



**THE CITY OF WINNIPEG**

# **BID OPPORTUNITY**

**BID OPPORTUNITY NO. 353-2006**

**2006 BRIDGE MAINTENANCE – MISCELLANEOUS CONCRETE AND EXPANSION  
JOINT REPAIRS**

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## **PART B - BIDDING PROCEDURES**

### **B1. PROJECT TITLE**

- B1.1 2006 BRIDGE MAINTENANCE – MISCELLANEOUS CONCRETE AND EXPANSION JOINT REPAIRS

### **B2. SUBMISSION DEADLINE**

- B2.1 The Submission Deadline is 12:00 noon Winnipeg time, July 5, 2006.
- B2.2 Bid Submissions 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. ENQUIRIES**

- B3.1 All enquiries shall be directed to the Contract Administrator identified in D3.1.
- B3.2 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.
- B3.3 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.
- B3.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator only to the Bidder who made the enquiry.
- B3.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B3 unless that response or interpretation is provided by the Contract Administrator in writing.

### **B4. ADDENDA**

- B4.1 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.
- B4.2 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.
- B4.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.
- B4.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet site for addenda shortly before submitting his Bid.
- B4.3 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.

## **B5. SUBSTITUTES**

- B5.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.
- B5.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.
- B5.3 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.
- B5.4 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.
- B5.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an “approved equal” or as an “approved alternative”, or may refuse to grant approval of the substitute.
- B5.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.
- B5.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.
- B5.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.
- B5.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative shall base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B14.
- B5.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

## **B6. BID SUBMISSION**

- B6.1 The Bid Submission consists of the following components:
- (a) Form A: Bid;
  - (b) Form B: Prices;
  - (c) Form G1: Bid Bond and Agreement to Bond, or Form G2: Irrevocable Standby Letter of Credit and Undertaking, or a certified cheque or draft;
- B6.2 All components of the Bid Submission 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 in ink, to constitute a responsive Bid.
- B6.3 The Bid Submission shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.
- B6.3.1 Samples or other components of the Bid Submission 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 Submission.
- B6.4 Bid Submissions submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.
- B6.5 Bid Submissions shall be submitted to:
- The City of Winnipeg  
Corporate Finance Department  
Materials Management Branch  
185 King Street, Main Floor  
Winnipeg MB R3B 1J1

## **B7. BID**

- B7.1 The Bidder shall complete Form A: Bid, making all required entries.
- B7.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:
- (a) if the Bidder is a sole proprietor carrying on business in his own name, his name shall be inserted;
  - (b) if the Bidder is a partnership, the full name of the partnership shall be inserted;
  - (c) if the Bidder is a corporation, the full name of the corporation shall be inserted;
  - (d) if the Bidder is carrying on business under a name other than his own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.
- B7.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B7.2.
- B7.3 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.
- B7.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:

- (a) if the Bidder is a sole proprietor carrying on business in his own name, it shall be signed by the Bidder;
- (b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;
- (c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;
- (d) if the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

B7.4.1 The name and official capacity of all individuals signing Form A: Bid shall be printed below such signatures.

B7.4.2 All signatures shall be original and shall be witnessed except where a corporate seal has been affixed.

B7.5 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 Submission and the Contract, when awarded, shall be both joint and several.

## **B8. PRICES**

B8.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

B8.2 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.

B8.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.

## **B9. QUALIFICATION**

B9.1 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;
- (b) be responsible and not be suspended, debarred or in default of any obligation to the City;
- (c) be financially capable of carrying out the terms of the Contract;
- (d) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract;
- (e) have successfully carried out work, similar in nature, scope and value to the Work;
- (f) employ only Subcontractors who:
  - (i) are responsible and not suspended, debarred or in default of any obligation 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 Branch internet site at <http://www.winnipeg.ca/matmgt>); and
  - (ii) have successfully carried out work similar in nature, scope and value to the portion of the Work proposed to be subcontracted to them, and are fully capable of performing the Work required to be done in accordance with the terms of the Contract;

- (g) have a written workplace safety and health program in accordance with The Workplace Safety and Health Act (Manitoba);

B9.2 Further to B9.1(g), the Bidder shall, within three (3) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

- (a) a valid COR certification number under the Certificate of Recognition (COR) Program - Option 1 administered by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or
- (b) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association; 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 Branch internet site at <http://www.winnipeg.ca/matmgt>.)

B9.3 The Bidder shall be prepared to 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.

B9.4 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.

## **B10. BID SECURITY**

B10.1 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.

B10.1.1 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.

B10.2 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.

B10.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B10.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.



B10.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B10.3 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.

## **B11. OPENING OF BIDS AND RELEASE OF INFORMATION**

B11.1 Bid Submissions will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Branch, or in such other office as may be designated by the Manager of Materials.

B11.1.1 Bidders or their representatives may attend.

B11.1.2 Bid Submissions determined by the Manager of Materials, or his designate, to not include the bid security specified in B10 will not be read out.

B11.2 After the public opening, the names of the Bidders and their Total Bid Prices as read out (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 Branch internet site at <http://www.winnipeg.ca/matmgt>.

B11.3 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 Branch internet site at <http://www.winnipeg.ca/matmgt>.

B11.4 The Bidder is advised that any information contained in any Bid Submission 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.

## **B12. IRREVOCABLE BID**

B12.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.

B12.2 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.

## **B13. WITHDRAWAL OF BIDS**

B13.1 A Bidder may withdraw his Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B13.1.1 Notwithstanding GC:23.3, 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.

B13.1.2 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.

B13.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials shall:

- (a) retain the Bid Submission until after the Submission Deadline has elapsed;
- (b) open the Bid Submission 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 B13.1.3(b), declare the Bid withdrawn.

B13.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B12.2 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.

#### **B14. EVALUATION OF BIDS**

B14.1 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 (pass/fail);
- (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B9 (pass/fail);
- (c) Total Bid Price;
- (d) economic analysis of any approved alternative pursuant to B5.

B14.2 Further to B14.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid Submission 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 if the interests of the City so require.

B14.3 Further to B14.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid Submission or in other information required to be submitted, that he is responsible and qualified.

B14.4 Further to B14.1(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.

B14.4.1 If there is any discrepancy between the Total Bid Price written in figures, the Total Bid Price written in words and the sum of the quantities multiplied by the unit prices for each item, the sum of the quantities multiplied by the unit prices for each item shall take precedence.

#### **B15. AWARD OF CONTRACT**

B15.1 The City will give notice of the award of the Contract by way of a letter of intent, or will give notice that no award will be made.

B15.2 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.

B15.2.1 Without limiting the generality of B15.2, 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.

**B15.3** 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.

## **PART C - GENERAL CONDITIONS**

### **C1. GENERAL CONDITIONS**

C1.1 The *General Conditions for Construction Contracts* (Revision 2000 11 09) are applicable to the Work of the Contract.

C1.1.1 The *General Conditions for Construction Contracts* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.

## **PART D - SUPPLEMENTAL CONDITIONS**

### **GENERAL**

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

- D1.1 In addition to the *General Conditions for Construction Contracts*, these Supplemental Conditions are applicable to the Work of the Contract.
- D1.2 The General Conditions are amended by striking out “The City of Winnipeg Act” wherever it appears in the General Conditions and substituting “The City of Winnipeg Charter”.
- D1.3 The General Conditions are amended by striking out “Tender Package” wherever it appears in the General Conditions and substituting “Bid Opportunity”.
- D1.4 The General Conditions are amended by striking out “Tender Submission” wherever it appears in the General Conditions and substituting “Bid Submission”.
- D1.5 The General Conditions are amended by deleting GC:6.16 and GC:6.17. The City of Winnipeg is now within the jurisdiction of the Manitoba Ombudsman pursuant to The Ombudsman Act.

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

- D2.1 The Work to be done under the Contract shall consist of 2006 Bridge Maintenance – Miscellaneous Concrete and Expansion Joint Repairs.
- D2.2 The major components of the Work are as follows:
- (a) St. James Bridge Concrete Pier Repairs;
  - (b) Expansion joint seal replacements and extrusion repairs on the northbound St. James Bridge, Piers 2, 8, and 17;
  - (c) Midtown Bridge Concrete Repairs on Pier 6;
  - (d) St. Vital Bridge Concrete Barrier Repairs; and
  - (e) Expansion joint seal replacement and extrusion repairs on the St. Vital Twin Bridges.

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

- D3.1 The Contract Administrator is Dillon Consulting Limited, represented by:
- Mr. Bob Wiebe  
P.Eng.  
200 – 895 Waverley Street  
Telephone No. (204) 453-2301  
Facsimile No. (204) 452-4412
- D3.2 At the pre-construction meeting, Mr. Wiebe 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 designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

## **D5. NOTICES**

- D5.1 Except as provided for in GC:23.2.2, 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.
- D5.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D5.3, D5.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D3.1.
- D5.3 All notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following address or facsimile number:
- The City of Winnipeg  
Chief Administrative Officer Secretariat  
Administration Building, 3rd Floor  
510 Main Street  
Winnipeg MB R3B 1B9  
Facsimile No.: (204) 949-1174
- D5.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:
- The City of Winnipeg  
Corporate Services Department  
Legal Services Division  
185 King Street, 3rd Floor  
Winnipeg MB R3B 1J1  
Facsimile No.: (204) 947-9155

## **D6. FURNISHING OF DOCUMENTS**

- D6.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

## **SUBMISSIONS**

### **D7. SAFE WORK PLAN**

- D7.1 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 GC:4.1 for the return of the executed Contract.
- D7.2 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 Branch internet site at <http://www.winnipeg.ca/matmgt>.

### **D8. INSURANCE**

- D8.1 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) all inclusive, with The City of Winnipeg being added as an additional insured, with a cross-liability clause, such liability policy to also contain a contractual liability, an unlicensed motor vehicle liability and a products and completed operations endorsement to remain in place at all times during the performance of the Work and throughout the warranty period;
- (b) automobile liability insurance for owned and non-owned automobiles used for or in connection with the Work in the amount of at least two million dollars (\$2,000,000.00) at all times during the performance of the Work and until the date of Total Performance;
- (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.

D8.2 Deductibles shall be borne by the Contractor.

D8.3 The Contractor shall provide the City Solicitor with a certificate of insurance of each policy, in a form satisfactory to the City Solicitor, 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 GC:4.1 for the return of the executed Contract.

## **D9. PERFORMANCE SECURITY**

D9.1 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.

D9.1.1 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.

D9.2 If the bid security provided in his Bid Submission was not a certified cheque or draft pursuant to B10.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

## **SCHEDULE OF WORK**

### **D10. COMMENCEMENT**

D10.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D10.2 The Contractor shall not commence any Work on the Site until:

- (a) the Contract Administrator has confirmed receipt and approval of:

- (i) evidence that the Contractor is 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;
  - (ii) evidence of the workers compensation coverage specified in GC:6.14;
  - (iii) the Safe Work Plan specified in D7;
  - (iv) evidence of the insurance specified in D8;
  - (v) the performance security specified in D9;
- (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.

#### **D11. WORKING DAYS**

- D11.1 Further to GC:1.1(gg), the Contract Administrator's determination of whether or not atmospheric and Site conditions are such that a Working Day is deemed to have elapsed may be based at one time on one type of work while at another time a Working Day may be based on another type of work. When more than one type of major work is involved, the quantity of equipment that must be able to work in order to meet the requirements of a Working Day may vary considerably from that specified in the General Conditions.

#### **D12. CRITICAL STAGES**

- D12.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:
- (a) St. Vital Bridge shall be completed within a continuous five (5) week period ending no later than September 1, 2006.
  - (b) St. James Bridge Northbound, repairs requiring land closures on the bridge shall be completed no later than September 1, 2006.

#### **D13. SUBSTANTIAL PERFORMANCE**

- D13.1 The Contractor shall achieve Substantial Performance by October 15, 2006..
- D13.2 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.
- D13.3 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.



#### **D14. TOTAL PERFORMANCE**

- D14.1 The Contractor shall achieve Total Performance by October 20, 2006.
- D14.2 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.
- D14.3 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.

#### **D15. LIQUIDATED DAMAGES**

- D15.1 If the Contractor fails to achieve critical stages, Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for same, the Contractor shall pay the City the following amounts per for each and every following the days fixed herein for same during which such failure continues:
- (a) St. Vital Bridge Works by Septmeber 1, 2006 – Two Hundred dollars (\$200.00);
  - (b) St. James Northbound repairs requiring lane closures. – Two Hundred dollars (\$200.00);
  - (c) Total Performance – Five Hundred dollars (\$500.00);
- D15.2 The amounts specified for liquidated damages in D15.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve critical stages, Substantial Performance or Total Performance by the days fixed herein for same.
- D15.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

#### **CONTROL OF WORK**

##### **D16. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)**

- D16.1 Further to GC:6.26, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

##### **D17. COOPERATION WITH OTHERS**

- D17.1 The Contractor's attention is directed to the fact that other Contractors, the personnel of Utilities and the staff of the City may be working on the structure, approach roadways, adjacent roadways or rights-of-way. The activities of these agencies may coincide with the Contractor's execution of the Work, and it will be the Contractor's responsibility to cooperate to the fullest extent with the other personnel working in the area, and such cooperation is an obligation of the Contractor under the terms of this Contract.
- D17.2 Specifically, the Contractor is advised that another Contractor will be undertaking deck sealing repair works to the St. Vital Northbound Bridge in both lanes. His Work will predominately require a single curb lane closure outside of morning rush hour. The Contractor shall coordinate his activities at this Site with the other Contractor. If possible the Work of the other

Contractor will be scheduled either before commencement or after completion of this Work but may have to be undertaken concurrently.

**D18. ENVIRONMENTAL PLANNING**

D18.1 The Contractor shall conduct his operations in accordance with all current federal, provincial, or other regulations concerning environmental protection and pollution control. It shall be the Contractor's responsibility to familiarize himself with all applicable regulations and to obtain all necessary approvals and permits for his operations.

**MEASUREMENT AND PAYMENT**

**WARRANTY**

**D19. WARRANTY**

D19.1 Notwithstanding GC:13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) years thereafter unless extended pursuant to GC:13.2.1 or GC:13.2.2, in which case it shall expire when provided for thereunder.

**FORM H1: PERFORMANCE BOND**  
(See D9)

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 dated the

\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, for:

BID OPPORTUNITY NO. 353-2006

2006 BRIDGE MAINTENANCE – MISCELLANEOUS CONCRETE AND EXPANSION JOINT 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)

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

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

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

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

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

**FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT  
(PERFORMANCE SECURITY)  
(See D9)**

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

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 353-2006

2006 BRIDGE MAINTENANCE – MISCELLANEOUS CONCRETE AND EXPANSION JOINT  
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 (1993 Revision), International Chamber of Commerce Publication Number 500.

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

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

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

## PART E - SPECIFICATIONS

### GENERAL

#### E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.

E1.1.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.

E1.1.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.

E1.1.3 Further to GC:2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.2 The following Drawings are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
	2006 Bridge Maintenance – Cover Page
B102-06-01	2006 Bridge Maintenance – St. James Bridge – Concrete Repairs – Pier 6/12, Pier 11, and Pier 13
B102-06-02	2006 Bridge Maintenance – St. James Bridge – Expansion Joint Repairs – Pier 2, Pier 8 and Pier 17
B114-06-01	2006 Bridge Maintenance – Midtown Bridge – Concrete Repairs – Pier 6
B116-06-01	2006 Bridge Maintenance – St. Vital Bridge – Concrete Repairs – Details 1 of 2
B116-06-02	2006 Bridge Maintenance – St. Vital Bridge – Concrete Repairs – Details 2 of 2
B116-06-03A	2006 Bridge Maintenance – St. Vital Bridge – Expansion Joint Repairs – Details 1 of 2
B116-06-03B	2006 Bridge Maintenance – St. Vital Bridge – Expansion Joint Repairs – Details 2 of 2

#### **Existing 1962 St. James Bridge Drawings for Reference**

B102-62-034	Layout and Reinforcement of Pier 13_B-5000-34
B102-62-052	Layout and Reinforcement Piers 5 and 11_B-5000-52
B102-62-053	Layout and Reinforcement Pier 6 - 12_B-5000-53

#### E2. DETAILED TRAFFIC CONTROL

E2.1 Description

- (a) The Work covered under this item shall cover specific traffic control requirements.
- (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.

E2.2 Notification

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

## E2.3 Construction Methods

### E2.3.1 General

- (a) The Contractor will be responsible for pedestrian and traffic control at the Site acceptable to the Contract Administrator.
- (b) For traffic control in the immediate Work area, the Contractor shall erect and maintain all applicable traffic control devices in accordance with the provision contained in the latest edition of the "Manual of Temporary Traffic Control in Work Areas on City Streets," issued by the City of Winnipeg.
- (c) The Contractor shall provide and maintain flagmen in accordance with the above-mentioned manual.
- (d) The Contractor shall take all other safety measures necessary to cope with any peculiar or unusual circumstances that have not been set out in the above-mentioned manual and shall, at all times, ensure that maximum protection is afforded to the road-user and that his operations in no way interfere with the safe operation of traffic.
- (e) Improper signing will be sufficient reason for the Contract Administrator or Inspector to immediately shut down the entire job.
- (f) Barricades supplied and installed by the Contractor and the telephone number(s) at which he can be reached twenty-four (24) hours per day, seven (7) days per week.
- (g) During the hours when the Contractor is not working, equipment and stockpiled materials shall be left in such a location so as not to interfere with or present a hazard to motorists or pedestrians.

### E2.3.2 Specific

- (a) St. James Bridge
  - (i) For expansion joint repairs at Piers 2 and 17, one northbound lane at a time may be closed except weekdays from 7:00 to 9:00 hours and 15:30 to 18:00 hours.
  - (ii) For the expansion joint repairs at Pier 8, the Academy on-ramp may be closed except weekdays from 7:00 to 18:00 hours. It is intended that Work be conducted weekday evenings or on weekends.
  - (iii) Contractor to ensure that the traffic lanes are clean and free of debris when they are opened.
- (b) Midtown Bridge
  - (i) During concrete pier repairs, the Contractor may close of the eastbound curb lane on Assiniboine Avenue. During periods of lane closure, the Contractor shall provide flagging at either end of the construction Site. The pedestrian sidewalk on the south side of Assiniboine Avenue shall be closed at times when repair work is taking place. Signs shall be placed appropriately at the nearest street crossing locations directing pedestrian traffic.
  - (ii) Contractor to ensure that the traffic lanes are clean and free of debris when they are opened.
- (c) St. Vital Bridge Pedestrian Traffic
  - (i) Throughout the project the northbound bridge sidewalk shall be closed. Signs at each end of the bridge should advise pedestrians to use the southbound bridge sidewalk. Signs shall be placed appropriately at the nearest street crossing locations and at the base of the staircases.
- (d) St. Vital Bridge Vehicle Traffic
  - (i) For concrete barrier repairs, the northbound curb lane may be closed except weekdays from 7:00 to 9:00 hours.



- (ii) For northbound bridge expansion joint repairs, one northbound lane may be closed at a time except weekdays from 7:00 to 9:00 hours.
- (iii) For southbound bridge expansion joint repairs, one southbound lane may be closed at a time except weekdays from 15:30 to 18:00 hours.
- (iv) Contractor to ensure that the traffic lanes are clean and free of debris when they are opened.

#### E2.4 Measurement and Payment

- (a) Traffic control will not be measured. This item of Work will be paid for at the Contract Lump Sum Price, per location for "Items of Work", listed here below, performed in accordance with the Specification and accepted by the Contract Administrator.

##### Items of Work:

##### Traffic Control

- i) St. James Bridge
- ii) Midtown Bridge
- iii) St. Vital Bridge

### **E3. ST. JAMES & MIDTOWN BRIDGES CONCRETE REPAIRS**

#### E3.1 Description

- (a) This Specification shall cover all operations relating to the repair of designated concrete on the St. James Bridge and Midtown Bridge, as herein specified.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

#### E3.2 Materials

##### E3.2.1 General

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

##### E3.2.2 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.

##### E3.2.3 Testing and Approval

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

##### E3.2.4 Pier Cap Concrete Repair Material

- (a) General
  - (i) Pier cap concrete repair material may be either one or a combination of concrete repair mortars, conventional concrete or self-compacting concrete.
- (b) Concrete Repair Mortar
  - (i) The concrete repair mortar shall be a shrinkage compensated, fibre reinforced product suitable for application by hand trowelling or spraying or form and pour or pump. The mortar product shall be EMACO S88C1 for trowelling or spraying or EMACO S66 CI for form and pour or pump by Masterbuilders or equivalent as approved in accordance with B5. Mix in accordance with manufacturer's specifications, including addition of aggregate for deep repairs.
- (c) Conventional Concrete Mix Design
  - (i) Proportioning shall be such as to yield concrete having the required strength and workability as follows:
    - 35 MPa Concrete
    - Specified Compressive Strength at 28 Days - 35 MPa
    - maximum water-to-cementing materials ratio = 0.4
    - Aggregate: 14 mm Nominal
    - Air Content: 5 to 8 percent
    - Chloride Ion Penetrability at 56 days: < 1500 coulombs
    - Superplasticizer: high range
    - Shrinkage reducing admixture
    - slump  $80 \pm 20$  before addition of superplasticizer
  - (ii) The Contractor shall submit the proposed mix designs at least one week before the commencement of concrete placing operations.
- (d) Self-Compacting Concrete
  - (i) Self-compacting concrete shall be so designed to have equivalent or better strength and durability properties as the conventional concrete.

#### E3.2.5 Concrete Aggregate

- (a) The Contractor shall furnish in writing to the Contract Administrator, the location of the sources where aggregate will be obtained in order that same may be inspected and tentatively approved by the Contract Administrator. Changes in the source of aggregate supply during the course of the Contract will not be permitted without notification in writing to and the expressed approval of the Contract Administrator.
  - (i) Fine Aggregate
    - i. Fine aggregate shall consist of sand having clean, hard, strong, durable, uncoated grains; free from injurious amounts of dust, soft or flaking particles, shale, alkali, organic matter, loam, or other deleterious substance.
    - ii. Fine aggregate shall be well-graded throughout and shall conform to the following grading requirements:

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

(ii) Coarse Aggregate (14 mm Nominal)

iii. Coarse aggregate shall be clean and free from alkali, organic, or other deleterious matter, shall have an absorption not exceeding 3% and shall conform to the following gradation requirements:

Sieve Size	Percent of Total Dry Weight Passing Each Sieve
20 mm	100%
14 mm	90% - 100%
10 mm	45% - 75%
5 mm	0% - 15%
2.5 µm	0% - 5%

**E3.2.6 Cement**

(a) All cement, unless hereinafter specifically stated, shall be Type 10 Portland Cement.

**E3.2.7 Fly Ash**

(a) Fly ash supplemental cementing material shall be Type C1 or Type F and shall not exceed 25% by mass of cement.

**E3.2.8 Water**

(a) Water used for mixing concrete 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.

**E3.2.9 Admixtures**

(a) Air-Entraining Agent

(i) The air-entraining agent shall conform to the requirements of ASTM Standard C260. It shall produce a satisfactory air void system and an air content within the ranges specified in CSA A23.1 for each class of concrete.

(b) Water-Reducing Agent

(i) Water-reducing agent shall conform to the requirements of ASTM Standard C494.

(c) Superplasticizing Agent

- (i) The superplasticizing agent shall conform to the requirements of ASTM Standard C494. The agent shall be free of chlorides and shall not affect the air-entraining agent's ability to produce a satisfactory air-void system.

(d) Shrinkage Reducing

- (i) Shrinkage reducing admixture shall conform to the requirements of ASTM Standard C157. An approved product is Tetraguard AS20 by Masterbuilders.

E3.2.10 Bonding Agent

- (a) If a bonding agent is used, the Contractor shall identify the product(s) and submit product information to the Contract Administrator for review.

E3.2.11 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.

E3.2.12 Epoxy Adhesive

- (a) Epoxy adhesive shall be ST431, as manufactured by Stemson Limited or equal as approved in accordance with B5.

E3.2.13 Formliner

- (a) Formliner shall be "Hyroform" or equal as approved in accordance with B5.

E3.2.14 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.

E3.3 Equipment

- E3.3.1 All equipment shall be of a type accepted by the Contract Administrator and shall be kept in good working order.

E3.4 Construction Methods

E3.4.1 Preparation

- (a) Remove all concrete from the designated repair areas to a depth shown on the drawings. Sawcut perimeter to a minimum depth of 25 mm. The specified depth of removal shall achieve a 25 mm clear distance between the existing reinforcing steel and the prepared concrete surface to allow the bars to be fully cleaned and new concrete completely encapsulate them. If this cannot be achieved within the designated repair depth, the Contract Administrator may direct additional concrete removal as extra Work.
- (b) After completion of concrete removals, satisfactory to the Contract Administrator, all resulting concrete and reinforcing steel surfaces shall be thoroughly cleaned by gritblasting. All gritblast materials shall be blown out of the repair area, cleaned up, and removed off and away from the Site.
- (c) Install embedded galvanic anodes in accordance with E4.

- (d) If recommended by the mortar/grout manufacturer's directions, pre-wet the patch surfaces for the duration recommended.
- (e) The Contractor will be required to pick up and remove from the Site all debris created by the repair procedures to the satisfaction of the Contract Administrator.

#### E3.4.2 Form Work 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.

#### E3.4.3 Formliner

- (a) Use a formliner of all concrete repair areas.

#### E3.4.4 Concrete Repair Mortar/Conventional Concrete Placement

- (a) The Contractor is responsible to create a bond between the new mortar/concrete and the existing substrates. This may be done by either the application of a suitable bonding agent or grout or by using a self-bonding mortar or concrete. The Contract Administrator will check all repaired areas for bond using a hammer "sounding" method after form removal. Place mortar or concrete by trowelling, pumping, spraying, or into forms ensuring that all entrapped air is removed.

#### E3.4.5 General Curing

- (a) Refer to Clause E3.4.9 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 anyone 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.

#### E3.4.6 Form Removal

- (a) All forms shall remain in place for a minimum of seven (7) 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) The minimum strength of concrete in place for safe removal of soffit forms for horizontal or inclined members, as well as vertical forms shall be 20 MPa, with the added provisions that the member shall be of sufficient strength to carry safely its own weight, together with superimposed construction loads, and that the forms shall stay in place a minimum of three days unless otherwise approved by the Contract Administrator.
- (c) Field-cured test specimens, representative of the in-place concrete being stripped, may be tested to verify the concrete strength.

#### E3.4.7 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.

#### E3.4.8 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°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°C before concrete is placed.
- (e) The temperature of the concrete shall be maintained at not less than 10°C for seven days or 15°C for five days or 20°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°C and not more than 55°C. Water shall be heated to a temperature between 55°C and 55°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°C, a complete hoarding of the Work, together with supplementary heat, shall be provided.
- (h) When the ambient temperature is below -15°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°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°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. Surface moisture evaporation rates shall not exceed the limits specified in E3.4.9(b). Following finishing operations, exposed concrete surfaces shall be protected from excessive drying by applying curing compound, covering the surfaces with polyethylene, or providing water curing.
- (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.

#### E3.4.9 Hot Weather Concreting

- (a) General



- (i) The requirements of this section shall be applied during hot weather; i.e. air temperatures above 25°C during placing.
  - (ii) Concrete shall be placed at as low a temperature as possible, preferably below 15°C, but not above 22°C. Aggregate stockpiles may be cooled by watersprays and sunshades.
  - (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°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°C, in order to minimize the temperature rise of the concrete.
- (c) Job Preparation
- (i) When the air temperature is at or above 25°C, or when there is a probability of its rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, as defined in E3.4.9(b), 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)	Temperatures, °C	
	Minimum	Maximum
Less than 0.3	10	35
0.3 to 1.0	10	30
1.0 to 2.0	5	25

E3.4.10 Clean Up

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

E3.5 Measurement and Payment

- E3.5.1 St. James Bridge
- (a) Concrete pier repairs at St. James Bridge will be measured on a unit basis and paid for at the Contract Unit Price per square metre for "St. James Bridge – Concrete Pier Repairs.", performed in accordance with this Specification and accepted by the Contract Administrator.

- E3.5.2 Midtown Bridge
- (a) Concrete pier repairs at Midtown Bridge will not be measured. This item of Work will be paid for at the Contract Lump Sum Price for "Midtown Bridge – Concrete Pier Repairs" performed in accordance with this Specification and accepted by the Contract Administrator.

#### **E4. EMBEDDED GALVANIC ANODES**

- E4.1.1 Description
- (a) This Section shall cover the installation of embedded galvanic anodes for corrosion mitigation of surface concrete repairs and for corrosion mitigation in mechanically sound concrete.
  - (b) The Work to be done by the Contractor under this Section shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

- E4.1.2 References
- (a) ACI/ICRI 1999 Concrete Repair Manual
  - (b) ACI Guideline No. 222 – Corrosion of Metals in Concrete
  - (c) CAN/CSA A23.1 Standard for Repair Mortars, Concrete and Bonding Agents
  - (d) CAN/CSA G30.18-M92 (R1998) Billet-Steel Bar for Concrete Reinforcement
  - (e) ASTM B418-95a Standard Specification for Cast and Wrought Galvanic Zinc Anodes
  - (f) G30.3-M1983 (R1998) Cold-Drawn Steel Wire for Concrete Reinforcement

#### **E4.2 Embedded Anodes for Concrete Surface Repairs**

- E4.2.1 Materials
- (a) Embedded galvanic anodes will be Galvashield® XP by Vector Corrosion Technologies (204) 489-6300. Anodes will be supplied by the City of Winnipeg, for pickup by the Contractor at the City of Winnipeg Bridge Yard, 849 Ravelston Ave. West. Upon completion of the Work, any extra anodes shall be returned to the City, and the Contractor will be required to deliver the extra anodes to the City of Winnipeg Bridge Yard.
  - (b) Repair mortars, concrete and bonding agents shall be Portland cement-based materials with suitable electrical conductivity, supplied by the Contractor. Non-conductive repair materials such as epoxy, urethane, or magnesium phosphate shall not be permitted.
  - (c) Deliver, store, and handle all materials in accordance with manufacturer's instructions.

#### **E4.2.2 Construction Methods**

- (a) Cleaning and Repair of Reinforcing Steel
  - (i) Clean exposed reinforcing steel of rust, mortar, etc. to provide sufficient electrical connection and mechanical bond.

(ii) If significant reduction in the cross section of the reinforcing steel has occurred, replace or install supplemental reinforcement as directed by the Contract Administrator.

(iii) Secure loose reinforcing steel by tying tightly to other bars with steel tie wire.

(b) Galvanic Anode Installation

(i) The Contract Administrator will determine the location of all anodes. Galvanic anodes shall be installed around the perimeter of the repair area with an approximate spacing of 500 mm. Each repair area will have a minimum of two (2) anodes. In no case shall the distance between anodes exceed 610 mm.

(ii) Provide sufficient clearance between anodes and substrate to allow repair material to encase the anodes.

(iii) Secure the galvanic anodes as close as possible to the patch edge using the anode tie wires. The tie wires shall be wrapped around the cleaned reinforcing steel and twisted tight to allow little or no free movement.

(iv) If the anode is to be tied onto a single bar, or if less than 25 mm of concrete cover is expected, place anode beneath the bar and secure to clean reinforcing steel.

(v) If sufficient concrete cover exists, the anode may be placed at the intersection between two bars and secured to each clean bar.

(c) Electrical Continuity

(i) Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm,  $\Omega$ ) with a multi-meter.

(ii) Confirm electrical continuity of the exposed reinforcing steel within the repair area. If necessary, electrical continuity shall be established with steel tie wire.

(iii) Electrical continuity is acceptable if the DC resistance measured with multi-meter is less than 5  $\Omega$ .

(d) Concrete Replacement

(i) Following normal concrete repair procedures, complete the repair with the repair material, taking care not to create any air voids within the repair. Refer to Section E3 for concrete surface repair specifications.

E4.2.3 Clean Up

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

E4.3 Measurement and Payment

E4.3.1 The installation of embedded galvanic anodes are considered incidental to the Works of Specification E3 and no additional measurement or payment will be made.

**E5. ST. VITAL BRIDGE CONCRETE TRAFFIC BARRIER REPAIRS**

E5.1 Description

(a) This Specification shall cover all operations relating to the repair of designated concrete traffic barriers on the St. Vital Bridge as herein specified.

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

E5.2 Materials

E5.2.1 General

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

E5.2.2 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.

E5.2.3 Testing and Approval

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

E5.2.4 Concrete Repair Mortar

- (a) The concrete repair mortar shall be a shrinkage compensated, fibre reinforced product suitable for application by hand trowelling or spraying or form and pour or pump. The mortar product shall be EMACO S88C1 for trowelling or spraying or EMACO S66 CI for form and pour or pump by Masterbuilders or equivalent as approved in accordance with B5. Mix in accordance with manufacturer's specifications, including addition of aggregate for deep repairs.

E5.2.5 Concrete Strength and Workability

- (a) Structural Concrete
- (i) Proportioning of fine aggregate, coarse aggregate, cement, water, and air-entraining agent shall be such as to yield concrete having the required strength and workability, as follows:

35 MPa Concrete

- Minimum Compressive Strength @ 28 days = 35 MPa
- Maximum water-to cementing materials Ratio = 0.40
- Aggregate: 20mm nominal
- Air Content: 5.0% or 8.0%
- Chloride Ion Penetrability at 56 days: < 1500 coulombs
- Slump = 75 mm ± 25 mm

E5.2.6 Concrete Aggregate

- (a) The Contractor shall furnish in writing to the Contract Administrator, the location of the sources where aggregate will be obtained, in order that same may be inspected and tentatively approved by the Contract Administrator. Changes in the source of aggregate supply during the course of the Contract will not be permitted without notification in writing to and the expressed approval of the Contract Administrator.

(i) Fine Aggregate

Fine aggregate shall consist of sand having clean, hard, strong, durable, uncoated grains; free from injurious amounts of dust, soft or flaking particles, shale, alkali, organic matter, loam, or other deleterious substance.

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

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

(ii) Coarse Aggregate (20 mm Nominal)

Coarse aggregate shall be clean and free from alkali, organic, or other deleterious matter, shall have an absorption not exceeding 3%, and shall conform to the following gradation requirements:

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

E5.2.7 Cement

(a) All cement, unless hereinafter specifically stated, shall be Type 10 Portland Cement.

E5.2.8 Fly Ash

(a) Fly ash supplemental cementing material shall be Type CI or Type F and shall not exceed 25% by mass of cement.

E5.2.9 Water

(a) Water used for mixing concrete 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.

E5.2.10 Admixtures

(a) Air-Entraining Agent

(i) The air-entraining agent shall conform to the requirements of ASTM Standard C260. It shall produce a satisfactory air void system and an air content within the ranges specified in CSA A23.1 for each class of concrete.

(b) Water-Reducing Agent

(i) Water-reducing agent shall conform to the requirements of ASTM Standard C494.

(c) Superplasticizing Agent

(i) The superplasticizing agent shall conform to the requirements of ASTM Standard C494. The agent shall be free of chlorides and shall not affect the air-entraining agent's ability to produce a satisfactory air-void system.

- (d) Shrinkage Reducing
  - (i) Shrinkage reducing admixture shall conform to the requirements of ASTM Standard C157. An approved product is Tetraguard AS20 by Masterbuilders.

E5.2.11 Bonding Agents

- (a) If a concrete bonding agent is used, the Contractor shall identify the product(s) and submit product information to the Contract Administrator for review.
- (b) Epoxy resin for bonding reinforcing steel into holes in hardened concrete shall be epoxy resin of a type listed in the approved products list, Specification CW 3310 conforming to the requirements of ASTM Standard C881. Type I or Type IV Grade 3 epoxy shall be used for bonding reinforcing steel into holes in hardened concrete. Bonding agents for bonding reinforcing steel into holes in hardened concrete other than epoxy resin may be permitted provided that they develop a minimum pullout resistance of 50 kN within 48 hours after installation.

E5.2.12 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.

E5.2.13 Reinforcing Steel

- (a) Reinforcing steel shall be epoxy-coated and conform to the requirements of CSA Standard G30.18-Grade 400W.

E5.2.14 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.

E5.2.15 Form Liner

- (a) Form liner shall be "Hyroform" or equal as approved in accordance with B5.

E5.2.16 Precompressed Foam Joint Filler

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

E5.2.17 Field Applied Epoxy-Coating

- (a) Field applied epoxy-coating shall be approved touch-up epoxy-coating material as specified by the manufacturer for touching up the shop coating and field coating existing reinforcing bars.
- (b) Approved touch-up epoxy-coating materials are as follows:
  - (i) 3M Scotchcoat 302, 309, 312, or 313.
  - (ii) Sterling 10686.

E5.2.18 Rail Post Anchor Bolts

- (a) Rail post anchor bolts shall be 250 mm x 16 mm diameter stainless steel; each complete with one stainless steel hex nut, one stainless steel lock washer, one

stainless steel flat washer, and one 50 mm diameter galvanized flat washer with 18 mm diameter hole. The anchor bolts shall be threaded for 65 mm and shall be prebent as shown on the Drawings (where applicable). The stainless steel hex head and socket head cap screws shall conform to ASTM A276 type 430 and the dimensional requirements of ANSI B18.3

E5.3 Equipment

E5.3.1 All equipment shall be of a type accepted by the Contract Administrator and shall be kept in good working order.

E5.4 Construction Methods

E5.4.1 Type 1 - Concrete Barrier Repairs

- (a) Remove all of the affected deteriorated concrete volume by saw cutting off the top of the barrier.
- (b) Restore all the reinforcing steel that was removed by installing into predrilled holes with an approved bonding grout as follows:
  - (i) Drill holes into adjacent concrete of the diameters and depths shown on the Drawings or to match existing. Drill bits shall have a diameter no larger than 2 mm larger than the nominal dowel or tie bar diameter.
  - (ii) Holes shall be located to the correct depth and alignment as indicated on the Drawings.
  - (iii) Drilling equipment shall be operated so as to ensure that no damage to the concrete 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, that 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.
  - (iv) Touch up all cut or damaged surfaces of new or existing exposed reinforcing steel with field-applied epoxy coating.
  - (v) Holes for reinforcing steel shall be blown clean with compressed air. Bonding agent shall be placed in the back of the drilling hole. The reinforcing steel shall be worked back into the holes for complete coverage around the portion of the bar that extends into the hole, such that bonding agent is squeezed from the hole.
  - (vi) 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.
  - (vii) Reuse existing cleaned traffic barrier rail post anchor bolts or supply new bolts equal to existing.
  - (viii) Place concrete into forms.

E5.4.2 Type 2 - Concrete Barrier Repairs

- (a) Sawcut perimeter of area to be repaired to a minimum depth of 20 mm. Mechanically remove unsound concrete to the limits indicated on the Drawings or to the depth of unsound concrete, whichever is greater. Remove at least 50 mm of existing concrete facing, even if not delaminated, and continue removal as required to expose sound aggregate. Where reinforcing steel with active corrosion is encountered, comply with the following:
  - (i) If half or greater of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing to a 20 mm minimum depth.
  - (ii) Abrasive blast reinforcing steel and concrete to remove rust and contaminants. Field epoxy-coat all exposed reinforcing.

(iii) Splice new reinforcing steel to existing steel where corrosion has depleted the cross section area by 25%, as directed by the Contract Administrator.

- (b) 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, using a self-bonding mortar or concrete, by encapsulating existing reinforcing steel or by installing small stainless steel anchor bolts. 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.

#### E5.4.3 General Curing

- (a) Refer to Clause E4.4.9 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. Construction joints shall only be covered and kept saturated by means of wet polyester curing blankets for the curing period.
- (d) Unformed surfaces shall have curing compound applied immediately after the wet curing period.
- (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) 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.

#### E5.4.4 Form Removal

- (a) All forms shall remain in place for a minimum of seven (7) 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) The minimum strength of concrete in place for safe removal of soffit forms for horizontal or inclined members, as well as vertical forms shall be 20 MPa, with the added provisions that the member shall be of sufficient strength to carry safely its own weight, together with superimposed construction loads, and that the forms shall stay in place a minimum of three days unless otherwise approved by the Contract Administrator.
- (c) Field-cured test specimens, representative of the in-place concrete being stripped, may be tested to verify the concrete strength.



#### E5.4.5 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.

#### E5.4.6 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°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°C before concrete is placed.
- (e) The temperature of the concrete shall be maintained at not less than 10°C for seven days or 15°C for five days or 20°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°C and not more than 65°C. Water shall be heated to a temperature between 55°C and 65°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°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. Surface moisture evaporation rates shall not exceed the limits specified in E5.4.7(b). Following finishing operations, exposed concrete surfaces shall be protected from excessive drying by applying curing compound, covering the surfaces with polyethylene, or providing water curing.
- (l) Sufficient standby heating equipment must be available to allow for any sudden drop in outside temperatures and any breakdowns which 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.

#### E5.4.7 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°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°C, in order to minimize the temperature rise of the concrete.
- (c) Job Preparation
  - (i) When the air temperature is at or above 25°C, or when there is a probability of its rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, as defined in E5.4.7(b), 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)	Temperatures, °C	
	Minimum	Maximum
Less than 0.3	10	35
0.3 to 1.0	10	30
1.0 to 2.0	5	25

**E5.4.8 Cleanup**

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

**E5.5 Measurement and Payment**

**E5.5.1 Type 1 Concrete Barrier Repairs**

- (a) Type 1 Concrete Barrier Repairs will be measured on a unit basis and paid for at the Contract Unit Price per linear metre for “St. Vital Bridge - Concrete Barrier Repairs - Type 1”, repaired in accordance with this Specification and accepted by the Contract Administrator.

**E5.5.2 Type 2 Concrete Barrier Repairs**

- (a) Type 2 Concrete Barrier Repairs will be measured on a unit basis and paid for at the Contract Unit Price per square metre for “St. Vital Bridge - Concrete Barrier Repairs - Type 2”, repaired in accordance with this Specification and accepted by the Contract Administrator.

**E6. EXPANSION JOINT REPAIRS (ST. JAMES & ST. VITAL BRIDGES)**

**E6.1 Description**

- E6.1.1 This Specification shall cover expansion joint repairs that will include the supply and installation of replacement expansion joint seals and the repair of steel expansion joint extrusions, as specified herein.

E6.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all other things necessary for and incidental to the satisfactory performance and completion of all Work hereinafter specified.

## E6.2 Materials

### E6.2.1 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 of a type acceptable to by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator.

### E6.2.2 Preformed Neoprene Joint Seals

- (a) The existing seal at St. James Bridge is Elastometal Acme PS-57 seal.
- (b) The existing seal at St. Vital Bridge is Wercholoz GSH 141W seal.
- (c) Preformed joint seal shall be manufactured from a vulcanized elastomeric compound using crystallization resistant polychloroprene (neoprene) as the only polymer.
- (d) The preformed neoprene joint seal shall meet the requirements of Ontario Provincial Standard Specification (OPSS) 1210 "Material Specification for Preformed Neoprene Joint Seals," latest edition, and as amended herein; and of Table E6.1 of this Specification. All tests will be made on specimens prepared from the extruded seals.
- (e) No shop or field splicing will be allowed in the seals.
- (f) The Contractor shall field verify the length of each seal.

### E6.2.3 Extrusion Steel

- (a) The existing extrusion at St. James Bridge is an Elastometal Type "A" Extrusion.
- (b) The existing extrusion at St. Vital Bridge is a Glacier WSF 160 Extrusion.
- (c) Replacement steel for extrusions shall conform to CSA G40.21M, Grade 230G minimum.
- (d) Replacement steel extrusions shall be hot dip galvanized.

### E6.2.4 Galvanizing Touch-up and Field-Applied Galvanizing

- (a) Field-applied galvanizing, to touch-up damaged hot-dip galvanizing, metallizing, or field welds, shall be done with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780-80 for "Repair of Damaged Hot-Dip Galvanized Coatings." Approved products are Galvalloy as manufactured by 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.

### E6.2.5 Quick Setting Concrete at Expansion Joint Repairs

- (a) Quick Setting Concrete Mix Design
  - (i) Proportioning shall be such as to yield concrete having the required strength and workability as follows:

#### 35 MPa Concrete

- Specified Compressive Strength at 24 hours of - 25 MPa
- Specified Compressive Strength at 28 Days - 35 MPa
- maximum water-to-cementing materials ratio = 0.4

- Aggregate: 14 mm Nominal
  - Air Content: 5 to 8 percent
  - Chloride Ion Penetrability at 56 days: < 1500 coulombs
  - Shrinkage reducing admixture
- (ii) A self-compacting concrete may be used and shall be so designed to have equivalent or better strength and durability properties as the 35 MPa concrete specified above.
- (iii) The Contractor shall submit the proposed mix designs at least one week before the commencement of concrete placing operations.

**E6.2.6 Concrete Aggregate**

- (a) The Contractor shall furnish in writing to the Contract Administrator, the location of the sources where aggregate will be obtained, in order that same may be inspected and tentatively approved by the Contract Administrator. Changes in the source of aggregate supply during the course of the Contract will not be permitted without notification in writing to and the expressed approval of the Contract Administrator.

(i) Fine Aggregate

Fine aggregate shall consist of sand having clean, hard, strong, durable, uncoated grains; free from injurious amounts of dust, soft or flaking particles, shale, alkali, organic matter, load, or other deleterious substance.

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

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

(ii) Coarse Aggregate (14 mm Nominal)

Coarse aggregate shall be clean and free from alkali, organic, or other deleterious matter, shall have an absorption not exceeding 3%, and shall conform to the following gradation requirements:

Sieve Size	Percent of Total Dry Weight Passing Each Sieve
20 mm	100%
14 mm	90% - 100%
10 mm	45% - 75%
5 mm	0% - 15%
2.5 µm	0% - 5%

- E6.2.7 Cement
- (a) All cement, unless hereinafter specifically stated, shall be Type 10 Portland Cement.
- E6.2.8 Fly Ash
- (a) Fly ash supplemental cementing material shall be Type CI or Type F and shall not exceed 25% by mass of cement.
- E6.2.9 Water
- (a) Water used for mixing concrete 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.
- E6.2.10 Admixtures
- (a) Air-Entraining Agent
- (i) The air-entraining agent shall conform to the requirements of ASTM Standard C260. It shall produce a satisfactory air void system and an air content within the ranges specified in CSA A23.1 for each class of concrete.
- (b) Water-Reducing Agent
- (i) Water-reducing agent shall conform to the requirements of ASTM Standard C494.
- (c) Superplasticizing Agent
- (i) The superplasticizing agent shall conform to the requirements of ASTM Standard C494. The agent shall be free of chlorides and shall not affect the air-entraining agent's ability to produce a satisfactory air-void system.
- (d) Shrinkage Reducing
- (i) Shrinkage reducing admixture shall conform to the requirements of ASTM Standard C157. An approved product is Tetraguard AS20 by Masterbuilders.
- E6.2.11 Bonding Agent
- (a) If a bonding agent is used, the Contractor shall identify the product(s) and submit product information to the Contract Administrator for review.
- E6.2.12 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.
- E6.2.13 Epoxy Adhesive
- (a) Epoxy adhesive shall be ST431, as manufactured by Stemson Limited or equal as approved in accordance with B5.
- E6.2.14 Formliner
- (a) Formliner shall be "Hyroform" or equal as approved in accordance with B5.
- E6.2.15 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 in accordance with B5.

### E6.3 Equipment

E6.3.1 All equipment shall be of a type accepted by the Contract Administrator and shall be kept in good working order.

### E6.4 Construction Methods

#### E6.4.1 Removal of Seals

(a) Remove each expansion joint seal indicated on the drawings. Salvage the southbound, south expansion joint, north seal.

#### E6.4.2 Straighten Expansion Joint Centre Beam

(a) Straighten expansion joint centre beams indicated on the drawings. Contractor may apply heat to the centre beam for workability. Ensure adjacent seals are removed prior to applying heat.

#### E6.4.3 Expansion Joint Extrusion Repair

(a) Deep gouged steel as determined with the Contract Administrator are to be repaired by removing concrete behind damaged steel, cutting out the damaged steel and replacing it with new steel to match extrusion shape. Welding shall be done in accordance with CSA W59, "Welded Steel Construction." Coat all welds after installation with field-applied galvanizing. Place quick setting concrete as specified.

(b) Shallow gouged steel as determined with the Contract Administrator to be repaired by filling with weld material and grinding smooth. Welding shall be done in accordance with CSA W59, "Welded Steel Construction." Coat all accessible welds after installation with field-applied galvanizing. Field galvanize all repaired steel areas.

#### E6.4.4 Field-Applied Touch-up Galvanizing

(a) Repaired steel extrusion areas shall receive field-applied touch-up galvanizing.

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

#### E6.4.5 Preparation of Concrete for Deep Gouged Extrusion Repairs

(a) Remove concrete to the limits shown on the drawings behind the extrusion to be repaired. The maximum sawcut depth shall be twenty-five (25) mm. Do not remove or damage the existing steel reinforcing.

(b) Remove all dust and debris.

#### E6.4.6 Quick Setting Concrete Placement

(a) Place quick setting concrete

(b) Trowel concrete smooth and flush with the extrusion top plate.

(c) Allow concrete to cure to achieve a minimum of 25 MPa prior to allowing vehicle traffic.

#### E6.4.7 Installation of Seals

(a) Replace each expansion joint seal indicated on the drawings with a new seal.

- (b) The seal at each expansion joint unit shall be installed as one continuous piece to the satisfaction of the Contract Administrator.

**E6.4.8 Joint Seal Markings**

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

**E6.4.9 Joint Seal Samples and Testing Procedures**

- (a) The Contractor shall supply seal sample material at no charge to The City for quality control testing purposes. The samples will each be 1½ m long. Each sample will represent not more than three expansion joint seals of the same size, lot, and make and shall be continuous with same until sampled by the Contract Administrator. As soon as the seals to be used in the joint assemblies have been manufactured, they shall be available to the Contract Administrator for sampling.
- (b) Testing procedures will be in accordance with the latest revisions of the methods indicated on Table E5.1, Physical Requirements.
- (c) All materials failing to meet the Specification requirements will be rejected.
- (d) Lots rejected may be culled by the supplier and, upon satisfactory evidence of compliance with the Specifications, will be accepted.

**Table E6.1: Physical Requirements**

Property	Physical Requirements	Test Procedure*
1. Tensile Strength	Minimum 13.5 MPa	ASTM D412 OPSS 1210.07.03.01.02
2. Elongation at Break	Minimum 250%	ASTM D412 OPSS 1210.07.03.01.02
3. Hardness, Type A Durometer	55: +7 Points -5 Points	ASTM D2240 OPSS 120.07.03.01.03
4. Oven aging Test 70 Hours at 100°C Reduction in Tensile Strength Reduction in Elongation Increase in Hardness	Maximum 20% Maximum 20% Maximum 10 Points	ASTM D573
5. Permanent Set at Break	Maximum 10%	ASTM D412
6. Low Temperature Stiffening Hardness, Type A Durometer	Maximum 15 Points	ASTM D2240 OPSS 1210.07.03.01.03
7. Oil Swell, ASTM Oil No. 3 70 H at 40°C (wipe with toluene to remove surface contamination)	No Cracks	ASTM D1149
8. **Safe Compressibility Test (Z min.)		



Bridge Seal - $\leq$ 63.5 mm	Minimum 50%	OPSS 1210.07.03.01.04
> 63.5 mm	Minimum 55%	
9. **Pressure Generation at 15% Deflection	Minimum 20 kPa	OPSS 1210.07.03.01.04
10. **Recovery		
22 h at -28°C	Minimum 80% No Cracking	OPSS 1210.07.03.01.05
70 h at -10°C	Minimum 88% Splitting or	
70 h at +100°C	Minimum 85% Sticking	

- \* ASTM - American Society for Testing and Materials  
 OPSS - Ontario Provincial Standard Specification
- \*\* This physical requirement not applicable to lock-in type joint seals

E6.4.10 Clean Up

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

E6.5 Measurement and Payment

- (a) Expansion Joint Repairs will not be measured. This item of Work will be paid for at the Contract Lump Sum Price, per location for "Items of Work", listed here below, performed in accordance with the Specification and accepted by the Contract Administrator.

- (i) Items of Work:

- Expansion Joint Repairs:

- St. James Bridge – Supply and installation of seals and extrusion repairs.

- St. Vital Bridge – Supply and installation of seals and extrusion repairs.