viii) the detailed work schedule specified in D14.

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

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

D15.4 The City intends to award this Contract by June 1, 2015.

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

## **D16. SUBSTANTIAL PERFORMANCE**

D16.1 The Contractor shall achieve Substantial Performance by September 18, 2015.

D16.2 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.

D16.3 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.

## **D17. TOTAL PERFORMANCE**

D17.1 The Contractor shall achieve Total Performance by September 30, 2015.

D17.2 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.

D17.3 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.

## **D18. LIQUIDATED DAMAGES**

D18.1 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 two thousand, five hundred dollars (\$2,500) per Calendar Day for each and every Calendar Day following the day fixed herein for Substantial Performance during which such failure continues.

D18.2 If the Contractor fails to achieve Total Performance in accordance with the Contract by the day fixed herein for Total Performance, the Contractor shall pay the City five hundred dollars (\$500) per Calendar Day for each and every Calendar Day following the day fixed herein for Total Performance during which such failure continues.

D18.3 The amount specified for liquidated damages in D18.1 & D18.2 is based on a genuine pre-estimate of the City's damages in the event that the Contractor does not achieve Substantial or Total Performance by the day fixed herein for same.

D18.4 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

## **CONTROL OF WORK**

### **D19. JOB MEETINGS**

- D19.1 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.
- D19.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he/she deems it necessary.

### **D20. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)**

- D20.1 Further to C6.24, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

### **D21. THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA) – QUALIFICATIONS**

- D21.1 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**

### **D22. PAYMENT**

- D22.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

## **WARRANTY**

### **D23. WARRANTY**

- D23.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) years thereafter, except where longer warranty periods are specified in the respective Specification sections, unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.
- D23.1.1 For the purpose of Performance Security, the warranty period shall be one (1) year.
- D23.2 Notwithstanding C13.2, 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 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.
- D23.2.1 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.

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

KNOW ALL MEN BY THESE PRESENTS THAT

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

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

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

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

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

BID OPPORTUNITY NO. 202-2015

NAIRN AVENUE OVERPASS - CONCRETE GIRDER AND PIER REPAIRS

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

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

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

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

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

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

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

**SIGNED AND SEALED**  
in the presence of:

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

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

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

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

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

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

**FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT  
(PERFORMANCE SECURITY)**  
(See D11)

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

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 202-2015  
NAIRN AVENUE OVERPASS - CONCRETE GIRDER AND PIER REPAIRS

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

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

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

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

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

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

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

Partial drawings are permitted.

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

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

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

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

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

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

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

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

This credit is subject to the Uniform Customs and Practice for Documentary Credit (2007 Revision), International Chamber of Commerce Publication Number 600.

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

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

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



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

**NAIRN AVENUE OVERPASS - CONCRETE GIRDER AND PIER REPAIRS**

<p><b>1. 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>2. 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>3. 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>

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

**NAIRN AVENUE OVERPASS - CONCRETE GIRDER AND PIER REPAIRS**

<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 Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.3 The following Drawings are applicable to the Work:

<u>DRAWING NO.</u>	<u>DRAWING TITLE</u>
B121-2015-01	COVER SHEET, LOCATION PLAN & DRAWING INDEX
B121-2015-02	SCOPE OF WORK & GENERAL NOTES
B121-2015-03	SITE PLAN
B121-2015-04	PIER COLUMN REPAIRS
B121-2015-05	PIER CAP, GIRDER & BEARING REPAIRS – SHEET 1
B121-2015-06	PIER CAP, GIRDER & BEARING REPAIRS – SHEET 2
B121-2015-07	DRAINAGE MODIFICATIONS

- E1.4 The following are provided for the Contractor's reference:

NAIRN AVENUE OVERPASS – PIER CONCRETE REPAIR  
& CORROSION MITIGATION WORKS (2002)

<u>DRAWING NO.</u>	<u>DRAWING TITLE</u>
B121-02-01AC	SITE PLAN
B121-02-02AC	PIER ELEVATIONS
B121-02-03AC	SECTIONS & DETAILS

NAIRN AVENUE OVERPASS – DECK REHABILITATION, STRUCTURAL STRENGTHENING  
AND RELATED WORKS (1985)

<u>DRAWING NO.</u>	<u>DRAWING TITLE</u>
B121-85-01 (B-5566)	COVER PAGE
B121-85-02 (B-5568)	DESIGN DATA AND DRAWING LIST
B121-85-03 (B-5569)	GENERAL ARRANGEMENT AND ITEMS OF PROPOSED WORKS
B121-85-04 (B-5570)	PLAN AND GENERAL ELEVATION OF EXISTING AND PROPOSED OVERPASS
B121-85-06 (B-5572)	PIER MODIFICATIONS
B121-85-07 (B-5573)	GIRDER STRENGTHENING I
B121-85-08 (B-5574)	GIRDER STRENGTHENING II
B121-85-09 (B-5575)	BEARING DETAILS
B121-85-17 (B-5583)	DECK DRAIN DETAILS
B121-85-20 (B-5586)	SLOPE PAVING DRAINAGE CHANNEL DETAILS
B121-85-21A (B-5587)	REINFORCING STEEL SCHEDULE
B121-85-21B (B-5588)	REINFORCING STEEL SCHEDULE

NAIRN AVENUE GRADE SEPARATION (1967)

<u>DRAWING NO.</u>	<u>DRAWING TITLE</u>
B121-67-1-1	80' SPAN GIRDER DETAILS [SHOP DRAWING]
B121-67-1-2	70' SPAN GIRDER DETAILS [SHOP DRAWING]
B121-67-49 (B5045-49)	PIERS 1 TO 5 & 7 TO 10
B121-67-51 (B5045-51)	GIRDER LAYOUT B
B121-67-52 (B5045-52)	PRECAST GIRDER DETAILS
B121-67-53 (B5045-53)	BEARING PAD AND DIAPHRAGM DETAILS
B121-67-59 (B5045-59)	REINFORCING SCHEDULE B
B121-67-60 (B5045-60)	REINFORCING SCHEDULE B

**E2. MOBILIZATION AND DEMOBILIZATION**

**E2.1 Description**

- (a) This Specification shall cover all operations relating to the mobilization and demobilization of the Contractor to the Bridge 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) Mobilizing and demobilizing on-site Work facilities;
  - (ii) Supplying, setting up, laying out, and removing site office facilities as detailed in E3 "Site Office Facilities";
  - (iii) Supplying and installing secure fencing around the site;
  - (iv) Maintaining and removing any access roadways; and
  - (v) Restoring all existing facilities.

**E2.3 Materials**

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

**E2.4 Equipment**

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

**E2.5 Construction Methods**

**E2.6 Layout of On-Site Work Facilities**

- (a) The Contractor shall mobilize all on-site Work and other temporary facilities.
- (b) Possible locations for the Contractor's staging areas include the City of Winnipeg Park areas on the north side of the Bridge. The Contractor shall coordinate with relevant parties to make arrangements for use of these areas.
- (c) Upon completion of construction activities, the Contractor shall remove all on-site Work and other temporary facilities.

E2.7 Cellular Telephone Communication

- (a) The Contractor's site supervisor is required to carry, at all times, a cellular telephone, with voice mail.

E2.8 Secure Site Fencing

- (a) A minimum 1.8 m high chain-link or wire grid secure fence around the site lay-down, lavatory facilities, and Work site areas shall be installed prior to commencement of site activities.
- (b) The fencing shall remain secure and in place for the full duration of the Work.
- (c) Access points to the fencing shall be secured by padlocks or other appropriate means outside of working hours.
- (d) The fencing shall be removed upon demobilization of on-site Work facilities.

E2.9 Traffic Gates

- (a) The Contractor shall supply, install, maintain, and remove steel gates to keep non-Contract traffic and pedestrians out of the Work site.
- (b) Traffic gates shall nominally match the height of the secure site fencing and shall be continuous with the secure site fencing.
- (c) The gates shall be removed upon completion of construction activities.

E2.10 Access Roadway

- (a) The Contractor shall maintain any access roadway they install.
- (b) The access road shall be maintained on a regular basis to provide continual unrestricted site access, to the satisfaction of the Contract Administrator.
- (c) City of Winnipeg streets and alleys adjacent to all access roads and staging areas must be kept clean at all times.
- (d) Upon completion of the Work, the area shall be restored to its original condition.

E2.11 Restoration of Existing Facilities

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

E2.12 Quality Control

E2.12.1 Inspection

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

E2.12.2 Access

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

## E2.13 Measurement and Payment

### E2.13.1 Mobilization and Demobilization

- (a) Mobilization and demobilization shall not be measured. This item of work shall be paid for at the Lump Sum Price for "Mobilization and Demobilization", which price shall be paid in full for supply all materials and performing all operations herein described and all other items incidental to the Work. Payment will be based on the following breakdown:
- |                                   |     |
|-----------------------------------|-----|
| (i) Commencement of Construction  | 30% |
| (ii) During Construction          | 60% |
| (iii) Upon Completion of the Work | 10% |

## E3. SITE OFFICE FACILITIES

### E3.1 Description

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

### E3.2 Materials

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

### E3.3 Equipment

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

### E3.4 Construction Methods

#### E3.4.1 Site Office Facilities

- (i) The Contractor shall supply the Contract Administrator's site office facilities meeting the following requirements:
- (ii) A site office shall be provided for the exclusive use of the Contract Administrator.
- (iii) The office shall be conveniently located within the site lay-down area near the Work site.
- (iv) The office shall be a newer building with a minimum floor area of 20 square metres, having a ceiling height of 2.4 m and adequate windows (complete with security bars) to provide for cross ventilation, with door entrance(s) with suitable lock(s).
- (v) The office shall be suitable for all weather use. It shall be equipped with suitable heating and air conditioning systems, so that the interior room temperature can be maintained between 20 to 22°C at any outside ambient temperature.
- (vi) The office shall be adequately lighted with fluorescent fixtures and have a minimum of 3 wall outlets.
- (vii) The office shall be furnished with one office desk with minimum plan dimensions 3' x 6' and two chairs, , one meeting table, two bookcases, and a minimum of eight (8) chairs.
- (viii) The office shall be equipped with reliable internet access, either provided by ethernet cable (hard line) or wireless internet service. Any wireless internet access shall be secured by an access password and by conventional WPA2 256-bit

encryption to prevent unauthorized access. If wireless internet access is not provided, then a minimum of two ethernet connections shall be provided.

- (ix) The office shall be equipped with an individual size fridge having minimum nominal volume of 1.7 cubic feet, and a microwave.
- (x) The site office building shall be cleaned on a weekly basis. The Contract Administrator may request additional cleaning when he deems it necessary.
- (xi) A minimum of three parking stalls shall be made available for use by the Contract Administrator immediately adjacent to the site office.
- (xii) All site office facilities and furnishings shall be approved by the Contract Administrator.
- (xiii) The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the site office facilities.
- (xiv) The site office facilities shall be provided from the date of the commencement of the Work to the date of Total Performance unless otherwise approved in writing by the Contract Administrator.

#### E3.4.2 Site Lavatory Facilities

- (i) A minimum of one portable flush or chemical-type toilet, lavatory, and mirror shall be provided at each of Pier #3 and Pier #8 work sites (refer to the Drawings). The portable toilets shall be accessible to the Contract Administrator at all times.
- (ii) The portable toilets shall be cleaned on a weekly basis. The Contract Administrator may request additional cleaning when he deems it necessary;

#### E3.5 Measurement and Payment

##### E3.5.1 Site Office Facilities

- (a) The supply of site office facilities, including site lavatory facilities, shall not be measured. This item of Work shall be included in the Lump Sum Price for "Mobilization and Demobilization", which price shall be paid in full for supply all materials and performing all operations herein described and all other items incidental to the Work.

### **E4. CONCRETE REMOVALS**

#### E4.1 Description

- (a) This Specification shall cover all operations relating to the removal and disposal of 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, dismantlement, 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 Works as hereinafter specified.

#### E4.2 Scope of Work

- (a) The Work under this Specification shall include the removal and disposal of existing girder, end diaphragm and pier column concrete to the limits as shown on the Drawings or as otherwise directed by the Contract Administrator.
- (b) Removing concrete with appropriate equipment satisfactory to the Contract Administrator.
- (c) Providing saw cuts where necessary to limit the extent of demolition.
- (d) Repairing any over demolition and reinforcing damage to the satisfaction of the Contract Administrator.
- (e) All concrete removal materials shall revert to the Contractor for off-site disposal.

#### E4.3 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.

#### E4.4 Materials

##### E4.4.1 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.

#### E4.5 Equipment

##### E4.5.1 General

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

##### E4.5.2 Demolition Catch Platforms and Work Platforms

- (a) The Contractor shall provide all necessary access/work platforms to facilitate concrete removals and associated inspection of all Works by the Contract Administrator.
- (b) Any proposal to drill into the existing bridge structure to secure any platforms must be submitted in writing to the Contract Administrator for review and acceptance prior to proceeding with any Work.

#### E4.6 Construction Methods

##### E4.6.1 General

- (a) It is noted that the pier columns are primary load-bearing members in a single-load-path structural systems and a high standard of care is required during all stages of construction.
- (b) Concrete shall be removed to the limits shown on the Drawings. Any unsound concrete detected beyond the removal extents depicted in the Drawings shall be reported to the Contract Administrator immediately. Removals beyond the limits shown on the Drawings shall only proceed as directed by and in the presence of the Contract Administrator.
- (c) The Contractor shall prevent movement, settlement, or damage of existing structures to remain, services, paving, trees, landscaping and adjacent grades. If the safety of the structure and/or existing structures or services appears to be endangered during structural removal operations, the Contractor shall cease operations and notify the Contract Administrator immediately.
- (d) The Contractor shall provide flagmen, guards, barricades, railings, and necessary warning lights, and whenever necessary, warning signs and lights at the excavations, temporary sidewalks, removals, and/or other construction, to secure the safety of workmen and the public. The safety precautions shall comply with all Provincial Statutes applicable to the Work. The Contractor shall provide all other protective measures as may be required by any law in force in Manitoba and the Canada Labour Code.
- (e) 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.
- (f) Under no circumstances shall the Contractor close any portion of existing roadways or walkways to traffic without prior written approval of the Contract Administrator. If any existing roadway is to be closed to traffic in no case shall the Contractor commence any construction operations until such time as all the signs, barricades, and flashers have been erected to the satisfaction of the Contract Administrator.

- (g) Remove concrete and other removal items with appropriate equipment satisfactory to the Contract Administrator. Jackhammers heavier than nominal 14 kg class and chipping hammers heavier than nominal 7 kg class shall not be used. The Contractor shall take all necessary precautions to ensure that material do not fall onto any roadways or sidewalks during removal operations.
- (h) 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.
- (i) The Contractor shall only use methods of concrete removal that will not damage the existing structure to remain or new structures.
- (j) Provide sawcuts where necessary to limit the extent of demolition.
- (k) Repair any over demolition and reinforcing steel damage to the satisfaction of the Contract Administrator.

#### E4.6.2 Details of Existing Structure

- (a) The applicable details and structure dimensions of the existing structures are shown on the Drawings for information only in establishing the methods and limits of Work.
- (b) The accuracy of this information is not guaranteed and the Contractor must verify all information before commencing Work.

#### E4.6.3 Waste Handling and Disposal of Removed Materials

- (a) Wherever practical, the Contractor shall recycle disposed materials.
- (b) 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 from the Contract Administrator. It shall be the Contractor's responsibility to find suitable disposal areas away from the site.

#### E4.7 Quality Control

##### E4.7.1 Inspection

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

##### E4.7.2 Access

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

#### E4.8 Measurement and Payment

##### E4.8.1 Concrete Removals

- (a) Concrete removals will be measured on an area basis and paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work, included in this Specification and accepted by the Contract Administrator.

- E4.8.2 Items of Work:
- (a) Concrete Removals:
    - (i) Pier Columns;
    - (ii) End Diaphragms; and
    - (iii) Girders.

## **E5. STRUCTURAL EXCAVATION**

### **E5.1 Description**

- (a) This Specification shall cover all operations relating to the clearing, grubbing, and structural excavation for pier repair Works, as specified herein and in the latest version of the City of Winnipeg Standard Construction Specification CW 2030, 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.

### **E5.2 Referenced Specifications and Drawings**

- (a) The latest version of the City of Winnipeg Standard Construction Specifications
  - (i) CW 2030 – Excavation Bedding and Backfill.

### **E5.3 Scope of Work**

- (a) The Work under this Specification shall involve:
  - (i) Excavating all material required to construct the Works;
  - (ii) The design, fabrication, erection, and removal of all temporary shoring, and such temporary protective measures as may be required to construct the Works;
  - (iii) Off-site disposing of excavated material;
  - (iv) Dewatering of all excavations, as required, to construct the Works;
  - (v) Incidental demolition and off-site disposal of portions of existing concrete settlement ponds and concrete drainage channels; and
  - (vi) Incidental demolition and off-site disposal of all existing chain link fence enclosures located at each existing concrete settlement pond.

### **E5.4 Submittals**

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.
- (b) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any Work on the Site, detailed design calculations and Shop Drawings for all shoring that is signed, sealed, and dated by a Professional Engineer experienced in shoring design and licensed to practice in Province of Manitoba.
- (c) The Professional Engineer who designed the shoring system shall inspect the shoring system during construction, and certify, in writing to the Contract Administrator, that construction is in conformance with the approved design.

### **E5.5 Materials**

#### **E5.5.1 General**

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

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

#### E5.5.2 Excavation

- (a) Excavated material shall be unclassified excavation and shall include the excavation and satisfactory disposal of all cleared and grubbed materials, surplus concrete pavement, asphalt pavement, earth, gravel, sandstone, loose detached rock, shale, rubbish, cemented gravel or hard pan, disintegrated stone, rock in ledge or mass formation wet or dry, trees, shrubs, or all other material of whatever character which may be encountered.
- (b) All excavated materials shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the Owner for any materials taken by the Contract Administrator for testing purposes.

#### E5.6 Equipment

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

#### E5.7 Construction Methods

##### E5.7.1 Excavation

- (a) Prior to commencing any excavation Works, underground clearances shall be obtained from all applicable utilities by the Contractor. Due care and caution shall be taken by the Contractor to work around all identified underground utilities.
- (b) The shored excavations shall be made in a manner such that all abutment Works may be properly constructed to the required depths and without reduction of dimensions as shown on the Drawings.
- (c) The dimensions of the shored excavation shall be such as to give sufficient clearances for the construction of forms and their subsequent removal and the construction of cutoff trenches and/or sumps to permit the pumping of water outside the limits of the excavations.
- (d) Excavations shall be completed to the elevations required to construct the Works or to such other elevations as may be directed by the Contract Administrator in the field. Excavation sequence shall be done in a "top down" direction, in order to maintain stability. The dimensions of excavation shall be such as to give sufficient clearances for the construction of forms and their subsequent removal.
- (e) All material shall be brought to the surface by approved method, and shall be disposed of away from the Site. Shored excavations shall be dewatered and maintained dewatered so that the material is excavated in its natural state. The bottom of the excavation shall be kept free from excessive moisture or free-flowing water.

##### E5.7.2 Alterations to Site

- (a) The Contractor shall excavate only material that is necessary for the expeditious construction of the structure or as set out by the Contract Administrator in the field. If the Contract Administrator permits the excavation of runways, existing stock piling, or trenches within the right-of-way, the Contractor shall, on completion of the Work, backfill the runways and trenches to the elevation of the original ground existing at the time of excavation and compact the backfill material, all at his own expense and as directed by the Contract Administrator.
- (b) The Contractor shall minimize the excavation extents to minimize the impact on existing infrastructure, including but not limited to removals of existing concrete settlement ponds and concrete drainage channels. Construction methods for concrete removals shall be as per Specification E4. Such removals are considered incidental to structural excavation.
- (c) The Contractor shall demolish and remove off site all chain link fence enclosures located at each existing concrete settlement pond as shown on the Drawings. Such removals are considered incidental to structural excavation.

E5.7.3 Excavated Material

- (a) All excavated material shall become the property of the Contractor and shall be removed from the Site.

E5.8 Quality Control

E5.8.1 Inspection

- (a) After each excavation is completed, the Contractor shall notify the Contract Administrator to inspect the excavation.
- (b) 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.
- (c) 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.

E5.8.2 Access

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

E5.9 Measurement and Payment

E5.9.1 Structural Excavation

- (a) Structural excavation shall be considered incidental to the applicable portions of structural Work requiring excavation, and no separate measurement or payment shall be made for this Work.

**E6. STRUCTURAL BACKFILL**

E6.1 Description

- (a) This specification shall cover all operations related to backfill work as herein specified and in the latest version of the City of Winnipeg Standard Construction Specifications CW 3110, CW 3170, 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, tolls, supplies, and all things necessary for and incidental to the satisfactory performance, and completion of all works as hereinafter specified.

E6.2 Referenced Specifications and Drawings

- (a) The latest version of the City of Winnipeg Standard Construction Specifications
  - (i) CW 3110 – Subgrade, Sub-Base, and Base Course Construction;
  - (ii) CW 3170 – Earthwork and Grading; and
  - (iii) CW 3310 – Portland Cement Concrete Pavement Works.

E6.3 Scope of Work

- (a) The Work under this Specification shall involve:
  - (i) Supplying and placing granular backfill for pier repair Work at the east and west columns of Pier #3 and Pier #8;
  - (ii) Supplying and placing structural backfill for all other elements required to construct the Works;

- (iii) Reconstruction of demolished portions of existing concrete settlement ponds and concrete drainage channels; and
- (iv) Quality Control and Quality Assurance testing, including retention of a third-party testing company, acceptable to the Contract Administrator, retained and paid for by the Contractor. Quality Control testing shall be undertaken by the Contractor.

#### E6.4 Submittals

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.

#### E6.5 Materials

##### E6.5.1 General

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

##### E6.5.2 Concrete

- (a) Concrete supplied shall be as per Specification CW 3310, Clause 6.2 (a).

##### E6.5.3 Granular Backfill

- (a) Granular backfill shall conform to the requirements of the latest version of the City of Winnipeg Standard Construction Specification CW 3110 for Sub-base material of maximum 50 mm size.

##### E6.5.4 Reinforcing Steel

- (a) Reinforcing steel material shall be in accordance with Specification E7.5

##### E6.5.5 Equipment

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

#### E6.6 Construction Methods

##### E6.6.1 Backfilling

- (a) All materials shall be accepted by the Contract Administrator at least seven (7) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials in whole or in part, do not conform to the Specification detailed herein, or are found to be defective in manufacture, or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.
- (b) Any backfill material that does not meet the gradation and/or compaction requirements of this Specification shall be removed and replaced by the Contractor at his own expense, to the satisfaction of the Contract Administrator.
- (c) Backfill materials shall be free of frozen lumps and shall be placed and compacted in an unfrozen state. Backfill shall not be placed on frozen subsoil.

##### E6.6.2 Reconstruction of Settlement Ponds and Drainage Channels

- (a) Construction methods for reconstruction of settlement ponds and drainage channels shall be as per Specification CW 3310, Clause 9. Such reconstruction work is considered incidental to structural backfill.
- (b) Construction methods for placement of reinforcing steel including installing into hardened concrete shall be as per Specification E7.11. Reinforcing steel shall be measured and paid for as per Specification E7.18.

#### E6.7 Quality Assurance and Quality Control

- (a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing including all operations from the selection and production of materials through to final acceptance of the specified Work.
- (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
- (c) The Contractor will be required to retain a qualified third-party testing company to undertake Quality Assurance tests. All test results are to be copied to the Contract Administrator immediately after the tests have been performed.
- (d) The Contract Administrator shall be notified at least one (1) Working Day in advance of any backfilling operations. No backfill shall be placed against any concrete until accepted by the Contract Administrator.
- (e) All backfilling work shall take place under the supervision of the Contract Administrator. The Contractor shall notify the Contract Administrator when backfilling work is to take place.
- (f) The frequency and number of tests to be made shall be subject to approval by the Contract Administrator.

#### E6.8 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 inspector for testing purposes as required. There will be no charge for samples taken.

#### E6.9 Measurement and Payment

##### E6.9.1 Structural Backfill

- E6.9.2 Supplying and placing structural backfill shall be considered incidental to the applicable portions of structural concrete work requiring backfill, and no measurement or payment shall be made for this Work.

### E7. REINFORCING STEEL

#### E7.1 Description

- (a) This Specification shall cover all operations relating to the supply, fabrication, and placement of black reinforcing steel, and associated bar accessories, as specified herein and as shown on the Drawings.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified

#### E7.2 Referenced Specifications and Drawings

- (a) The latest edition and subsequent revisions of the following:
  - (i) ASTM 615M – Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement;
  - (ii) ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete;
  - (iii) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
  - (iv) CAN/CSA G30.18 – Billet-Steel Bars for Concrete Reinforcement;

- (v) Reinforcing Steel Institute of Canada (RSIC) – Reinforcement Steel Manual of Standard Practice.

### E7.3 Scope of Work

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

### E7.4 Submittals

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.

### E7.5 Materials

#### E7.6 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.

#### E7.6.1 Handling and Storage of Materials

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

#### E7.7 Reinforcing Steel

- (a) Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) All reinforcing steel shall conform to the requirements of CAN/CSA G30.18, Grade 400W.
- (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.
- (d) All reinforcing steel shall be straight and free from paint, oil, millscale, and injurious defects. Rust, surface seams or surface irregularities will not be cause for rejection, provided that the minimum dimensions, cross sectional area, and tensile properties of a hand-wire-brushed specimen are not less than specified.

#### E7.8 Bar Accessories

- (a) Bar accessories shall be of types suitable for each type of reinforcing and acceptable to the Contract Administrator. They shall be made from a non-rusting material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (b) Bar chairs, bolsters, and bar supports shall be made from cementitious material. No plastic or PVC, or galvanized bar supports shall be used.
- (c) The use of pebbles, pieces of broken stone or brick, plastic, metal pipe, and wooden blocks, will not be permitted.
- (d) Placing of bar supports shall be done to meet the required construction loads.

- (e) Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices that may be approved by the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

#### E7.9 Epoxy Adhesive

- (a) Epoxy resin (also called "epoxy adhesive") shall conform to the requirements of ASTM C881. Type IV, Grade 3 epoxy shall be used for bonding reinforcing steel into hardened concrete. An approved product is Hilti Hit HY 200 or equal, as approved by the Contract Administrator in accordance with B7 "Substitutes".

#### E7.10 Equipment

##### E7.10.1 General

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

#### E7.11 Construction Methods

##### E7.11.1 Fabrication of Reinforcing Steel

- (a) 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.

#### E7.12 Reinforcing Steel

##### E7.12.1 Black Steel Reinforcing

- (a) Heating shall not be used as an aid in bending black steel reinforcing.
- (b) Hooks and bends should be smooth and not sharp.
- (c) Fabrication of the black steel reinforcing shall be straight and free of paint, oil, mill scale, and injurious defects.

#### E7.13 Placing and Fastening of Reinforcing Steel

##### (a) General

- (i) Reinforcing steel shall be placed accurately in the positions shown on the Drawing and shall be retained in such positions by means of a sufficient number of bar accessories so that the bars shall not be moved out of alignment during or after the depositing of concrete. The Contract Administrator's decision in this matter shall be final.
- (ii) Reinforcing steel shall be free of all foreign material in order to ensure a positive bond between the concrete and steel. The Contractor shall also remove any dry concrete which has been deposited on the steel from previous pouring operations before additional concrete may be placed. Intersecting bars shall be tied positively at each intersection.
- (iii) Splices in reinforcing steel shall be made only where indicated on the Drawing. Prior acceptance by the Contract Administrator shall be obtained where other splices must be made. Welded splices shall not be permitted.
- (iv) Reinforcing steel shall be placed to provide a clear space between the reinforcing bars as shown on the Drawings to accurately place preformed holes where necessary.
- (v) Reinforcing steel shall not be straightened or re-bent in a manner that will injure the metal. Bars with bends not shown on the Drawings shall not be used. Heating of reinforcing steel shall not be permitted without prior acceptance by the Contract Administrator.
- (vi) Reinforcing steel shall be placed within the tolerances specified in CAN/CSA A23.1

- (vii) The Contractor shall supply and place all necessary support accessories to ensure proper placement of reinforcing steel. All reinforcement shall be accurately placed in the positions shown on the Drawings, and firmly tied and chaired before placing the concrete.
- (viii) Distances from the forms shall be maintained by means of stays, spacers, or other approved supports. Spacers and supports for holding reinforcing steel at the required location and ensuring the specified concrete cover over the reinforcing steel shall be as specified in E9.3.11 "Bar Accessories.
- (ix) Welding or tack welding is not permitted unless formally directed in writing by the Contract Administrator.
- (x) Unless otherwise shown on the Drawings, the minimum distance between bars shall be 40 mm.

#### E7.14 Splicing

##### (a) General

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

#### E7.15 Installing Reinforcing Steel into Hardened Concrete

- (a) The Contractor shall drill holes into adjacent slabs for hooks of the diameters and depths specified for each size of reinforcing steel, as shown on the Drawings. Drill bits shall have a diameter no larger than 2 mm larger than the nominal dowel, tie bar, or stud diameter.
- (b) Holes shall be located to the correct depth and alignment as indicated on the Drawings. The spacing of the holes shall be as per RSIC.
- (c) Drilling equipment shall be operated so as to ensure that no damage to the pavement results from such drilling operation. Coring of holes is not permitted. In the event that existing reinforcing steel bars are hit during the drilling operations, the hole shall be abandoned and a new hole shall be drilled nearby to the correct depth. All abandoned holes shall be filled with non-shrink grout.
- (d) Holes for reinforcing steel shall be drilled and prepared according to the instructions of the manufacturer of the epoxy adhesive to be used which has been accepted by the Contract Administrator.
- (e) Once all reinforcing steel is in position, it shall be inspected and approved by the Contract Administrator before any new concrete is placed. Otherwise, the concrete may be rejected by the Contract Administrator and shall be removed by the Contractor at his own expense.

#### E7.16 Quality Control

##### E7.16.1 Inspection

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

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

#### E7.16.2 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.

#### E7.17 Quality Assurance

##### E7.17.1 Testing

- (a) Quality Assurance testing shall be used to determine the acceptability of the reinforcing steel supplied by the Contractor.
- (b) The Contractor shall provide, without charge, the samples of reinforcing steel required for Quality Assurance Tests and provide such assistance and use of tools and construction equipment as is required.
- (c) The Contractor shall submit mill certificates for the reinforcing steel to the Contract Administrator at least 5 working days before the installation of reinforcing steel.

#### E7.18 Measurement and Payment

##### E7.18.1 Reinforcing Steel

- (a) Reinforcing steel bars will be measured on a mass basis and paid for at the Contract Unit Price per kilogram for "Supply and Place Reinforcing Steel", which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted and measured by the Contract Administrator.
- (b) Supplying and installing all the listed materials, construction methods, and quality control measures associated with this Specification and Drawings shall be considered incidental to "Supply and Place Reinforcing Steel", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

##### E7.18.2 Install Reinforcing into Existing Concrete

- (a) Installing reinforcing steel into hardened concrete will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Install Reinforcing Steel Into Hardened Concrete", which price shall be paid 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. This payment shall be made in addition to the mass of steel measured above.

### **E8. SELF-COMPACTING CONCRETE**

#### E8.1 Description

- (a) This Specification shall cover all operations relating to the preparation of self-compacting concrete for, and all concreting operations related to, the construction of 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.

## E8.2 Referenced Specifications and Drawings

- (a) The latest edition and subsequent revisions of the following:
- (i) ACI 309 – Guide for Consolidation of Concrete;
  - (ii) ACI 347 – Guide to Formwork for Concrete;
  - (iii) American Concrete Publication SP4 – Formwork for Concrete;
  - (iv) ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings;
  - (v) ASTM C131 – Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine;
  - (vi) ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete;
  - (vii) ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete;
  - (viii) ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete;
  - (ix) ASTM C494 – Standard Specification for Chemical Admixtures for Concrete;
  - (x) ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete;
  - (xi) ASTM C1202 – Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration;
  - (xii) ASTM C1399 – Standard Test Method for Obtaining Average Residual-Strength of Fibre-Reinforced Concrete;
  - (xiii) ASTM C1609 – Standard Test Method for Flexural Performance of Fibre-Reinforced Concrete (Using Beam with Third Point Loading);
  - (xiv) ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types);
  - (xv) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
  - (xvi) CAN/CSA A3001 – Cementitious Materials for Use in Concrete;
  - (xvii) CAN/CSA G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel;
  - (xviii) CAN/CSA G164-M92 – Hot Dip Galvanizing of Irregularly Shaped Articles;
  - (xix) CAN/CSA O121 – Douglas Fir Plywood;
  - (xx) CAN/CSA-S6 – Canadian Highway Bridge Design Code;
  - (xxi) CAN/CSA S269.1 – False Work for Construction Purposes;
  - (xxii) CAN/CSA S269.3 – Concrete Formwork;
  - (xxiii) ICRI Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers, and Polymer Overlays;
  - (xxiv) Ministry of Transportation Ontario MTO Lab Test Method LS 609 – Petrographic Analysis of Coarse Aggregate; and
  - (xxv) Ontario Provincial Standard Specification OPSS 1010 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.
  - (xxvi) SSPC-SP6/NACE No.3 Commercial Blast Cleaning

## E8.3 Scope of Work

- (a) The Work under this Specification shall involve the following concrete Works:
- (i) Pier repair self-compacting concrete Works shall comprise of new cast-in-place pier column jackets at Pier #3 and Pier #8.
  - (ii) Quality Control and Quality Assurance testing, including retention of a third-party testing company, acceptable to the Contract Administrator, retained and

paid for by the Contractor. Quality Control testing shall be undertaken by the Contractor.

#### E8.4 Submittals

##### E8.4.1 General

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, a proposed schedule, including methods, material and sequence of operations.

#### E8.5 Concrete Mix Design Test Data

##### (a) Concrete

- (i) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, test data showing that the concrete to be supplied will meet the performance criteria stated in this Specification for each concrete type.
- (ii) The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

##### E8.5.1 Notification of Ready Mix Supplier

- (a) The Contractor shall submit to the Contract Administrator the name and qualifications of the Ready Mix Concrete Supplier that he is proposing to use, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement. The Contract Administrator will verify the acceptability of the Supplier and the concrete mix design requirements. Acceptance of the Supplier and the concrete mix design(s) by the Contract Administrator does not relieve or reduce the responsibility of the Contractor or Supplier from the requirements of this Specification.

##### E8.5.2 Temporary False Work, Formwork and Shoring Works

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the scheduled erection of Temporary False Work, Formwork, and Shoring Works, Shop Drawings for any temporary Works, including false work, formwork, and shoring, that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.
- (b) Design Requirements
  - (i) All forms shall be of wood, metal or other materials as approved by the Contract Administrator.
  - (ii) The false work, formwork, and shoring for these Works shall be designed by a Professional Engineer registered in the Province of Manitoba. False work shall be designed according to the requirements of the requirements of the CAN/CSA S269.1. The Shop Drawings shall bear the Professional Engineer's seal. Shop Drawings submitted without the seal of a Professional Engineer will be rejected. The submission of such Shop Drawings to the Contract Administrator shall in no way relieve the Contractor of full responsibility for the safety and structural integrity of the formwork and shoring.
  - (iii) The false work, formwork, and shoring for these Works shall be designed to safely support all vertical and lateral loads until such loads can be supported by the concrete all in accordance with the requirements of CAN/CSA S269.3. All proposed fastening methods to the existing structure must be submitted to the Contract Administrator for review and approval. Drilling into the precast concrete girders will not be accepted.
  - (iv) The loads and lateral pressures outlined in Part 3, Section 102 of ACI 347 and wind loads as specified by the Manitoba Building Code shall be used for design and the formwork design must be calculated to resist at least the full hydrostatic concrete pressure. Additional design considerations concerning factors of

- safety for formwork elements and allowable settlements outlined in Section 103 of the above reference shall apply.
- (v) As a minimum, the following spacing's shall apply, for studding and waling:
  - (vi) 20-mm plywood: studding 400 mm centre to centre (max.),
  - (vii) Walers 760 mm centre to centre (max.)
  - (viii) Forms shall be designed and constructed so that the completed Work will be within minus 3 mm or plus 6 mm of the dimensions shown on the Drawings.
  - (ix) Formwork shall be designed to provide camber, where applicable, to maintain the specified tolerance to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete, due to construction loads.
  - (x) Slots, recesses, chases, sleeves, inserts, bolts, hangers, and other items shall be accommodated in the design, in coordination and cooperation with the trade concerned. No openings in structural members are to be shown on the Shop Drawings without the prior written approval of the Contract Administrator.
  - (xi) Shores shall be designed with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.
  - (xii) Mud sills of suitable size shall be designed beneath shores, to be bedded in sand or stone, where they would otherwise bear on soil. The soil below shores must be adequately prepared to avoid settlement during or after concreting. Shores must not be placed on frozen ground.
  - (xiii) Shores shall be braced horizontally in two directions and diagonally in the same two vertical planes so that they can safely withstand all dead and moving loads to which they will be subjected.
  - (xiv) All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.
  - (xv) Formwork shall be designed to have sufficient strength and rigidity so that the resultant finished concrete conforms to the shapes, lines, and dimensions of the members shown on the Drawings.
  - (xvi) Forms shall be designed to be sufficiently tight to prevent leakage of grout or cement paste.
- (b) Shop Drawings shall show design loads, type, and number of equipment to be used for placing the concrete, method of construction, method of removal, type and grade of materials, and any further information that may be required by the Contract Administrator. The Contractor shall not proceed with any Work on site until the Shop Drawings have been reviewed and approved in writing by the Contract Administrator. False work must be designed to carry all loads associated with construction of overhangs including deflection due to dead loads, placement of concrete, hoarding, construction live loads, and any other loads that may occur.
  - (c) For timber formwork and false work, the Shop Drawings shall specify the type and grade of lumber and show the size and spacing of all members. The Shop Drawings shall also show the type, size and spacing of all ties or other hardware, and the type, size and spacing of all bracing.

## E8.6 Materials

### E8.6.1 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.

**E8.6.2 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.

**E8.6.3 Concrete**

- (a) Concrete materials susceptible to frost damage shall be protected from freezing.
- (b) Concrete shall be Agilia Vertical, LaFarge North America, proprietary ready-mix concrete, or accepted equal and meet the requirements for hardened concrete as specified in the following Table E8.1.

<b>TABLE E8.1 REQUIREMENTS FOR HARDENED CONCRETE</b>							
<b>Type of Concrete</b>	<b>Location</b>	<b>Nominal Compressive Strength MPa</b>	<b>Class of Exposure</b>	<b>Air Content Category</b>	<b>Max Aggregate Size</b>	<b>Special Requirements</b>	<b>Slump-Flow</b>
Type 1	Pier Column Jackets	35 @ 28 Days	C-1	1	10 mm	Self-Compacting Concrete  28-Day Moist Cured Electrical Resistivity < 15,000 ohm-cm  Low-Shrinkage Concrete according to the definition of CAN/CSA-A23.1, Clause 8.9.2	550-650 mm

**E8.6.4 Formwork**

- (a) Formwork materials shall conform to CAN/CSA A23.1, and American Concrete Publication SP4, "Formwork for Concrete."
- (b) Form sheeting plywood to be covered with form liner or to be directly in contact with soil shall be exterior Douglas Fir, concrete form grade, conforming to CSA Standard O121-M1978, a minimum of 20 mm thick.
- (c) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CAN/CSA "O121". Approved Manufacturers are "Evans" and "C-Z."
- (d) Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.
- (e) No formwork accessories will be allowed to be left in place within 50 mm of the surface following form removal. Items to be left in place must be made from a non-rusting material or galvanized steel; and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (f) Forms for exposed surfaces that do not require a form liner may be either new plywood or steel as authorized by the Contract Administrator.
- (g) Studding shall be spruce or pine and shall have such dimensions and spacing that they shall withstand without distortion all the forces to which the forms shall be subjected.

- (h) Walers shall be spruce or pine, with minimum dimensions of 100 mm x 150 mm. Studding shall be spruce or pine, with minimum dimensions of 50 x 150.
- (i) Stay-in-place formwork or false work is not acceptable and shall not be used by the Contractor unless specifically shown on the Drawings.

E8.6.5 Form Coating

- (a) Form coating shall be "Sternson C.R.A." by Sternson, "SCP Strip Ease" by Specialty Construction Products, or equal as accepted by the Contract Administrator, in accordance with B7, "Substitutes".

E8.6.6 Permeable Formwork Liner

- (a) Formwork liner shall be Texel Drainaform, Hydroform, or equal as accepted by the Contract Administrator, in accordance with B7, "Substitutes". This formwork liner shall be used on all formed surfaces.

E8.6.7 Patching Mortar

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

E8.6.8 Flexible Joint Sealant

- (a) Flexible joint sealant for all horizontal, vertical, and sloping joints shall be guaranteed non-staining, grey polyurethane, accepted by the Contract Administrator and applied in strict accordance with the details shown on the Drawings and the Manufacturer's instructions including appropriate primers if recommended. Approved products are Vulkem 116 by Mameco, Sonolastic NP1 by Sonneborn, Sikaflex-1a by Sika, Bostik 915 by Bostik, or equal as accepted by the Contract Administrator, in accordance with B7, "Substitutes".

E8.6.9 Fibre Joint Filler

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

E8.6.10 Backup Rod

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

E8.6.11 Miscellaneous Materials

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

E8.7 Equipment

E8.7.1 General

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

E8.8 Construction Methods

E8.8.1 General

- (a) It is intended that this Section cover all construction Work associated with Structural Concreting operations.

- (b) Rate of application shall be the rate required to meet the requirements of ASTM C309 for the texture of concrete the curing compound is being applied to.

#### E8.8.2 Temporary False Work, Formwork, and Shoring

##### (a) Construction Requirements

- (i) The Contractor shall construct false work, formwork and shoring strictly in accordance with the accepted Shop Drawings.
  - (ii) The false work, formwork, and shoring for these Works shall be erected, and braced, as designed, and maintained to safely support all vertical and lateral loads until such loads can be supported by the concrete. All proposed fastening shall be as shown on the accepted Shop Drawings.
  - (iii) Forms shall be constructed and maintained so that the completed Work is within minus 3 mm or plus 6 mm of the dimensions shown on the Drawings.
  - (iv) Formwork shall be cambered, where necessary to maintain the specified tolerance to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete, due to construction loads.
  - (v) Slots, recesses, chases, sleeves, inserts, bolts, hangers, and other items shall be formed or set in coordination and cooperation with the trade concerned. No openings shall be made in structural members that are not shown on the Shop Drawings without the prior written approval of the Contract Administrator.
  - (vi) Shores shall be provided with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.
  - (vii) Mud sills of suitable size shall be provided beneath shores, bedded in sand or stone, where they would otherwise bear on soil. The soil below shores must be adequately prepared to avoid settlement during or after concreting. Shores must not be placed on frozen ground.
  - (viii) Shores shall be braced horizontally in two directions and diagonally in the same two vertical planes so that they can safely withstand all dead and moving loads to which they will be subjected.
  - (ix) All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.
  - (x) Formwork shall have sufficient strength and rigidity so that the resultant finished concrete conforms to the shapes, lines, and dimensions of the members shown on the Drawings.
  - (xi) Forms shall be constructed so as to be sufficiently tight to prevent leakage of grout or cement paste.
- (b) Form panels shall be constructed so that the contact edges are kept flush and aligned.
  - (c) Forms for the concrete barriers shall be accordingly aligned to each other and to the geometry shown on the Drawings so as to provide a smooth, continuous barrier. Any misalignments in the barrier shall be cause for rejection and removal of same.
  - (d) Forms shall be clean before use. Plywood and other wood surfaces shall be sealed against absorption of moisture from the concrete by a field applied form coating or a factory applied liner as accepted by the Contract Administrator.
  - (e) Where prefabricated panels are used, care shall be taken to ensure that adjacent panels remain flush. Where metal forms are used, all bolts and rivets shall be counter sunk and well ground to provide a smooth, plane surface.
  - (f) Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be commercially manufactured types. The portion remaining within the concrete shall leave no metal within 50 mm of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed 30 mm in diameter. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest possible size. Torch cutting of steel hangers and ties will not be permitted. Formwork hangers for exterior surfaces of decks and curbs

shall be an acceptable break-back type with surface cone, or removable threaded type. Cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in colour.

- (g) Formwork shall be constructed to permit easy dismantling and stripping and such that removal will not damage the concrete. Provision shall be made in the formwork for shores to remain undisturbed during stripping where required.
- (h) It shall be permissible to use the forms over again where possible to a maximum of three uses, provided they are thoroughly cleaned and in good condition after being removed from the former portions of the Work. The Contract Administrator shall be the sole judge of their condition and his decision shall be final regarding the use of them again.
- (i) Where required by the Contract Administrator, the Contractor shall cast test panels not using less than two panels of representative samples of the forms he proposes for reuse and shall strip them after forty-eight (48) hours for the Contract Administrator to judge the type of surface produced.
- (j) All form lumber, studding, etc., becomes the property of the Contractor when the Work is finished, and it shall be removed from the concrete and the site by the Contractor after the concrete is set, incidental to the Work of this Specification, and the entire site shall be left in a neat and clean condition.

#### E8.8.3 Concrete Construction Joints

- (a) Concrete construction joints shall be located only where shown on the Drawings or as otherwise directed in writing by the Contract Administrator. Concrete construction joints shall be formed at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints.
- (b) Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.
- (c) After the forms are stripped off the construction joint, the entire face of the joint, including the reinforcing steel, shall be thoroughly cleaned down to sound concrete and the surface roughened.
- (d) Refer to, E8.8.6, "Preparation for Concreting Against Hardened Concrete", for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

#### E8.8.4 Permeable Formwork Liner

- (a) Permeable formwork liner shall be installed according to the manufacturer's instructions. The Contractor shall ensure the liner is free of folds, bends, or wrinkles that would create a non-uniform surface finish.
- (b) The permeable formwork liner shall be used for only one (1) application.
- (c) The supply, setup, application, and removal of permeable formwork liner shall be considered incidental to the placement of structural concrete, and no separate measurement or payment shall be made for this Work.

#### E8.8.5 Supply of Concrete

- (a) All concrete shall be supplied from a plant certified by the Manitoba Ready Mix Concrete Association. The Contractor, upon request from the Contract Administrator, shall furnish proof of this certification.
- (b) All mixing of concrete must meet the provisions of CAN/CSA A23.1, Clause 5.2, Production of Concrete.
- (c) Time of Hauling
  - (i) The maximum time allowed for all types of concrete to be delivered to the Site of the Work, including the time required to discharge, shall not exceed 120 minutes after batching. Batching of all types of concrete is considered to occur when any of the mix ingredients are introduced into the mixer, regardless of

- whether or not the mixer is revolving. For concrete that includes silica fume and fly ash, this requirement is reduced to 90 minutes.
- (ii) Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of batching. In hot or cold weather, or under conditions contributing to quick stiffening of the concrete, a time less than 120 and/or 90 minutes may be specified by the Contract Administrator. The Contractor will be informed of this requirement 24 hours prior to the scheduled placing of concrete.
  - (iii) To avoid the reduction of delivery and discharge time in hot weather, the Contractor will be allowed to substitute crushed ice for a portion of the mixing water provided the specified water/cementitious ratio is maintained. All of the ice shall be melted completely before discharging any of the concrete at the delivery point.
  - (iv) Unless otherwise noted in Table E12.1, "Requirements for Hardened Concrete", no retarders shall be used.
  - (v) The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water. If the slump of the concrete is less than that designated by the mix design statement, then water can be added on site provided the additional water meets the requirements of CAN/CSA A23.1 5.2.4.3.2. If additional water is to be added on site, it must be done under the guidance of the Suppliers' designated quality control person. The Supplier shall certify that the addition of water on site does not change the Mix Design for the concrete supplied. Any other water added to the concrete without such control will be grounds for rejection of the concrete by the Contract Administrator.
  - (vi) A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the Owner upon request.
- (d) Delivery of Concrete
- (i) The Contractor shall satisfy himself that the Concrete Supplier has sufficient plant capacity and satisfactory transporting equipment to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such that the development of cold joints will not occur. The methods of delivering and handling the concrete shall facilitate placing with a minimum of rehandling, and without damage to the structure or the concrete.
- (e) Concrete Placement Schedule
- (i) The Contractor shall submit to the Contract Administrator the proposed concrete placement schedule for all concrete placements for review and approval. If, in the opinion of the Contract Administrator, the volume of the placement is deemed larger than can be placed with the facilities provided, the Contractor shall either:
    - i. Limit the amount to be placed at any time (using adequate construction joints);
    - ii. Augment his facilities and Plant in order to complete the proposed placement;
    - iii. In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting; and
  - (ii) The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.
  - (iii) At least two (2) days prior to the first pier column jacket self-compacting concrete pour, a Pre-Pour Meeting shall be held at the work site. The purpose of the meeting will be to confirm the understanding of all parties of the schedule

and procedure for the concrete pour and concurrent quality control and quality assurance testing. The meeting shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City, the Contractor's Site Superintendent, the Contractor's Supervisor, the concrete supplier's designated quality control representative responsible for ensuring the supplied concrete meets the Contract Specifications for supply and delivery, and a representative of the third-party testing company. Each representative shall be a responsible person capable of expressing the position of the party they represent on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule.

E8.8.6 Preparation for Concreting Against Hardened Concrete

- (a) All hardened concrete against which new concrete is to be placed shall be prepared in the following manner:
  - (i) The resulting surface shall be roughened to remove latent cement and miscellaneous debris.
  - (ii) Following the completion of concrete removals, all surfaces at the cold joint interface including concrete and exposed reinforcing steel are to be sandblasted to the requirements of SSPC-SP6/NACE No.3 Commercial Blast Cleaning to reveal a clean substrate and kept clean until concrete placement. Sandblasting shall be followed by a high pressure water wash to remove all residues.

E8.8.7 Placing Concrete

- (a) General
  - (i) The Contractor shall notify the Contract Administrator at least one (1) Working day prior to concrete placement so that an adequate inspection may be made of formwork, shoring, reinforcement and related Works.
- (b) Placing Concrete
  - (i) Equipment for mixing or conveying concrete shall be thoroughly flushed with clean water before and after each pour. Water used for this purpose shall be discharged outside the forms. All equipment and processes are subject to acceptance by the Contract Administrator.
  - (ii) Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation and a marked change in consistency.
  - (iii) Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.
  - (iv) Before depositing any concrete, all debris shall be removed from the space to be occupied by the concrete, and any mortar splashed upon the reinforcement or forms shall be removed.
  - (v) Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.
  - (vi) Placing of concrete, once started, shall be continuous. No concrete shall be placed on concrete which has sufficiently hardened to cause the formation of seams or "cold joints" within the section. If placing must be interrupted, construction joints shall be located where shown on the Drawings or as accepted by the Contract Administrator.
  - (vii) When the Contractor chooses to pump the concrete, the operation of the pump shall produce a continuous flow of concrete without air pockets. The equipment shall be arranged such that vibration is not transmitted to freshly placed concrete that may damage the concrete. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients.
  - (viii) Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.

- (ix) 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 present on a minimum of two opposite faces of the pier column form shall be used. The Contractor shall obtain the Contract Administrator's acceptance, prior to pouring concrete, of all placing operations.
- (x) 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.

#### E8.8.8 General Curing Requirements

- (a) Refer to E8.8.11, "Cold Weather Concreting" for cold weather curing requirements and E8.8.12, "Hot Weather Concreting" of this Specification for hot weather curing requirements.
- (b) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, running water, vibration, and mechanical shock. No machinery shall travel in the vicinity of freshly placed concrete for a period of 24 hours. Concrete shall be protected from freezing until at least 24 hours after the end of the curing period.
- (c) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3°C in one hour or 20°C in 24 hours.
- (d) The use of curing compound shall not be allowed on concrete areas that are to receive additional concrete, dampproofing, a waterproofing membrane, or an asphalt overlay.
- (e) Formed surfaces shall receive, immediately after stripping and patching, the curing compound coating.
- (f) For curing of formed surfaces, formwork shall remain in place for seven (7) consecutive days following concreting. The top surface of the concrete surface shall be moist cured during this timeframe.
- (g) Curing compound shall be applied at the rate specified by the Manufacturer for the accepted product. The compound must be applied uniformly and by roller.
- (h) Following the completion of patching operations, the surface shall be sprayed with an initial coating of curing compound, as per the Manufacturer's recommendations. As soon as initial set has occurred, the surface shall receive a second roller-applied application of curing compound, to the satisfaction of the Contract Administrator.

#### E8.8.9 Form Removal

- (a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to form removal. The Contractor shall not commence any form removal operations without the prior written acceptance of the Contract Administrator.
- (b) All forms shall remain in place and the concrete shall not be loaded for a minimum of seven (7) days after initial concrete placement, unless otherwise authorized by the Contract Administrator in writing.
- (c) Field-cured test specimens representative of the cast-in-place concrete being stripped shall be tested as specified in this Specification to verify the concrete strength.

#### E8.8.10 Patching of Formed Surfaces

- (a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to removal of forms. Immediately after forms have been removed and before the Contractor commences any surface finishing or concrete patching operations, all newly exposed concrete surfaces shall be inspected by the Contract Administrator.
- (b) Any repair or surface finishing started before this inspection may be rejected and required to be removed.
- (c) Patching of formed surfaces shall take place within 24 hours of formwork removal.

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

E8.8.11 Cold Weather Concreting

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

E8.8.12 Hot Weather Concreting

- (a) General
  - (i) The requirements of this section shall be applied during hot weather, i.e., air temperatures forecast to go higher than 27°C during placing.
  - (ii) Concrete at discharge shall be at as low a temperature as possible, preferably as low as 15°C, but not above 25°C. Concrete containing silica fume shall be between 10°C minimum and 18°C maximum at discharge. Aggregate stockpiles should be cooled by water sprays and sun shades.
  - (iii) The Contractor shall use cold water and/or ice in the mix to keep the temperature of the fresh concrete down, if required. Ice may be substituted for a portion of the mixing water; provided it has melted by the time mixing is completed.
  - (iv) Form and conveying equipment shall be kept as cool as possible before concreting by shading them from the sun, painting their surfaces white and/or the use of water sprays.
  - (v) Sun shades and wind breaks shall be used as required during placing and finishing.
  - (vi) Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".
  - (vii) The Contract Administrator's acceptance is necessary before the Contractor may use admixtures such as retardants to delay setting, or water reducing agents to maintain Workability and strength, and these must appear in the Mix Design Statement submitted to the Contract Administrator.
  - (viii) Hot weather curing shall follow immediately after the finishing operation.
- (b) Hot-Weather Curing
  - (i) When the air temperature is at or above 25°C, curing shall be accomplished by fog misting and by using saturated absorptive fabric, in order to achieve cooling

- by evaporation. Note that fog misting is mandatory for all deck slab and median slab pours at all temperatures.
- (ii) Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.
- (c) Job Preparation
- (i) When the air temperature is forecast to rise to 25°C or higher during the placing period, provisions shall be made by the Contractor for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by mist fogging and evaporation, to the satisfaction of the Contract Administrator.
- (d) Concrete Temperature
- (i) The temperature of the concrete as placed shall be as low as practicable and in no case greater than the following temperatures, as shown in Table E8.2, "Acceptable Concrete Temperatures", for the indicated size of the concrete section.

<b>TABLE 8.2: ACCEPTABLE CONCRETE TEMPERATURES</b>		
<b>THICKNESS OF SECTION, M</b>	<b>TEMPERATURES °C</b>	
	<b>MINIMUM</b>	<b>MAXIMUM</b>
Less than:		
1	10	27
1.2	5	25

E8.8.13 Cleanup

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

E8.9 Concrete Quality

E8.9.1 Inspection

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

E8.9.2 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 Independent Inspector for testing purposes as required. There will be no charge to the City for samples taken.

E8.9.3 Materials

- (a) All materials supplied under this Specification shall be subject to inspection and testing by the Independent Quality Assurance Testing Laboratory approved by the

Contract Administrator. There shall be no charge to the City of Winnipeg for any materials taken by the Independent Inspector for testing purposes.

- (b) All materials shall conform to the latest edition and all subsequent revisions of CAN/CSA A23.1.
- (c) All testing of materials shall conform to the latest edition and all subsequent revisions of CAN/CSA A23.2.
- (d) All materials shall be submitted to the Contract Administrator for acceptance at least twenty (20) Business Days prior to its scheduled incorporation into any construction. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

#### E8.9.4 Quality Assurance and Quality Control

- (a) The Contract Administrator shall be afforded full access for the inspection and control and assurance testing of concrete and constituent materials, both at the site of Work and at any plant used for the production of concrete, to determine whether the concrete is being supplied in accordance with this Specification.
- (b) The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.
- (c) The Contractor shall provide, without charge, the samples of concrete and the constituent materials required for Quality Assurance tests and pay for such tests and assistance and use of tools and construction equipment as is required.
- (d) Quality Assurance and Control tests will be used to determine the acceptability of the concrete supplied by the Contractor.
- (e) The Contractor will be required to retain qualified third-party testing company to undertake Quality Assurance tests, of all concrete supplied. All test results are to be copied to the Contract Administrator immediately after the tests have been performed.
- (f) The frequency and number of concrete Quality Control and Quality Assurance tests shall be in accordance with the requirements of CAN/CSA A23.1. An outline of the quality tests is indicated below.
- (g) Any and all Work performed by the Contractor for which the results of Quality Assurance testing, certified by the third-party testing company and as required by this Specification, cannot be produced by the Contractor may be rejected by the Contract Administrator.

#### E8.9.5 Concrete Testing

- (a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits in Table E8.1 "Concrete Mix Design Requirements" of this Specification, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.
- (b) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in Table E8.1, "Concrete Mix Design Requirements" of this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.
- (c) The air-void system shall be proven satisfactory by data from tests performed in accordance with the latest edition and all subsequent revisions of ASTM Standard Test Method C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C, shall be determined prior to the start of construction on cylinders of concrete made with the same materials, mix

proportions, and mixing procedures as intended for the project. If deemed necessary by the Contract Administrator to further check the air-void system during construction, testing of cylinders may be from concrete as delivered to the job Site and will be carried out by the Contract Administrator. The concrete will be considered to have a satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.

- (d) Rapid chloride permeability testing shall be performed in accordance with ASTM C1202.
- (e) The conductivity of the concrete shall be determined in accordance with ASTM C1202, and shall meet the special requirements of Table E8.1.
- (f) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method A23.2-1C, "Sampling Plastic Concrete".
- (g) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C, "Making and Curing Concrete Compression and Flexure Test Specimens".
- (h) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which will be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.
- (i) Compressive strength tests on specimens cured under the same conditions as the concrete Works shall be made to check the strength of the in-place concrete so as to determine if the concrete has reached the minimum allowable working compressive strength as specified in Table E12.1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field-cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

#### E8.9.6 Corrective Action

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

#### E8.10 Measurement and Payment

##### E8.10.1 Self-Compacting Concrete

- (a) Supplying and placing self-compacting concrete will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Column Jacket", which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work, included in this Specification and accepted by the Contract Administrator.
- (b) Supplying and installing all the listed materials, concrete design requirements, equipment, construction methods, and Quality Control and Quality Assurance measures associated with this Specification and Drawings shall be considered incidental to "Column Jacket", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

## **E9. CONCRETE GIRDER REPAIRS**

### **E9.1 Description**

E9.1.1 The Work covered under this item shall include all operations relating to concrete works related to the girder repairs and end diaphragm repairs, as herein specified and shown on the Drawings. Typical concrete repairs are shown on the Drawings. The specific locations and extents of repairs will be marked out by the Contract Administrator.

E9.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

### **E9.2 Scope of Work**

- (a) Local concrete repairs as described in the Drawings and Specifications
- (b) Quality Control and Quality Assurance testing, including retention of a third-party testing company, acceptable to the Contract Administrator, retained and paid for by the Contractor. Quality Control testing shall be undertaken by the Contractor.

### **E9.3 Materials**

#### **E9.3.1 General**

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

#### **E9.3.2 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 CSA Standard CAN/CSA-A23.1.

#### **E9.3.3 Testing and Approval**

- (a) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by a Testing Laboratory designated by the Contract Administrator. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.
- (b) All materials shall be approved by the Contract Administrator at least 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 his own expense.

#### **E9.3.4 Bonding Agents**

- (a) Latex Bonding Agent
  - (i) Latex bonding agent shall be Acryl-Stix, SikaCem 810, or equal as approved by the Contract Administrator.
- (b) Bonding Grout
  - (i) Grout for bonding new concrete to existing concrete, if used, may consist of the following constituents by weight:
    - 1 part water;
    - 1 part latex bonding agent; and
    - 1 ½ parts Type GUSF Portland Cement
  - (ii) The consistency of the bonding grout shall be such that it can be brushed on the existing concrete surface in a thin, even coating that will not run or puddle in low spots.

#### E9.3.5 Curing Compound

- (a) If permitted for use, curing compound shall be liquid membrane-forming and conform to the requirements of ASTM Standard C309 and the proposed standard ASTM P198. Rate of application shall be 1.5 times the rate required to meet the requirements of ASTM P198 for the texture of concrete to which the curing compound is being applied.
- (b) Curing compounds shall be resin-based and white-pigmented.

#### E9.3.6 Patching Mortar for Minor Surface Defects

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

#### E9.3.7 Non-Shrink Cementitious Grout

- (a) Where non-shrink cementitious grout is used, it shall be Sternson M-bed Standard, Specialty Construction Products CPD Non-Shrink Grout, Sika 212 Non-Shrink Grout, Meadows CG-86, or equal as accepted by the Contract Administrator. The minimum compressive strength for the grout at 28 days shall be 40 MPa.

#### E9.3.8 Formwork

- (a) Formwork materials shall conform to CSA Standard CAN/CSA-A23.1, and American Concrete Publication SP:4, "Formwork for Concrete".
- (b) No "stay-in-place" formwork or falsework is permitted.
- (c) Form sheeting plywood to be covered with form liner or to be directly in contact with soil shall be exterior Douglas Fir, concrete form grade, conforming to CSA Standard O121-M1978, a minimum of 20 mm thick.
- (d) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CSA Standard O121-M1978. Approved manufacturers are "Evans" and "C-Z".
- (e) Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.
- (f) No formwork accessories will be allowed to be left in place within 50 mm of the surface following form removal. Items to be left in place must be made from a non-rusting material or galvanized steel; and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (g) Forms for exposed concrete surfaces that do not require a form liner may be either new plywood or steel as authorized by the Contract Administrator.
- (h) Studding shall be spruce or pine and shall have such dimensions and spacing that they shall withstand distortion from all the forces to which the forms will be subjected. Minimum dimensions shall be 50 mm x 150 mm.
- (i) Walers shall be spruce or pine, with minimum dimensions of 100 mm x 150 mm.
- (j) All forms are incidental to these Works and must be removed by the Contractor once adequate strength and curing of the concrete has been achieved.

#### E9.3.9 Permeable Formliner

- (a) Formwork liner shall be Texel Drainform, Hydroform, or equal as accepted by the Contract Administrator, in accordance with B7, "Substitutes". This formwork liner shall be used on all formed surfaces with the exception of soffits.
- (b) Paper-lined forms shall be used on all soffit surfaces, such as the local repairs to the existing girder soffits, or the underside of existing concrete diaphragms. The Contractor shall provide conclusive evidence that the paper-lined form proposed for use will not stain or otherwise blemish the hardened concrete surface.

#### E9.3.10 Reinforcing Steel

- (a) Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) All reinforcing steel shall conform to the requirements of CSA Standard G30.18, Grade 400, Billet-Steel Bars for concrete reinforcement. If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete works exhibits flaws in manufacture or fabrication, such material shall be immediately removed from the Site and replaced with acceptable reinforcing steel.
- (c) All reinforcing steel shall be straight and free from paint, oil, mill-scale, and injurious defects. Surface seams or surface irregularities will not be cause for rejection, provided that the minimum dimensions, cross section area, and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA Standard G30.18.

#### E9.3.11 Bar Accessories

- (a) Bar accessories shall be of a type approved by the Contract Administrator. They shall be made from a non-rusting material, and shall not stain, blemish, or spall the concreted surface for the life of the concrete.
- (b) Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices that may be approved by the Contract Administrator.

#### E9.3.12 Concrete

- (a) Concrete repair material shall be compatible with the concrete substrate and the Contractor's method of placement. The Contractor may choose to use a proprietary repair mortar subject to the approval of the Contract Administrator.
- (b) The Contractor shall be responsible for the design and performance of all concrete mixes supplied under this Specification. Either ready mix concrete or proprietary repair mortars, where applicable, may be used having the following minimum properties in accordance with CSA A23.1-09:
  - (i) Class of Exposure: C-1
  - (ii) Compressive Strength @ 28 days = 35 MPa
  - (iii) Water/Cementing Materials Ratio = 0.4
  - (iv) Air Content: Category 1 per Table 4 of CSA A23.1-09
  - (v) Low-Shrinkage Concrete according to the definition of CAN/CSA A23.1, Clause 8.9.2
- (c) Repair mortars must also meet the following special requirement to ensure compatible behaviour with the corrosion control system:
  - (i) 28-day moist cured electrical resistivity less than 15,000 ohm-cm
- (d) Mix design for ready mix concrete shall be submitted to Contract Administrator at least two weeks prior to concrete placing operations.
- (e) The workability of each concrete mix shall be consistent with the Contractor's placement operations.
- (f) Any proposed proprietary repair mortar shall be subject to the approval of the Contract Administrator and must meet or exceed the properties of the ready mix concrete.

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

(h) Concrete materials susceptible to frost damage shall be protected from freezing.

#### E9.3.13

##### Aggregates

(a) The Contractor shall be responsible for testing the fine and coarse aggregates to establish conformance to these Specifications, and the results of these tests shall be provided to the Contract Administrator if requested. All aggregates shall comply with CSA A23.1.

##### (b) Coarse Aggregate

- (i) The maximum nominal size of coarse aggregate shall be sized to suit the Contractor's mix design. Gradation shall be in accordance with CSA A23.1, Table 11, Group 1. The coarse aggregate shall satisfy the Standard Requirements specified in CSA A23.1, Table 12, "Concrete Exposed to Freezing and Thawing".
- (ii) Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter, and shall have an absorption not exceeding 2.25%.
- (iii) The aggregate retained on the 5 mm sieve shall consist of clean, hard, tough, durable, angular particles with a rough surface texture, and shall be free from organic material, adherent coatings of clay, clay balls, and excess of thin particles or any other extraneous material.
- (iv) Coarse aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than 30%.
- (v) Tests of the coarse aggregate shall not exceed the limits for standard for requirements prescribed in CSA A23.1, Table 12, for concrete exposed to freezing and thawing.

##### (c) Fine Aggregate

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

#### E9.3.14

##### Cementing Materials

(a) Cementing materials shall conform to the requirements of CSA A3001.

##### (b) Silica Fume

- (i) Should the Contractor choose to include silica fume in the concrete mix design, it shall not exceed 8% by mass of cement.

##### (c) Fly Ash

- (i) Fly ash shall be Type C1 or Type F and shall not exceed 25% by mass of cement.

(d) Cementitious materials shall be stored in a suitable weather-tight building that shall protect these materials from dampness and other destructive agents. Cementitious materials that have been stored for a length of time resulting in the hardening or formation of lumps shall not be used in the Work.

#### E9.3.15 Admixtures

- (a) Air entraining admixtures shall conform to the requirements of ASTM C260.
- (b) Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.
- (c) All admixtures shall be compatible with all other constituents. The addition of calcium chloride, accelerators, and air-reducing agents will not be permitted, unless otherwise approved by the Contract Administrator.
- (d) Appropriate low range water reducing and/or superplasticizing admixtures shall be used in concrete containing silica fume. Approved retarders or set controlling admixtures may be used for concrete containing silica fume.
- (e) An aminocarboxylate based migrating corrosion inhibitor admixture shall be used in concrete that will be used as a repair material that will either be in contact with or adjacent to reinforcing steel in existing concrete. Proposed admixtures shall be subject to the approval of the Contract Administrator.

#### E9.3.16 Water

- (a) Water to be used for mixing and curing concrete or grout and saturating substrate shall conform to the requirements of CSA A23.1 and shall be free of oil, alkali, acidic, organic materials or deleterious substances.

#### E9.3.17 Concrete Supply

- (a) Concrete shall be proportioned, mixed, and delivered in accordance with the requirements of CSA A23.1, except that the transporting of ready mixed concrete in non-agitating equipment will not be permitted unless prior written approval is received from the Contract Administrator.
- (b) Unless otherwise directed by the Contract Administrator, the discharge of ready mixed concrete shall be completed within 120 minutes after the introduction of the mixing water to the cementing materials and aggregates.
- (c) The Contractor shall maintain all equipment used for handling and transporting the concrete in a clean condition and proper working order.

#### E9.3.18 Miscellaneous Materials

- (a) The Contractor shall supply all materials, as approved by the Contract Administrator, to ensure the satisfactory completion of the concrete works.

### E9.4 Equipment

#### E9.4.1 General

- (a) All equipment shall be of a type accepted by the Contract Administrator. The equipment shall be in good working order, kept free from hardened concrete or foreign materials, and shall be cleaned at frequent intervals.
- (b) The Contractor shall have sufficient standby equipment available on short notice at all times.

#### E9.4.2 Vibrators

- (a) The Contractor shall have sufficient numbers of internal concrete vibrators and experienced operators on Site to properly consolidate all concrete in accordance with ACI 309. The type and size of vibrators shall be appropriate for the particular application, the size of the pour, and the amount of reinforcing and shall conform to standard construction procedures.
- (b) The Contractor shall use rubber coated vibrators for consolidating concrete containing epoxy-coated reinforcing steel.
- (c) The Contractor shall have standby vibrators available at all times during the pour.

#### E9.4.3 Miscellaneous Equipment

- (a) The Contractor shall provide all miscellaneous equipment as required to properly and thoroughly execute and complete all operations related to the supply and placement of concrete.

#### E9.5 Construction Methods

##### E9.5.1 General

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

##### E9.5.2 Preparation for Concreting Against Hardened Concrete

- (a) All hardened concrete against which new concrete is to be placed shall be prepared in the following manner:
  - (i) Following the completion of concrete removals, all surfaces at the cold joint interface including concrete and exposed reinforcing steel are to be sandblasted to the requirements of SSPC-SP6/NACE No. 3 Commercial Blast Cleaning to reveal a clean substrate and kept clean until concrete placement. Sandblasting shall be followed by a high pressure water wash to remove all residues.

##### E9.5.3 Formwork and Shoring

- (a) Formwork shall be designed, erected, braced, and maintained to safely support all vertical and lateral loads until such loads can be supported by the concrete.
- (b) As a maximum, the following spacings shall apply, for studding and whaling:
  - (i) 20 mm plywood: studding – 450 mm centre to centre
  - (ii) Walers – 760 mm centre to centre
- (c) Forms shall be clean before use. Plywood and other wood surfaces shall be sealed against adsorption of moisture from the concrete by a field-applied form coating or a factory-applied liner.
- (d) Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be a commercially manufactured type. The portion remaining within the concrete shall leave no metal within 50 mm of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed 25 mm in diameter.
- (e) All exposed edges shall be chamfered 25 mm unless otherwise noted on the Drawings.
- (f) Slots, recesses, chases, sleeves, inserts, bolts, hangers, and other items shall be formed or set in coordination and cooperation with the trade concerned. No openings shall be made in structural members that are not shown on the structural drawings without the prior approval of the Contract Administrator.
- (g) Shores shall be provided with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.
- (h) Mud sills of suitable size shall be provided beneath shores, bedded in sand or stone, where they would otherwise bear on soil. The soil below shores must be adequately prepared to avoid settlements during or after concreting. Shores must not be placed on frozen ground.
- (i) Brace shores horizontally in two directions and diagonally in the same two vertical planes so that they can safely withstand all dead and moving loads to which they will be subjected.
- (j) The loads and lateral pressures outlined in Part 3, Section 102 of “Recommended Practice for Concrete Formwork” (ACI 347) and wind loads as specified by the National Building Code shall be used for design. Additional design considerations

concerning factors of safety for formwork elements and allowable settlements outlined in Section 103 of the above reference shall apply.

- (k) Formwork shall have sufficient strengths and rigidity so that the resultant finished concrete conforms to the shapes, lines and dimensions of the members shown on the Drawings.
- (l) Formwork shall be constructed to permit easy dismantling and stripping and such that removal will not damage the concrete. Provision shall be made in the formwork for shores to remain undisturbed during stripping where required.
- (m) Forms shall be constructed and maintained so that the completed Work is within minus 3 mm or plus 6 mm of the dimensions shown on the Drawings.
- (n) Formwork shall be cambered, where necessary to maintain the specified tolerances, to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads.
- (o) Forms shall be sufficiently tight to prevent leakage of grout or cement paste.
- (p) Form panels shall be constructed so that the contact edges are kept flush and aligned.
- (q) All form lumber, studding, etc. becomes the property of the Contractor when the Work is finished, and it shall be removed from the concrete and the Site by the Contractor after the concrete is set, free of extra charge, and the entire Site left in a neat and clean condition.
- (r) It shall be permissible to use the forms over again where possible, provided they are thoroughly cleaned and in good condition after being removed from the former portions of the Work. The Contract Administrator shall be the sole judge of their condition and his decision shall be final regarding the use of them again.

#### E9.5.4 Formliner

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

#### E9.5.5 Bonding New Concrete to Existing Concrete

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

#### E9.5.6 Mixing and Placing Concrete

- (a) The Contract Administrator must be notified at least twenty-four (24) hours prior to placing concrete so that an adequate inspection may be made of the prepared concrete substrate or other prepared works. Placement without prior notification will not be allowed.
- (b) Equipment for mixing and placing concrete shall be thoroughly flushed with clean water prior to commencement of the repair operation. All equipment and processes are subject to the acceptance by the Contract Administrator.
- (c) Placing of concrete, once started, shall be continuous. No concrete shall be placed against concrete that has sufficiently hardened to cause the formation of seams of "cold joints" within the section. If placing must be interrupted, construction joints shall be located where shown on the Drawings or as approved.
- (d) Concrete shall be placed as nearly as possible in its finish position. Rakes or mechanical vibrators shall not be used to transport concrete.

- (e) The maximum drop of free 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.
- (f) All concrete, during and immediately after deposition, 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 that may cause honeycombing, pitting or planes of weakness. Mechanical vibrators, when immersed, shall have a minimum frequency of 7,000 revolutions per minute.
- (g) Vibrators shall be inserted systematically into the concrete at intervals such that the zones of influence of the vibrator overlap (generally 300 to 900 mm). Apply the vibrator at any point until the concrete is sufficiently compacted (5 to 15 seconds) but not long enough for segregation to occur. Spare vibrators in working condition shall be kept on the job Site during all placing operations.
- (h) Concrete shall not be placed during rain or snow, unless adequate protection is provided for formwork and concrete surfaces.
- (i) All unformed concrete surfaces shall be given a magnesium or steel float finish.

#### E9.5.7 General Curing

- (a) Refer to Clause E9.5.11(b) for hot weather curing requirements.
- (b) The use of curing compound will not be allowed on concrete areas that are to receive additional concrete or waterproofing.
- (c) 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 thereafter. Construction joints shall only be covered and kept saturated by means of wet polyester curing blankets for the curing period.
- (d) If permitted for use, curing compounds shall be applied at the rate of not less than 4 m<sup>2</sup>/L. The compound must be applied uniformly and by roller. Spraying of the compound will not be permitted.
- (e) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, or running water, vibration, and mechanical shock. Concrete shall be protected from freezing until at least twenty-four hours after the end of the curing period.
- (f) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3° in any one hour period or 20° in any twenty-four hour period.
- (g) Formed surfaces shall receive, immediately after stripping and patching, the same application of curing compound as finished surfaces.
- (h) After completing the finishing of unformed surfaces, where curing compound is not permitted, the surfaces shall be promptly covered with a minimum of a single layer of clean, damp polyester curing blanket and 6 mil polyethylene.
- (i) 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.

#### E9.5.8 Form Removal

- (a) All forms shall remain in place for a minimum of three (3) days. The Contract Administrator must be notified at least 24 hours prior to any form removal. The Contractor must receive approval from the Contract Administrator prior to beginning Work.

- (b) Field-cured test specimens, representative of the in-place concrete being stripped, may be tested to verify the concrete strength

#### E9.5.9 Patching of Formed Surfaces

- (a) Immediately after forms have been removed, but before any repairing or surface finishing is started, the concrete surface shall be inspected by the Contract Administrator. Any repair or surface finishing started before this inspection may be rejected and required to be removed.
- (b) All formed concrete surfaces shall have bolts, ties, struts, and all other timber or metal parts not specifically required for construction purposes cut back fifty (50) mm from the surface before patching.
- (c) 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 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.
- (d) 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.
- (e) 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.

#### E9.5.10 Cold Weather Concreting

- (a) The requirements of this section shall be applied to all concreting operations during cold weather, i.e., if the mean daily temperature falls below 5<sup>0</sup>C during placing or curing.
- (b) The Contract Administrator will advise the Contractor, in writing, as to the degree of heating of water and aggregates.
- (c) Supplementary equipment, as required below, shall be at the job Site if concrete is likely to be placed in cold weather.
- (d) Formwork and reinforcing steel shall be heated to at least 5<sup>0</sup>C before concrete is placed.
- (e) The temperature of concrete shall be maintained at not less than 10<sup>0</sup>C for seven days or 15<sup>0</sup>C for five days or 20<sup>0</sup>C for three days after placing. The concrete shall be kept above freezing temperature for at least a period of seven days. In no case shall the heating be removed until the concrete has reached a minimum compressive strength, which will be specified by the Contract Administrator for Work under construction, and as determined from compressive strength tests for specimens secured under the same conditions as the concrete works in question.
- (f) Aggregates shall be heated to a temperature of not less than 20<sup>0</sup>C and not more than 55<sup>0</sup>C. Water shall be heated to a temperature between 55<sup>0</sup>C and 55<sup>0</sup>C. The temperature of the concrete at the time of placement shall be within the range specified in CSA Standard CAN/CSA-A23.1 for the thickness of the section being placed.
- (g) When the mean daily temperature may fall below 5<sup>0</sup>C, a complete hoarding of the Work, together with supplementary heat, shall be provided.

- (h) When the ambient temperature is below  $-15^{\circ}\text{C}$ , the hoarding shall be constructed so as to allow the concrete to be placed without the hoarding having to be opened. If the mixing is done outside of the hoarding, the concrete shall be placed by means of hoppers installed through the hoarding. The hoppers are to be plugged when not in use.
- (i) When the ambient temperature is equal to or above  $-15^{\circ}\text{C}$ , the Contractor will be permitted to open small portions of the hoarding for a limited time to facilitate the placing of the concrete.
- (j) Before depositing any of the concrete, the Contractor shall show that enough heating equipment is available to keep the air temperature surrounding the forms within the specified range. This shall be accomplished by bringing the temperature inside of the hoarding to the specified  $20^{\circ}\text{C}$ , at least 12 hours prior to the start of the concrete placing.
- (k) The Contractor shall supply all required heating apparatus and the necessary fuel. When dry heat is used, a means of maintaining atmospheric moisture shall be provided. The relative humidity within the heated enclosure shall be maintained at a minimum of 40 percent during concrete placing and finishing operations.
- (l) Sufficient standby heating equipment must be available to allow for any sudden drop in outside temperatures and any breakdowns that may occur in the equipment.
- (m) Combustion-type heaters may be used if their exhaust gases are vented outside the enclosures and not allowed to come into contact with concrete surfaces. Fire extinguishers must be readily at hand wherever combustion-type heaters are used.
- (n) The Contractor shall keep a curing record of each concrete pour. The curing record shall include: date and location of the pour, mean daily temperature, hoarding relative humidity, temperatures above and below the concrete surface at several points, and notes regarding the type of heating, enclosure, unusual weather conditions, etc. This record shall be available for inspection by the Contract Administrator at the end of the concrete operations.

#### E9.5.11 Hot Weather Concreting

- (a) General
  - (i) The requirements of this section shall be applied during hot weather, i.e. air temperatures above  $25^{\circ}\text{C}$  during placing.
  - (ii) Concrete shall be placed at as low a temperature as possible, preferably below  $15^{\circ}\text{C}$ , but not above  $22^{\circ}\text{C}$ . Aggregate stockpiles may be cooled by watersprays and sunshades.
  - (iii) Ice may be substituted for a portion of the mixing water, providing it has melted by the time mixing is completed.
  - (iv) Form and conveying equipment shall be kept as cool as possible before concreting, by shading them from the sun, painting their surfaces white, and/or the use of watersprays.
  - (v) Sunshades and wind breaks shall be used as required during placing and finishing.
  - (vi) Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".
  - (vii) The Contract Administrator's 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.
  - (viii) Curing shall follow immediately after the finishing operations.
- (b) Hot Weather Curing
  - (i) When the air temperature is at or above  $25^{\circ}\text{C}$ , curing shall be accomplished by water spray or by using saturated absorptive fabric, in order to achieve cooling by evaporation. Mass concrete shall be water cured for the basic curing period

when the air temperature is at or above 20<sup>0</sup>C, in order to minimize the temperature rise of the concrete.

(c) Job Preparation

- (i) When the air temperature is at or above 25<sup>0</sup>C, or when there is a probability of its rising to 25<sup>0</sup>C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by fogging and evaporation.

(d) Concrete Temperature

- (i) The temperature of the concrete as placed shall be as low as practicable and in no case greater than that shown below for the indicated size of the concrete section.

Thickness of Section (m)	Temperature, <sup>0</sup> C	
	Minimum	Maximum
Less than 0.3	10	35
0.3 to 1.0	10	30
1.0 to 2.0	5	25

E9.5.12 Clean Up

- (a) The Contractor shall maintain the Sites of Work in a tidy condition and free from the accumulation of waste and debris to the satisfaction of the Contract Administrator.

E9.6 Measurement and Payment

E9.6.1 Concrete Girder and End Diaphragm Repairs

- (a) Concrete girder and end diaphragm repairs will be measured on an area basis and paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work, included in this Specification and accepted by the Contract Administrator.

E9.6.2 Items of Work:

- (a) Concrete Girder and End Diaphragm Repairs:
  - (i) Type 1; and
  - (ii) Type 2.

**E10. ACTIVATED ARC SPRAY ZINC METALLIZING**

E10.1 Description

E10.1.1 This Specification shall cover all operations related to the supply and installation of activated arc zinc spray (metallizing) onto designated concrete surfaces, including required electrical connections, protection of bearings, materials, testing, and ensuring continuity of the reinforcing steel as outlined in this Specification and as shown on the Contract Drawings. Schematic activated arc spray zinc metallizing extents and details are shown on the Drawings. Additional locations may be required as directed by the Contract Administrator.

E10.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

## E10.2 References

- (a) ACI 222R Protection of Metals in Concrete Against Corrosion
- (b) ASTM B833 Specification for Zinc Wire
- (c) ASTM B6 Standard Specification for Zinc

## E10.3 Submittals

E10.3.1 Submit qualifications of National Association of Corrosion Engineers (NACE) – certified Cathodic Protection Technician and certified Cathodic Protection Specialist employed by the activated zinc metallizing technology company. Qualifications shall include a copy of NACE certifications and documentation verifying experience in the installation and testing of galvanic protection systems for reinforced concrete structures.

E10.3.2 Submit quality control program approved by the Cathodic Protection Technician that includes verification of anode thickness and bond testing. Submittal shall be approved by the Contract Administrator prior to any field installations. Measurements taken during the execution of the quality control program shall be clearly documented and submitted to the Contract Administrator.

E10.3.3 Submit qualification of personnel operating arc spray zinc metallizing equipment.

## E10.4 Materials

### E10.4.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.
- (b) All materials supplied under this Specification shall be subject to inspection and approval by the Contract Administrator.
- (c) The zinc spray shall be Galvanode ASZ+ humectant-activated metallized zinc coating system by Vector Corrosion Technologies, Winnipeg, MB (204) 289-6300.  
[www.vector-corrosion.com](http://www.vector-corrosion.com) or equivalent as approved by the Contract Administrator.

### E10.4.2 Thermal Spray Zinc Wire

- (a) The thermal spray zinc wire shall be 5 mm (3/16") diameter 99.99% pure zinc wire as approved by the Contract Administrator. The zinc wire shall be in compliance with ASTM B6 Special High Grade Specification for Zinc Wire.
- (b) The Contractor shall submit mill certificates for the zinc spray wire to the Contract Administrator for review at least 5 working days before the start of zinc spray application.
- (c) Zinc wire shall be stored in accordance with the manufacturer's recommendations.

### E10.4.3 Blasting Abrasive

- (a) Blasting abrasive shall be non-metallic and free of corrosion producing contaminants. Sand abrasive shall be oil free. Slag abrasive shall contain no more than 0.1% oil by weight.

### E10.4.4 Humectant

- (a) Humectant shall be Galvanode Humectant activator solution or equivalent as approved by the Contract Administrator. Humectant shall be a 300 g/L aqueous lithium bromide solution (LiBr) containing 10 ml/L surfactant, or equivalent as approved by the Contract Administrator.

### E10.4.5 Miscellaneous Materials

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

## E10.5 Equipment

E10.5.1 Equipment shall be portable electric arc type specifically designed for application of metallized zinc coatings using 5 mm (3/16") diameter high purity zinc wire, or equivalent as approved by the Contract Administrator.

E10.5.2 Equipment operation shall be performed by personnel with verifiable experience on projects of similar size and scope. The Contractor shall submit qualifications of personnel to the Contract Administrator for review at least 5 working days before the start of zinc spray application.

## E10.6 Construction Methods

### E10.6.1 Surface Preparation

- (a) All oil and grease shall be removed from the concrete before any blast cleaning or thermal spray application is carried out. All loose, cracked, or delaminated concrete shall be removed prior to blast cleaning. The Contractor shall allow 28 days curing time of the concrete repair areas prior to application of Activated Arc Spray Zinc.
- (b) The concrete surface shall be blast cleaned in accordance with SSPC-SP 13/NACE No. 6, Surface Preparation of Concrete. The blast cleaning shall remove all contaminants, corrosion products, laitance, and weak concrete. The blast cleaning shall provide a sound concrete surface for the zinc coating to bond to.
- (c) Exposed reinforcing bars shall be cleaned to SSPC-SP 10/NACE No. 2, Near-White Blast Cleaning.
- (d) The Concrete shall be clean, dry and dust free prior to application of the zinc coating. This shall be attained by blowing the surface with dry compressed air, and vacuum cleaning if required. The ambient air temperature and the concrete substrate temperature shall be a minimum of 5<sup>0</sup>C before applying the zinc coating.

### E10.6.2 Rebar Connections

- (a) There shall be a minimum of two connections per vertical face to be protected. Connections are to be established with vertical reinforcing bars. The same reinforcing bar may not be connected to twice. Connections shall not be established with prestressing strands.
- (b) Rebar connections can be established at locations where steel is exposed by removal of spalled and delaminated concrete. If no exposed steel exists, locate reinforcing steel with rebar locator and chip out or drill concrete to expose rebar.
- (c) The rebar connection shall consist of 6 mm (1/4 in) galvanized threaded rod drilled and tapped into the embedded reinforcing steel. Threaded rod shall be of sufficient length to protrude a minimum of 50 mm (2 in) from concrete surface. Connection between threaded rod and rebar shall be sealed with 100% solids, non-conductive epoxy such that no part of the connection will be in contact with the concrete when patching is complete.
- (d) Electrical continuity should be verified between rebar connections and between rebar connections and rebar in spalled concrete locations with a multi-meter. Readings greater than 1mV potential between locations shall indicate discontinuous rebar. Discontinuous steel shall be made continuous by installation of a continuity bond using continuous steel.

### E10.6.3 Zinc Spraying

- (a) Before spraying zinc, protect bearings so that metallizing will not in any way damage or interfere with the proper functioning of the bearings. Protection methods are to be approved by the Contract Administrator prior to metallizing. An accepted protection method is blocking with plywood sheets.
- (b) Apply the zinc to the surface of dry, prepared concrete using multiple 3 to 4 mil thick passes applied at 90<sup>0</sup> to each other until a minimum thickness of 508 µm (20 mils) is achieved.

- (c) Install a 100 mm x 100 mm (4 in x 4 in) flattened expanded zinc mesh plate at each rebar connection. Zinc plate shall be bolted to the surface over the threaded rebar connections using galvanized steel nuts and galvanized washers.
- (d) After the plate is tightened in place, an additional layer of zinc is applied at 508  $\mu\text{m}$  (20 mils) thickness over the connection and the zinc mesh plate. Coating shall extend a minimum of 150 mm (6 in) beyond the edge of the plate in all directions.

#### E10.6.4 Humectant

- (a) After the zinc coating is installed in each area, apply humectant solution to the surface of the zinc coating by brush, roller or spray in a minimum of two coats, or as specified by the manufacturer. Each coat shall be applied and allowed to dry prior to the application of subsequent coats. Coats shall continue to be applied until the total quantity of activator solution applied is 0.1 liter/m<sup>2</sup> (0.26 gal/100 ft<sup>2</sup>), or as specified by the manufacturer.

#### E10.7 Testing

##### E10.7.1 Coating Thickness

- (a) The thickness of the zinc coating shall be measured using 50 mm x 50 mm squares of tape applied to the concrete surface prior to application of the zinc coating. The tape sample will be removed after the zinc coating is completed and the tape will peel away from the zinc coating. The thickness of the zinc coating sample will then be measured with a micrometer.

#### E10.8 Quality Control

- E10.8.1 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 operation from the selection and production of materials through to final acceptance of the work.
- E10.8.2 A NACE-qualified Cathodic Protection Technician working under the direction of a NACE-qualified Cathodic Protection Specialist and employed by the activated zinc metallizing technology company shall provide technical Site support during the installation of the galvanic protection system. The Cathodic Protection Technician shall develop and oversee QA/QC procedures for the installation of the galvanic system approved by the Cathodic Protection Specialist. The Cathodic Protection Technician and Cathodic Protections Specialist shall have verifiable experience in the installation and testing of galvanic protection systems for reinforced concrete structures.
- E10.8.3 The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Contract Administrator reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

#### E10.9 Measurement and Payment

##### E10.9.1 Metallizing Concrete Girders, End Diaphragms and Pier Caps

- (a) Metallizing of concrete girders, end diaphragms and pier caps will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Metallizing", which price shall be paid in full for supplying all materials 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 price quoted by the Contractor shall not include for the making discontinuous steel continuous by installation of a continuity bond using continuous steel. Such re-establishment of continuity shall be as directed by the Contract Administrator as required and shall be paid on a time and materials basis.

## **E11. PIER COLUMNS – GALVANIC CORROSION CONTROL**

### **E11.1 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 construction drawings.
- (b) The Works also include designing, supplying and installation of one monitoring system to check the activeness of the protection system in terms of polarization potential and current density.
- (c) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

### **E11.2 References**

- (a) ACI 222R (2001) Protection of Metals in Concrete Against Corrosion
- (b) ASTM B6 Standard Specification for Zinc
- (c) ASTM B69 (2001) Standard Specification for Rolled Zinc
- (d) ASTM B418 Standard Specification for Cast and Wrought Galvanic Zinc Anodes
- (e) SSPC-10 (1994) Near-White Blast Cleaning

### **E11.3 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, and GFRP reinforcing mesh 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 column jackets on this project, in both elevation and section views.

### **E11.4 Materials**

#### **E11.4.1 Zinc Anode**

- (a) Distributed galvanic zinc anode units shall be alkali-activated zinc with nominal dimensions of 33 mm diameter and nominal length of 2280 mm. The zinc anode shall be manufactured in compliance with ASTM B418 Type II (Z13000) and ASTM B69 Rolled Special High Grade Zinc (Z13004) using zinc in compliance with ASTM B6 Special High Grade (Z13001) with iron content less than 15 ppm. The dimensions and zinc content of the anode shall be as recommended by the Contractor's enlisted NACE specialist and as approved by the Contract Administrator.
- (b) The zinc shall be alkali-activated with a pH greater than 14. The anode unit shall contain no constituents that are corrosive to reinforcing steel as per ACI 222R such as chlorides, bromides, or other halides. The anode unit shall be supplied with a minimum of two lead wires of sufficient length to make connections between anodes and the reinforcing steel.
- (c) The galvanic protection shall be Galvanode DAS distributed anode system supply by Vector Corrosion Technologies, or approved equal.
- (d) Application for approved equals shall be requested in writing two weeks before submission of project bids. Application for galvanic anode equals shall include verification of the following information:
  - (i) The zinc anode is alkali-activated with a pH of 14 or greater.
  - (ii) The anode unit does not contain any corrosive constituents detrimental to reinforcing steel, e.g. chloride, bromide, etc.

- (iii) Proven track record of the anode technology showing satisfactory field performance with a minimum of three projects of similar size and application.
- (iv) Independent third party evaluation of the anode technology, e.g. Hitec, Concrete Innovations Appraisal Service, BRE, etc.

#### E11.5 Construction Methods

##### E11.5.1 General

- (a) The anode placement and spacing shall satisfy the minimum kg/m of column height as shown on the Drawings and as approved by the Contract Administrator.
- (b) The spacing of anodes shall not exceed 400 mm on-center, and end-to-end spacing of anodes shall not exceed 150 mm on-center.
- (c) The anode units are connected to the reinforcing steel and encased in a concrete with a minimum of 50 mm clear concrete cover over the anode units. After the anodes are installed and encased in concrete, the anodes will provide galvanic protection to the existing reinforcing steel.

##### E11.5.2 Manufacturer Technical Assistance

- (a) The Contractor shall enlist and pay for a NACE-qualified Cathodic Protection Specialist employed by the corrosion mitigation technology company to provide the design of distributed anode to be used as well as a monitoring system.
- (b) The Contractor will enlist and pay for the services of a NACE-qualified corrosion technician supplied by the galvanic anode manufacturer to provide training and on-site technical assistance during the installation of the galvanic column protection system. The qualified corrosion technician shall have verifiable experience in the installation and testing of embedded galvanic control systems for reinforced concrete structures.
- (c) The Contractor shall coordinate its work with the designated corrosion technician to allow for site support during project start-up and initial anode installation. The technician shall provide Contractor training and support for development of application procedures, shop drawings for submittals, anode and concrete installation, reinforcing steel connection procedures, and verification of electrical continuity of embedded steel.

##### E11.5.3 Reinforcing Steel Connections

- (a) The Contractor shall directly connect each anode unit to exposed reinforcing steel receiving corrosion control. Whenever possible, electrical connections should be located at repair areas where reinforcing steel is exposed.
- (b) Electrical connections to the reinforcing steel shall be established using suitable mechanical, welded stud or brazing techniques. Proposed electrical connection details shall be approved by the anode manufacturer and shall be detailed on the shop drawing submittal.
- (c) All reinforcing steel connections shall receive a coat of 100% solids, non-conductive epoxy such that no wire connections or brazing material will be in contact with the concrete when concrete pouring is complete. The Contractor shall verify continuity between the connections and the reinforcing steel prior to coating with epoxy.

##### E11.5.4 Electrical Continuity

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

##### E11.5.5 Galvanic Anodes

- (a) Distributed galvanic anode units shall be installed with an even spacing as shown on the drawing or as recommended by the manufacturer. The anodes shall be secured against plastic spacers that provide minimum clearance between the existing concrete

surface and the anode 25 mm or as sufficient to allow complete consolidation of the concrete around the anode.

#### E11.6 Measurement and Payment

- (a) Pier columns galvanic corrosion control will be measured on a length basis and paid for at the Contract Unit Price for "Pier Column Corrosion Control", which price will be payment in full for supplying all materials/equipment and performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator. The length to be paid for shall be the total number of metres of column height of galvanic corrosion control made in accordance with this Specification and accepted by the Contract Administrator.

### **E12. MISCELLANEOUS METALS**

#### E12.1 Description

- (a) This Specification shall cover supply, fabrication, galvanizing, transportation, handling, delivery and installation of miscellaneous metals, including all hardware, as specified herein and as shown on the Drawings.

#### E12.2 Scope of Work

- (a) The Scope of Work shall include:
  - (i) Supply and installation of galvanized HSS deck drain pipe extensions and associated supporting members, connections, and anchorage;
  - (ii) Supply and installation of galvanized angle and stainless steel connections for drip edges.

#### E12.3 Submissions

- (a) At least fourteen (14) days prior to the scheduled commencement of any fabrication, the shop drawings, mill certificates, welding procedures, and welding consumable certificates shall be submitted to the Engineer for his acceptance.
- (b) The Shop Drawings shall clearly show shapes, weights, dimensions, details, connections, bolts holes and accessories.

#### E12.4 Materials

##### E12.4.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all miscellaneous metal materials as set forth in this Specification.
- (b) All scaffolding, falsework, platforms, and swing stages required for the installation of miscellaneous metal components, including catwalks, structural steel sleeves, ice breakers, pier perimeter angles, and mask walls shall be designed by a Professional Engineer registered in the Province of Manitoba and shop drawings must be submitted to the Engineer for review at least ten (10) days prior to the start of work.
- (c) All materials supplied under this Specification shall be subject to inspection and testing.

##### E12.4.2 Steel

- (a) Steel shall conform to the requirements of CSA Standard G40.21-04 (R2009), Grade 300W.

##### E12.4.3 Hot-Dip Galvanizing

- (a) All designated steel items supplied under this Specification shall be hot-dip galvanized in accordance with CSA Standard G164-M92 (R2003) to retention of 610 gm/m<sup>2</sup> unless specified otherwise.

#### E12.4.4 Galvanizing Touch-Up

- (a) Field-applied galvanizing, to touch up damaged hot-dip galvanizing on site and to galvanize field welds shall be done with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780-01 for "Repair of Damaged Hot Dip Galvanizing Coatings". Accepted products are Galvalloy as Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California and 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, Manitoba.

#### E12.4.5 Welding Consumables

- (a) Welding consumables for all processes shall be certified by the manufacturer as complying with the requirements of the following specifications:
  - (i) Manual, shielded metal arc-welding (SMAW):
    - All electrodes for manual, shielded metal arc-welding shall conform to CSA Standard CSA W48.1-06 classification number E7018 for single pass tack welds and Standard CSA W48.3-06, classification numbers E8016-B1 or E8016-C3 for final welds.
  - (ii) Gas metal arc-welding (GMAW):
    - All electrodes used in the gas metal arc-welding process shall be composite electrodes conforming to CSA Standard CSA W48.4-06, classification E70-T5.
  - (iii) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of  $-46^{\circ}\text{C}$ .
  - (iv) Submerged arc-welding (SAW):
    - All electrodes and fluxes used for the submerged arc-welding process shall conform to CSA Standard CSA W48.6-06, classification F72-EM12K.
  - (v) All electrodes, wires and fluxes used shall be of a classification requiring a minimum impact of 27 joules at  $-30^{\circ}\text{C}$  as outlined in the various codes mentioned above.
- (b) In multiple pass welds the weld may be deposited such that at least two (2) layers on all surfaces and edges are deposited with one (1) of the filler metals as listed above for each particular welding process, provided the underlying layers are deposited with one of the filler metals specified in CSA Standard W59-03 (R2008).

#### E12.4.6 Nelson Studs and Anchors

- (a) Nelson studs shall be 25.4 mm diameter, 159 mm long H4L Headed Nelson Studs, made from ASTM A 108-07 cold worked, deformed wire in accordance with ASTM A496-07, and shall be welded in accordance with the manufacturer's recommendation.

#### E12.5 Construction Methods

##### E12.5.1 Fabrication

- (a) General
  - (i) Except as otherwise specified herein, miscellaneous metal work shall be fabricated in accordance with the latest CSA W59-03 and subsequent revisions. Fabrication shall be in accordance with the latest CSA Standards CAN/CSA CHBDC S6-06 and S16-09 and all subsequent revisions.
- (b) Preparation of Material
  - (i) Straightening Material
    - Prior to being used in fabrication, all steel shall be straight and free from kinks or bends. If straightening is necessary, it shall be done by methods that will not injure the metal. The steel shall not be heated unless

permission is given by the Engineer. Sharp kinks and bends will be cause for rejection of the steel.

(ii) Bending Material

- Steel items to be bent shall be bent by methods that will not injure the metal. The steel shall not be heated unless permission is given by the Engineer. Any damage to the galvanizing surface shall be repaired in accordance with Clause E12.5.1(f) "Preheat and Interpass Temperatures", of this Specification.

(iii) Edge Preparation for Welding

- The edges of plates or sections which are to be welded together shall be prepared by sawing, shearing, flame-cutting, machining, chipping, or arc air gouging to the details shown on the shop drawings. Surfaces and edges to be welded shall be smooth, uniform, and free from fins, tears, cracks, and other defects which would adversely affect the quality or strength of the weld. Surfaces to be welded shall also be free from loose scale, slag, rust, grease, moisture, or other material that will prevent proper welding. Where mill scale withstands vigorous wire brushing, a light film of drying oil or a thin rust-inhibitive coating may remain.
- Surfaces within 50 mm of any weld location shall be free from any paint or other material that would prevent proper welding or produce objectionable fumes while welding.
- Edges of material thicker than specified in the following list shall be trimmed if and as required to produce a satisfactory welding edge wherever a weld along the edge is to carry calculated stress:  
Sheared edges of material thicker than ..... 12 mm  
Rolled edges of plates (other than  
Universal Mill Plates) thicker than ..... 9 mm  
Toes of angles or rolled shapes (other  
than wide flange sections) thicker than ..... 16 mm  
Universal Mill Plates or edges of  
flanges of wide section thicker than ..... 25 mm
- Edges may be prepared by oxygen cutting, provided that a smooth and regular surface free from cracks and notches is secured, and provided that an accurate profile is secured by the use of a mechanical guide. Freehand cutting shall be done only where accepted by the Engineer.
- In all oxygen cutting, the cutting flame shall be so adjusted and manipulated as to avoid cutting beyond (inside) the prescribed lines. Roughness of cut surfaces shall not be greater than that defined by the United States Standards.
- Institute surface roughness value of 1,000 (USAI B46.1, Surface Texture). Roughness exceeding this value shall be removed by machining or grinding.
- Occasional gouges shall be tolerated only at the discretion of the Engineer and shall be repaired in accordance with his instruction.

(iv) Edge Preparation (Non-Welded Edges)

- Steel may be cut to size by sawing, shearing, flame-cutting or machining. All steel after cutting shall be marked by a method agreed to by the Engineer so that its Specification may be immediately identified.
- Sheared edges of plates more than 16 mm in thickness shall be planed to a depth of 6 mm.
- Any flame cutting of steel shall be in accordance with Clause E12.5.1(b)(ii) "Bending Material".

- Edges of flame cut flange plates shall be ground to a radius of 2 mm. Re-entrant cuts shall be filleted to a radius of not less than 19 mm.
- (c) Assembly and Welding Sequences
- (i) If requested by the Engineer, the Fabricator shall supply full details of the proposed assembly and welding sequence of any particular weldment.
- (d) Marking
- (i) Prior to fabrication, all steel shall be marked for identification by heat number and specification by a marking system.
- (e) Assembly
- (i) The shop assembly of the various components of the weldments shall be executed in accordance with CSA W59-03.
  - (ii) Tack welding shall be done by qualified operators, using the smallest size weld required to hold the components of the assembly together. Tack welds shall not be less than 50 mm in length and shall be incorporated in the final weld.
  - (iii) Tack welds shall be made with 4 mm maximum size electrodes and shall be subject to the preheat requirements of Clause E12.5.1(f) "Preheat and Interpass Temperatures.
- (f) Preheat and Interpass Temperatures
- (i) No welding shall be done when the temperature of the base metal is lower than -20°C.
  - (ii) For all welding processes, preheat and interpass temperatures shall be maintained during welding, at temperatures in accordance with the requirements of CSA Standard W59-03 (R2008).
  - (iii) Preheat shall be applied in such a manner that moisture from the heating equipment does not penetrate the joint.
  - (iv) Preheat temperature shall in no case exceed 200°C but there shall be no limit on interpass temperature.
- (g) Welding
- (i) Welding shall be done by the manual shielded metal arc, gas shielded metal arc or submerged arc processes in accordance with the accepted procedures and CSA W59-03.
  - (ii) All welding shall be done under cover and, in the case of gas metal arc welding, shall be done in an area free from wind or draft.
  - (iii) Where the submerged arc or gas metal arc processes are to be used, the Engineer may order that:
    - A preliminary test run of the accepted procedure be made over the length of the joint to prove that the disposition of the equipment, the handling of hoses, and the method and accuracy of travel are satisfactory.
    - Each operator make a weld specimen not less than 1.2 m in length for fillet welds and 150 mm in length for butt welds. Steel of the same specification and thickness as that to be used in the work shall be used in the specimen welds. No welding shall be done until such a specimen is satisfactory to the Engineer.
  - (iv) Materials to be used for backing studs and run-off tabs shall conform to the same Specifications as the base material.
  - (v) Butt welds shall be extended beyond the edges of the parts to be joined by means of start and run-off tabs providing sufficient thickness to avoid the weld burning through and with a joint preparation similar to that on the main material. For manual shielded metal arc-welding, the width of the tabs shall be not less than the thickness of the thicker part being joined or 75 mm whichever is greater. For submerged arc-welding, the width of the tabs shall be not less than 75 mm. Each weld pass shall be carried far enough beyond the edge of the parts being joined to ensure sound welds in the joint. Tabs shall be removed

- upon completion and cooling of the weld without damage to the parent plate and the end of the weld made smooth and flush with the edges of the abutting parts.
- (vi) In gas metal arc-welding, the equipment shall be capable of sustaining a gas flow rate of from 0.85 to 1.27 m<sup>3</sup> per hour (30 to 45 C.F.H.).
  - (vii) Mechanical scaling tools shall not be used on any weld surface that is a final weld surface. Scaling tools may be used on welded passes, provided their use does not crack or injure the first pass of a multi-pass weld.
  - (viii) Semi-automatic machines may be used only when they are equipped with a mechanical control travel speed.
  - (ix) Repairs to welds of base metal shall be made by grinding or arc-air gouging followed by gouging. The use of flame gouging or oxygen gouging will not be permitted.
- (h) Bent Plates
- (i) When bending plates, the plates shall be so taken from the stock plates that the bend line will be at right angles to the direction of rolling. The radius of the bend measured inside shall be not less than the thickness of the plate.
  - (ii) Before bending, the corners of the plate shall be rounded to a radius of 2 mm throughout that portion of the plate at which bending is to occur.
- (i) Weld Profiles
- (i) Weld profiles shall meet the requirements of CSA Standard W59-03 (R2008), Clause 5.9.
- (j) Shipping
- (i) Members shall be loaded in such a manner that they can be transported and unloaded at their destination without being excessively stressed, deformed or otherwise damaged.
- (k) Handling and Storing Materials
- (i) Material to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. Long members shall be supported on skids placed near enough to prevent injury from deflection.
- (l) Straightening Bent Material
- (i) The straightening of plates and angles or other shapes shall be done by methods that will not produce a fracture or other injury. The metal shall not be heated unless permitted by the Engineer, in which case the heating shall not be to a higher temperature than that producing a "dark cherry red" colour. After heating, the metal shall be cooled as slowly as possible.
  - (ii) Following the straightening of a bend or buckle, the surface of the metal shall be carefully inspected for evidence of fracture, and if necessary, replaced or repaired.
- (m) Welding to Galvanized Metal
- (i) All field welding to galvanized metal shall be touched up by the Galvalloy Process in accordance with E12.5.1(f) "Preheat and Interpass Temperatures", of these Specifications. All Gallvalloy repairs shall be made flush with adjacent metal.

#### E12.5.2 Handling and Storing Materials

- (a) Material to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. Caution shall be exercised when storing miscellaneous steel which is exposed to weather or condensation to prevent local corrosion which may develop in areas where water is trapped. Coating with a water-soluble oil after fabrication may be used to avoid this problem. Long members shall be supported on skids placed near enough to prevent injury from deflection.

- (b) Field Assembly
  - (i) The parts shall be accurately assembled as shown on the accepted shop drawings and any matchmarks shall be followed. Hammering which will injure or distort the members shall not be done. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.
  - (ii) Field connection shall have one-half of the holes filled with bolts and the other half filled with cylindrical erection pins (half bolts and half pins) before final bolting. Fitting up bolts shall be the same nominal diameter as the high tensile bolts, and cylindrical erection pins shall be 1 mm larger.
- (c) Bolting
  - (i) All field connections shall be bolted with high strength bolts. Bolting with high strength bolts shall be carried out in accordance with CSA Standard S16-09.
- (d) Misfits
  - (i) The correction of minor misfits involving harmless amounts of reaming, cutting and chipping as determined by the Engineer will be considered a legitimate part of erection. However, any error in shop fabrication which prevents the proper assembling and fitting up of parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be the responsibility of the Contractor.
- (e) Damage to Surround Structure
  - (i) The surrounding structure shall be carefully protected during the erection of the miscellaneous metal by the Contractor. All concrete surfaces and corners liable to damage shall be protected with wood blocking, sacking or other means, to prevent damage and chipping of concrete due to wire ropes, swing loads, or other activities. The Contractor shall repair any such damage to the satisfaction of the Engineer.
  - (ii) The erection of miscellaneous metal and attachment to the structure shall be done so that, during erection, there shall be no forces applied to cause overstressing of the structures.
- (f) Galvanizing Touch-Up Procedure
  - (i) Any areas of damaged galvanizing and all field welds are to receive field-applied galvanizing.
  - (ii) 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.

## E12.6 Quality Control

### E12.6.1 Inspection

- (a) 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.

### E12.6.2 Qualifications of Contractor

- (a) The Contractor shall produce evidence that his plant is recently fully approved by the C.W.B. to the requirements of CSA Standard W47.1-09, Division 3.

## E12.7 Measurement and Payment

- E12.7.1 Supply, fabrication and erection of miscellaneous metal will be measured on a mass basis and paid for at the Contract Unit Price per kilogram for "Miscellaneous Metal", which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

## E13. METALLIZING OF BRIDGE BEARINGS

### E13.1 Description

- (a) This Specification shall cover the preparation and metallizing of the existing bridge bearings at Piers #3 and #8, as specified herein and as detailed 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 Materials

#### E13.2.1 General

- (a) All materials supplied under this Specification shall be of a type approved by the Contract Administrator and shall be subject to inspection, testing and approval.
- (b) All materials shall be handled in a careful and workmanlike manner.

#### E13.3 Approved cold-applied galvanic anti-corrosion system is as follows:

- (a) ZINGA, as manufactured by ZINGAMETALL, Ghent, Belgium, available from Pacific Evergreen Industries Ltd., Vancouver, BC, Ph. (604) 926-5564, and Centennial Mine & Industrial Supply, Saskatoon, SK, Ph. (306) 975-1944.

#### E13.4 Abrasive for Blast Cleaning

- (a) The blast cleaning abrasive shall be free of corrosion-producing contaminants. Silica or other sand will not be permitted. Slag abrasives shall contain no more than 0.1% oil by weight. The blast-cleaning abrasives and grit size employed shall be capable of achieving a surface anchor-tooth profile having a peak-to-valley height of 2 to 4 mils.

#### E13.4.1 Incidental and Miscellaneous Materials

- (a) Incidental and miscellaneous materials utilized in undertaking the surface preparation and coating Works shall be supplied strictly in accordance with the manufacturer's guidelines and in accordance with these Specifications.
- (b) This will include solvent mixtures associated with solvent cleaning operations, and any other incidental materials used in conjunction with the Works of this Specification.
- (c) The use of all such materials shall be reviewed with the Contract Administrator to ensure conformance with the Specification, prior to the use of same in the Works. The Contract Administrator's decision in these matters shall be final.

#### E13.4.2 Metallizing

- (a) Metallizing material shall be as per Specification E10.4.

### E13.5 Equipment

- (a) Metallizing equipment shall be as per Specification E10.5.

## E13.6 Construction Methods

### E13.6.1 Surface Preparation

#### (a) General

- (i) The Contractor shall comply with all applicable environmental health and safety regulations related to the surface preparation and metallizing of bridge bearings.

#### (b) Surface Cleaning

- (i) Before any blast cleaning operations or metallizing applications commence, the following surface cleaning operations shall be undertaken on all steel designated to receive metallizing.
  - Temporarily protect bearing pad and soleplate stainless steel sliding surface by use of mastic tape or as approved by the Contract Administrator.
  - All oil and grease shall be removed manually with solvent cleaning as per SSPC Specification SP1.
  - Water used for high pressure water washing shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances. It shall be equal to potable water in physical and chemical properties.

#### (c) Blast Cleaning Operation

- (i) The Contractor shall prepare the structural steel immediately prior to, by blast cleaning in accordance with SSPC-SP6.
- (ii) The Contractor shall ensure that the amount of blasting medium used for blast cleaning is kept to the absolute minimum by conscientious efforts of his workforce and by the efficient use of equipment.
- (iii) No rust scale shall remain in the designated areas.

#### (d) Surface Testing and Inspection

- (i) The Contractor shall provide the Contract Administrator with access and notice to allow for testing and inspection of prepared surfaces.
- (ii) Immediately following blast cleaning and clean-up operations, the Contractor shall notify the Contract Administrator in order that an inspection can be carried out. No metallizing installation shall take place until the prepared surface has been accepted by the Contract Administrator.

### E13.6.2 Zinc Spraying

- (a) Apply the zinc to the prepared dry surface using multiple passes until a minimum thickness of 508  $\mu\text{m}$  (20 mils) is achieved.
- (b) After the zinc is applied areas deemed inaccessible and/or with low measured thickness of zinc shall receive the application of Zinga coating.

### E13.6.3 Coating of Bridge Bearings

- (a) The approved product Zinga shall be applied by either a brush or roller. The Zinga shall be applied in two (2) coats, with each coat having a dry film thickness of 60  $\mu\text{m}$  (2.36 mils). Each coat shall be left to dry for a minimum of one (1) hour before the application of the next coat.
- (b) After the zinc coating is installed in each area, apply humectant solution to the surface of the zinc coating by brush, roller or spray in a minimum of two coats, or as specified by the manufacturer. Each coat shall be applied and allowed to dry prior to the application of subsequent coats. Coats shall continue to be applied until the total quantity of activator solution applied is 0.1 liter/ $\text{m}^2$  (0.26 gal/100  $\text{ft}^2$ ), or as specified by the manufacturer.

## E13.7 Testing

### E13.7.1 Coating Thickness

- (a) The thickness of the zinc coating shall be measured using 50 mm x 50 mm squares of tape applied to the concrete surface prior to application of the zinc coating. The tape sample will be removed after the zinc coating is completed and the tape will peel away from the zinc coating. The thickness of the zinc coating sample will then be measured with a micrometer.

## E13.8 Quality Control

- E13.8.1 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 operation from the selection and production of materials through to final acceptance of the work.
- E13.8.2 A NACE-qualified Cathodic Protection Technician working under the direction of a NACE-qualified Cathodic Protection Specialist and employed by the activated zinc metallizing technology company shall provide technical Site support during the installation of the galvanic protection system. The Cathodic Protection Technician shall develop and oversee QA/QC procedures for the installation of the galvanic system approved by the Cathodic Protection Specialist. The Cathodic Protection Technician and Cathodic Protections Specialist shall have verifiable experience in the installation and testing of galvanic protection systems for reinforced concrete structures.
- E13.8.3 The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Contract Administrator reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

## E13.9 Measurement and Payment

- E13.9.1 Metallizing of bridge bearings will be measured on a unit basis and paid for at the Contract Unit Price per unit for "Bearing Repair", which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.