



THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 413-2010

**2010 BRIDGE MAINTENANCE – ST. VITAL BRIDGE APPROACH PAVEMENT
WORKS**

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 2010 BRIDGE MAINTENANCE – ST. VITAL BRIDGE APPROACH PAVEMENT WORKS

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, June 11, 2010.

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

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

B3. 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 Division website at <http://www.winnipeg.ca/matmgt/bidopp.asp>

B4.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

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 may base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with 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.
- B5.10 Notwithstanding B5.2 to B5.9, in accordance with B6.6, deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B14.1(a).

B6. BID COMPONENTS

- B6.1 The Bid shall consist of the following components:
- (a) Form A: Bid;
 - (b) Form B: Prices, hard copy;

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

- B6.2 Further to B6.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B5.

- B6.3 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Bid.

- B6.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

- B6.4.1 Samples or other components of the Bid which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder's Bid.

- B6.4.2 A hard copy of Form B: Prices must be submitted with the Bid. If there is any discrepancy between the Adobe PDF version of Form B: Prices and the Microsoft Excel version of Form B: Prices, the PDF version shall take precedence.

- B6.5 Bidders are advised not to include any information/literature except as requested in accordance with B6.1.

- B6.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, will be evaluated in accordance with B14.1(a).

- B6.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

- B6.8 Bids shall be submitted to:
The City of Winnipeg
Corporate Finance Department
Materials Management Division
185 King Street, Main Floor
Winnipeg MB R3B 1J1

- 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, shall be affixed;
 - (d) if the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.
- B7.4.1 The name and official capacity of all individuals signing Form A: Bid should be printed below such signatures.
- 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 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.
- B8.1.1 For the convenience of Bidders, and pursuant to B6.4.2 and B14.4.3, an electronic spreadsheet Form B: Prices in Microsoft Excel (.xls) format is available along with the Adobe PDF documents for this Bid Opportunity on the Bid Opportunities page at the Materials Management Division website at <http://www.winnipeg.ca/matmgt>
- 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.
- B8.4 Prices from Non-Resident Bidders are subject to a Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).

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; and
 - (b) be financially capable of carrying out the terms of the Contract; and
 - (c) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract.
- B9.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:
- (a) be responsible and not be suspended, debarred or in default of any obligations to the City. A list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/debar.stm>
- B9.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

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

B9.4 Further to B9.3(c), the Bidder shall, within five (5) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder/Subcontractor has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

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

B9.5 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B9.6 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

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.

B10.1.2 All signatures on bid securities shall be original.

B10.1.3 The Bidder shall sign the Bid Bond.

B10.1.4 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.

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 Bids will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Division, or in such other office as may be designated by the Manager of Materials.
- B11.1.1 Bidders or their representatives may attend.
- B11.1.2 Bids 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 Following the submission deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt>
- 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 Division website at <http://www.winnipeg.ca/matmgt>
- B11.4 The Bidder is advised that any information contained in any Bid may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

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 C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.
- 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 will:
- (a) retain the Bid until after the Submission Deadline has elapsed;
 - (b) open the Bid to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and
 - (c) if the notice has been given by any one of the persons specified in 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, or acceptable deviation therefrom (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 is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.
- 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 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.
- B14.4.2 Further to B14.1(a), in the event that a unit price is not provided on Form B: Prices, the City will determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.
- B14.4.3 The electronic Form B: Prices and the formulas imbedded in that spreadsheet are only provided for the convenience of Bidders. The City makes no representations or warranties as to the correctness of the imbedded formulas. It is the Bidder's responsibility to ensure the extensions of the unit prices and the sum of Total Bid Price performed as a function of the formulas within the electronic Form B: Prices are correct.

B15. AWARD OF CONTRACT

- B15.1 The City will give notice of the award of the Contract 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, in accordance with B14.
- B15.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

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

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. SCOPE OF WORK

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

- (a) Concrete Repairs
 - (i) Osborne Street from St. Vital Bridge to 110 m North of St. Vital Bridge
 - (ii) Dunkirk Street from St. Vital Bridge to
- (b) Structural Slab Repairs
 - (i) Pedestrian Underpass South of St. Vital Bridge
 - (ii) Pedestrian Underpass North of St. Vital Bridge

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

- (a) Concrete repairs
 - (i) Adjustment of catchbasins, catchpits, manholes, drainage inlets and other pavement appurtenances
 - (ii) Full depth concrete repairs of existing slabs and joints
 - (iii) Partial depth concrete repairs of existing slabs and joints
 - (iv) Renewal of curb for condition or grade as required
 - (v) Renewal of existing miscellaneous concrete slabs
 - (vi) Boulevard restoration
- (b) Structural Slab Repairs
 - (i) Full depth removal and reconstruction of existing structural concrete slabs
 - (ii) Partial depth structural concrete repairs
 - (iii) Renewal of curb
 - (iv) Boulevard restoration

D3. CONTRACT ADMINISTRATOR

D3.1 The Contract Administrator is Dillon Consulting Limited, represented by:

Mark Doucet, P.Eng.
Project Manager
200 – 895 Waverley Street
Telephone No. (204) 453-2301
Facsimile No. (204) 452-4412

D3.2 At the pre-construction meeting, Mark Doucet, P.Eng. 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.
- D4.2 At least two (2) business days prior to the commencement of any Work on the Site, the Contractor shall provide the Contract Administrator with a phone number where the supervisor identified in D4.1 or an alternate can be contacted twenty-four (24) hours a day to respond to an emergency.

D5. NOTICES

- D5.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.
- 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 Notwithstanding C21., all notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following address or facsimile number:
The City of Winnipeg
Chief Financial Officer
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
Internal Services Department
Legal Services Division
Attn: City Solicitor
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. AUTHORITY TO CARRY ON BUSINESS

- D7.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on

business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D8. SAFE WORK PLAN

- D8.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.
- D8.2 The Safe Work Plan shall be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/safety/default.stm>

D9. INSURANCE

- D9.1 The Contractor shall provide and maintain the following insurance coverage:
- (a) commercial general liability insurance, in the amount of at least two million dollars (\$2,000,000.00) inclusive, with The City of Winnipeg added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability, broad form property damage cover and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;
 - (b) automobile liability insurance for 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) an all risks Installation Floater carrying adequate limits to cover all machinery, equipment, supplies and/or materials intended to enter into and form part of any installation.
- D9.2 Deductibles shall be borne by the Contractor.
- D9.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in the C4.1 for the return of the executed Contract.
- D9.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least thirty (30) Calendar Days prior written notice to the Contract Administrator.

D10. PERFORMANCE SECURITY

- D10.1 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.
- D10.1.1 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.

D10.2 If the bid security provided in his Bid 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 and in no event later than the date specified in the C4.1 for the return of the executed Contract.

D11. SUBCONTRACTOR LIST

D11.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at or prior to a pre-construction meeting, or at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the C4.1 for the return of the executed Contract.

D12. EQUIPMENT LIST

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

D13. DETAILED WORK SCHEDULE

D13.1 The Contractor shall provide the Contract Administrator with a detailed work schedule at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the General Conditions for the return of the executed Contract.

D13.2 The detailed work schedule shall consist of the following:

- (a) a critical path method (C.P.M.) schedule for the Work;
- (b) a Gantt chart for the Work based on the C.P.M. schedule; and
- (c) all acceptable to the Contract Administrator.

D13.3 Further to D13.2(a), the C.P.M. schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path.

D13.4 Further to D13.2(b), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or Specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

SCHEDULE OF WORK

D14. COMMENCEMENT

D14.1 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.

D14.2 The Contractor shall not commence any Work on the Site until:

- (a) the Contract Administrator has confirmed receipt and approval of:
 - (i) evidence of authority to carry on business specified in D7;
 - (ii) evidence of the workers compensation coverage specified in C6.15;
 - (iii) the twenty-four (24) hour emergency response phone number specified in D4.2.
 - (iv) the Safe Work Plan specified in D8;
 - (v) evidence of the insurance specified in D9;

- (vi) the performance security specified in D10;
 - (vii) the Subcontractor list specified in D11;
 - (viii) the equipment list specified in D12;
 - (ix) the detailed work schedule specified in D13; and
- (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.

D14.3 The Contractor shall not commence the Work on the Site before July 5, 2010.

D14.4 The City intends to award this Contract by June 30, 2010.

D15. RESTRICTED WORK HOURS

D15.1 Further to clause 3.10 of CW 1130, the Contractor shall require written permission forty-eight (48) hours in advance from the Contract Administrator for any Work to be performed between 2000 hours and 0700 hours, or on Saturdays, Sundays, Statutory Holidays and or Civic Holidays.

D16. WORK BY OTHERS

D16.1 Work by others on or near the Site will include but not necessarily be limited to:

- (a) City of Winnipeg – Bridge Operations Branch
- (b) City of Winnipeg – Public Works, Streets Maintenance Division

D17. SUBSTANTIAL PERFORMANCE

D17.1 The Contractor shall achieve Substantial Performance by August 13, 2010.

D17.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.

D17.3 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a certificate of Substantial Performance is the date on which Substantial Performance has been achieved.

D18. TOTAL PERFORMANCE

D18.1 The Contractor shall achieve Total Performance by August 20, 2010.

D18.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.

D18.3 The date on which the Work has been certified by the Contract Administrator as being totally performed to the requirements of the Contract through the issue of a certificate of Total Performance is the date on which Total Performance has been achieved.

D19. LIQUIDATED DAMAGES

D19.1 If the Contractor fails to achieve Total Performance in accordance with the Contract by the day fixed herein for Total Performance, the Contractor shall pay the City five hundred dollars (\$500)

per Calendar Day for each and every Calendar Day following the day fixed herein for Total Performance during which such failure continues.

- D19.2 The amount specified for liquidated damages in D19.1 is based on a genuine pre-estimate of the City's damages in the event that the Contractor does not achieve Total Performance by the day fixed herein for same.
- D19.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D20. SCHEDULED MAINTENANCE

- D20.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:
- (a) Reflective Crack Maintenance (during two year warranty period) as specified in CW 3250;
 - (b) Sodding (maintenance period) as specified in CW 3510.
- D20.2 Determination of Substantial Performance and Total Performance shall be exclusive of scheduled maintenance identified herein. All scheduled maintenance shall be completed prior to the expiration of the warranty period. Where the scheduled maintenance cannot be completed during the warranty period, the warranty period shall be extended for such period of time as it takes the Contractor to complete the scheduled maintenance.

CONTROL OF WORK

D21. JOB MEETINGS

- D21.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.
- D21.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D22. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

- D22.1 Further to C6.24, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

D23. COOPERATION WITH OTHERS

- D23.1 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 the obligation of the Contractor under the terms of the Contract.

D24. ENVIRONMENTAL PLANNING

- D24.1 The Contractor shall conduct his operations in accordance with all 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.

D25. CLEAN UP

D25.1 The Contractor shall maintain the Site of Work in a tidy condition free from the accumulation of waste and debris.

MEASUREMENT AND PAYMENT

D26. PAYMENT

D26.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

WARRANTY

D27. WARRANTY

D27.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) years thereafter unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.

FORM H1: PERFORMANCE BOND
(See D10)

KNOW ALL MEN BY THESE PRESENTS THAT

_____ ,
(hereinafter called the "Principal"), and

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

_____ dollars (\$_____)

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

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

BID OPPORTUNITY NO. 413-2010

2010 BRIDGE MAINTENANCE – ST. VITAL BRIDGE APPROACH PAVEMENT WORKS
which is by reference made part hereof and is hereinafter referred to as the "Contract".

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

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

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

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

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

_____ day of _____, 20____.

SIGNED AND SEALED
in the presence of:

(Witness as to Principal if no seal)

(Name of Principal)

Per: _____ (Seal)

Per: _____

(Name of Surety)

By: _____ (Seal)
(Attorney-in-Fact)

**FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)**
(See D10)

(Date)

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

RE: PERFORMANCE SECURITY – BID OPPORTUNITY NO. 413-2010

2010 BRIDGE MAINTENANCE – ST. VITAL BRIDGE APPROACH PAVEMENT WORKS

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)

FORM K: EQUIPMENT
(See D12)

2010 BRIDGE MAINTENANCE – ST. VITAL BRIDGE APPROACH PAVEMENT WORKS

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

FORM K: EQUIPMENT
(See D12)

2010 BRIDGE MAINTENANCE – ST. VITAL BRIDGE APPROACH PAVEMENT WORKS

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

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

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

<u>Drawing No.</u>	<u>Drawing Name/Title</u>	<u>Drawing (Original) Sheet Size</u>
U216-10-01	2010 Bridge Maintenance Program – Churchill Drive Pedestrian Underpass – Plan & Profiles – Osborne Street Pavement Works	11" x 17"
U216-10-02	2010 Bridge Maintenance Program – Churchill Drive Pedestrian Underpass – Details – Osborne Street Pavement Works	11" x 17"
U217-10-01	2010 Bridge Maintenance Program – Golf Course Pedestrian Underpass – Plan – Dunkirk Street Pavement Works	11" x 17"
U217-10-02	2010 Bridge Maintenance Program – Golf Course Pedestrian Underpass – Details – Dunkirk Street Pavement Works	11" x 17"

E2. PROTECTION OF EXISTING TREES

- E2.1 The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing boulevard trees within the limits of the construction area:
- The Contractor shall not stockpile materials and soil or park vehicles and equipment on boulevards within 2 metres of trees.
 - Trees identified to be at risk by the Contract Administrator are to be strapped with 25 x 100 x 2400 mm wood planks, or suitably protected as approved by the Contract Administrator.
 - Excavation shall be performed in a manner that minimizes damage to the existing root systems. Where possible, excavation shall be carried out such that the edge of the excavation shall be a minimum of 1.5 times the diameter (measured in inches), with the outcome read in feet, from the closest edge of the trunk. Where roots must be cut to facilitate excavation, they shall be pruned neatly at the face of excavation.
 - Operation of equipment within the dripline of the trees shall be kept to the minimum required to perform the Work required. Equipment shall not be parked, repaired, refuelled; construction materials shall not be stored, and earth materials shall not be stockpiled within the driplines of trees. The dripline of a tree shall be considered to be the ground surface directly beneath the tips of its outermost branches. The Contractor shall ensure that the operations do not cause flooding or sediment deposition on areas where trees are located.

- (e) Work on-site shall be carried out in such a manner so as to minimize damage to existing tree branches. Where damage to branches does occur, they shall be neatly pruned.

E2.2 All damage to existing trees caused by the Contractor's activities shall be repaired to the requirements and satisfaction of the Contract Administrator and the City Forester or his designate.

E2.3 No separate measurement or payment will be made for the protection of trees.

E2.4 Except as required in clause E2.1(c) and E2.1(e), Elm trees shall not be pruned at any time between April 1 and July 31.

E3. TRAFFIC CONTROL

E3.1 Further to clauses 3.6 and 3.7 of CW 1130:

- (a) Where directed, the Contractor shall construct and maintain temporary asphalt ramps to alleviate vertical pavement obstructions such as manholes and planing drop-offs to the satisfaction of the Contract Administrator. Payment shall be in accordance with CW 3410.
- (b) In accordance with the Manual of Temporary Traffic Control in Work Areas on City Streets, the Contractor ("Agency" in the manual) shall make arrangements with the Traffic Services Branch of the City of Winnipeg to place all temporary regulatory signs. The Contractor shall bear all costs associated with the placement of temporary traffic control devices by the Traffic Services Branch of the City of Winnipeg in connection with the Works undertaken by the Contractor.

E4. TRAFFIC MANAGEMENT

E4.1 Further to clause 3.7 of CW 1130:

- (a) Maintain a minimum of one lane of traffic northbound and one lane of traffic southbound during their respective construction times;
- (b) Should the Contractor be unable to maintain pedestrian or vehicular access to a residence or business, he shall review the planned disruption with the business or residence and the Contract Administrator, and take reasonable measures to minimize the impact. The Contractor shall provide a minimum of 24 hours notification to the affected residence or business and the Contract Administrator, prior to disruption of access;
- (c) Pedestrian and ambulance/emergency vehicle access must be maintained at all times;
- (d) The Contractor shall ensure all adjacent bus stop bays are accessible at all times and are not blocked at any time; and
- (e) On and off ramp access shall be maintained at all times.

E5. WATER OBTAINED FROM THE CITY

E5.1 Further to clause 3.7 of CW 1120, the Contractor shall pay for all costs, including sewer charges, associated with obtaining water from the City in accordance with the Waterworks and Sewer By-laws.

E6. SURFACE RESTORATIONS

E6.1 Further to clause 3.3 of CW 1130, when Total Performance is not achieved in the year the Contract is commenced, the Contractor shall temporarily repair any Work commenced and not completed to the satisfaction of the Contract Administrator. The Contractor shall maintain the temporary repairs in a safe condition as determined by the Contract Administrator until permanent repairs are completed. The Contractor shall bear all costs associated with temporary repairs and their maintenance.

E7. RECYCLED CONCRETE BASE COURSE MATERIAL

E7.1 Description

E7.1.1 General

- (a) Further to CW 3110, this Specification covers supply and placement of recycled concrete base course material for Full-Depth Partial Slab Patches (Class A, B, C, & D), miscellaneous concrete slabs and sidewalks.

E7.1.2 Definitions

- (a) Deleterious material – are materials such as vegetation, organic material, wood, glass, plastic, metal, reinforcing steel, building rubble, brick, salvaged asphalt materials, clay, shale, and friable particles.

E7.1.3 Referenced Standard Construction Specifications

- (a) CW 3110 – Sub-Grade. Sub-Base and Base Course Construction.
- (b) CW 3230 – Full-Depth Patching of Existing Pavement Slabs and Joints.
- (c) CW 3235 – Renewal of Existing Miscellaneous Concrete Slabs.
- (d) CW 3325 – Portland Cement Concrete Sidewalk.

E7.2 Materials

E7.2.1 Recycled Concrete Base Course Material

- (a) Recycled concrete base course material when used for Full-Depth Partial Slab Patches (Class A, B, C, & D), miscellaneous concrete slabs and sidewalks will be considered equal to granular or limestone base course material specified in Section 2.2 of CW 3110.
- (b) Recycled concrete base course material will be approved by the Contract Administrator.
- (c) Recycled concrete base course material will consist of sound durable particles produced by crushing, screening, and grading of recovered concrete materials, free from soft material that would disintegrate through decay or weathering.
- (d) The recycled concrete base course material will be well graded and conform to the following grading requirements:

Recycled Concrete Base Course Material Grading Requirements

CANADIAN METRIC SIEVE SIZE	PERCENT OF TOTAL DRY WEIGHT PASSING EACH SIEVE
20 000	100%
5 000	40% - 70%
2 500	25% - 60%
315	8% - 25%
80	6% - 17%

- (e) Recycled concrete base course material when subjected to the abrasion test will have a loss of not more than 35% when tested in accordance with grading B of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- (f) The amount of deleterious material will be limited to a maximum of two percent of the total dry weight.

E7.3 Construction Methods

E7.3.1 Placement of Recycled Concrete Base Course Material

- (a) Place and compact recycled concrete base course material as a levelling course to a maximum thickness of 50 mm.

- (b) Spread materials uniformly to avoid segregation free of pockets of fine and coarse material.
- (c) Level and compact to the finished elevation. Compact to 100% Standard Proctor Density for Full-Depth Partial Slab Patches (Class A, B, C, & D) and 90% Standard Proctor Density for miscellaneous concrete slabs and sidewalks.
- (d) Maintain the finished material until the pavement or sidewalk is placed.

E7.4 Measurement and Payment

E7.4.1 Recycled Concrete Base Course Material

- (a) The supplying, placing and compaction of recycled concrete base course material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for the "Supplying and Placing Base Course Material" as specified in accordance with CW 3110.
- (b) No measurement or payment will be made for material placed as a levelling course under miscellaneous concrete slabs and sidewalks where the costs are included in accordance with CW 3235 and CW 3325.
- (c) No measurement or payment will be made for materials rejected by the Contract Administrator.

E8. REMOVAL OF STRUCTURAL CONCRETE ROADWAY SLABS

E8.1 Description

E8.1.1 This Specification shall cover all operations related to removal of existing structural concrete roadway slabs.

E8.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E8.2 Materials

E8.2.1 General

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

E8.3 Construction Methods

E8.3.1 General

- (a) The Work comprises of:
 - (i) The removal and disposal of all designated structural concrete.
 - (ii) The off-site disposal of surplus and unsuitable material.

E8.4 Measurement and Payment

E8.4.1 Structural concrete and other removals will not be measured. This item of work will be paid for at the Contract Lump Sum Price for "Structural Concrete Removals" performed in accordance with this Specification and accepted by the Contract Administrator.

E9. CONCRETE REINFORCEMENT

E9.1 Description

E9.1.1 This Specification shall cover the supply, fabrication, anchoring, and placement of the following reinforcing bars for structural concrete:

- (a) GFRP reinforcing bars,
- (b) Hot-dip galvanized reinforcing steel, and
- (c) Galvanized dowels and expansion sleeves.

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

E9.2 Materials

E9.2.1 General

- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.
- (b) The Contractor shall provide a bar list for all reinforcement to the Contract Administrator three (3) weeks prior to installation.
- (c) All materials shall be handled in a careful and workmanship like manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the requirements of CSA Standard CAN/CSA-A23.1, Storage of Materials, except as otherwise specified herein.

E9.2.2 GFRP Reinforcing

- (a) ASLAN 100 by Hugh Brothers or approved equal in accordance with B5.

E9.2.3 Hot-dip Galvanized Reinforcing Steel

- (a) Reinforcing steel shall be hot-dip galvanized after fabrication in accordance with CSA Standard G164 to a minimum retention of 600 g/m². The galvanizer shall safeguard against hydrogen embrittlement using recommended practices from applicable standards. Reinforcing steel shall be deemed to include reinforcing bars and tie-bars.
- (b) All galvanized reinforcing steel shall conform to the requirements of CSA Standard G30.18, Grade 400W, Billet-Steel Bars for concrete reinforcement. If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete works exhibits flaws in manufacture or fabrication, such material shall be immediately removed from the Site and replaced with acceptable reinforcing steel.
- (c) All galvanized reinforcing steel shall be straight and free from paint, oil, mill-scale, and injurious defects. Surface seams or surface irregularities will not be cause for rejection, provided that the minimum dimensions, cross section area, and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA Standard G30.18.

E9.2.4 Galvanized Dowels and Galvanized Expansion Sleeves

- (a) Dowels and expansion sleeves shall be fabricated in accordance with CSA Standard CAN/CSA-G30.18-M92.
- (b) The dowels shall be galvanized in accordance with CSA Standard G164-M92, to a minimum net retention of 600 g/m².

E9.2.5 Field-Applied Galvanizing

- (a) Field-applied galvanizing shall be a one-pack compound containing 99.995 percent pure electrolytic zinc dust. On application, it shall cure to a minimum of 96 percent zinc content in the dry film. The field galvanizing product shall be Zinga as distributed by Continental Mine & Industrial Supply, Saskatoon, Saskatchewan, phone (306) 975-1944, or approved equal in accordance with B5.

E9.2.6 Bar Accessories

- (a) Bar accessories shall be of a type acceptable to the Contract Administrator. They shall be made from a non-rusting material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (b) Bar chairs, bolsters, and bar supports shall be cementitious material. No plastic, PVC, or galvanized bar chairs will be used.
- (c) Approved products are as supplied by Con Sys Inc., Box 341, Pinawa, Manitoba, Canada R0E 1L0 (204) 753-2404, or equal as accepted by the Contract Administrator.
- (d) Bar accessories are not included in the drawings and shall include bar chairs, spacers, clips, wire ties, wire (16 gauge minimum), or other similar devices and are to be acceptable to the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

E9.2.7 Bonding Agent

- (a) Epoxy resin shall be of a type listed in the approved products list, Specification CW 3710 conforming to the requirements of ASTM Standard C881. Type 1, Grade 3 epoxy shall be used for bonding reinforcing steel into hardened concrete.
- (b) 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. Alternative bonding agents are listed in the approved products list.

E9.3 Construction Methods

E9.3.1 Supply

- (a) Fabricate reinforcing steel in accordance with CSA Standard G30.18 to the lengths and shapes as shown on the drawings.
- (b) GFRP reinforcement shall be bent to the proper shape during fabrication. Absolutely no field bending of the bars is permitted. Should modifications to the GFRP reinforcement be required, the Contractor shall notify the Contract Administrator immediately.
- (c) Contractor shall supply shop drawings 1 week prior to installation, indicating construction staging, reinforcing splices and lap lengths.

E9.3.2 Handling and Storage

- (a) General
 - (i) The Contractor shall handle and store the concrete reinforcement in a manner that ensures it is not damaged or contaminated with dirt or other materials.
 - (ii) The concrete reinforcement shall not be placed directly on the ground. Timber pallets, platforms, skids or other supports shall be placed under the reinforcement to keep it free from dirt and mud and to provide easy handling.
 - (iii) Prior to concrete placement, the Contractor and Contract Administrator shall inspect the concrete reinforcement for surface damage.
- (b) GFRP Reinforcement
 - (i) The Contractor shall load, haul, store, and handle the GFRP bars in accordance with the Manufacturer/Supplier's instruction to prevent damage. GFRP bars are susceptible to surface damage; therefore, special care is required in the loading, hauling, storage and handling of these bars. Bundling bands shall be padded or suitable banding shall be used to prevent damage to the reinforcement.
 - (ii) The GFRP bars shall be covered with an opaque material to avoid UV radiation and exposure to chemical substances.
 - (iii) GFRP bars are very light and flexible; therefore, hoisting bundles of GFRP shall be performed with a strong back spreader bar or multiple supports to avoid

excessively bending of the bars. The GFRP reinforcement shall not be dropped or dragged.

(c) Hot-dip Galvanized Reinforcing Steel

- (i) Reinforcing steel shall not be straightened or rebent in a manner that will injure the metal. Bars with bends not shown on the drawings shall not be used. Heating of reinforcing steel will not be permitted without the prior approval of the Contract Administrator. Give a minimum of twenty-four (24) hours' advance notice to the Contract Administrator prior to the placing of any concrete to allow for inspection of the reinforcement.
- (ii) All field cut ends of galvanized steel and damaged galvanizing shall have one coat of a field-applied galvanizing coating applied.

E9.3.3 Existing Reinforcing Steel Electrical Isolation

- (a) The Contractor is required to electrically isolate any existing or new non-galvanized steel from any of the new galvanized steel. This may be done by applying a coat of epoxy to the cleaned and prepared surface of the non-galvanized steel only, wherever the new steel will be tied to it or will otherwise be in contact with it. Other methods as approved by the Contract Administrator will be considered. This electrical isolation work will be considered incidental to reinforcing steel placement and no separate measurement or payment will be made.

E9.3.4 Placing and Fastening

(a) General

- (i) The Contractor shall supply and place all necessary support accessories to ensure proper placement of concrete reinforcement. All concrete reinforcement shall be accurately placed in the positions shown on the drawings and firmly tied and chaired before placing the concrete.
- (ii) Distances from the forms shall be maintained by means of stays, spacers, or other approved supports. Spacers and supports for holding reinforcement at the required location and ensuring the specified concrete cover over the reinforcement shall be made from precast concrete or non-rusting metal. Precast concrete supports of approved shape and dimensions, with compressive strengths equal to or exceeding the placed concrete, are acceptable. Any non-rusting metal chairs protruding through the surface of the rusting metal chairs shall not be used to support reinforcement on surfaces that are to be exposed. Where possible, this reinforcement is to be supported entirely from above. The use of pebbles, pieces of broken stone or brick, plastic, metal pipe, and wooden blocks, will not be permitted.
- (iii) Immediately before placing, concrete reinforcement shall be free of all material that would reduce the bond to concrete.

(b) Placing GFRP Reinforcement

- (i) The Contractor shall place the GFRP reinforcement in accordance with the Manufacturer/Supplier's instructions.
- (ii) All GFRP reinforcement shall be secured to and supported within formwork as required to prevent displacement by concrete placement or workers. All GFRP reinforcement shall be accurately supported using concrete or non-corrosive chairs before concrete placement is started. The Contractor shall use chairs that incorporate a positive locking mechanism to restrain GFRP reinforcement from floating during concrete placement.
- (iii) The Contractor will be allowed to cut the GFRP reinforcement with a high speed grinding cutter, fine blade saw, diamond blade or masonry blade with the prior approval of the Contract Administrator.
- (iv) Shearing GFRP reinforcement will not be allowed.
- (v) The Contractor shall place the GFRP reinforcement within the tolerances as specified in ACI 117.

- (vi) The Contractor shall remove form oil from GFRP bars using a method approved by the Manufacturer before placing concrete.

E9.3.5 Tying Reinforcement

(a) GFRP Reinforcement

- (i) For lapping GFRP reinforcement at joints and intersections, the Contractor shall tie all intersections using plastic coated or nylon zip ties, or non-rusting material approved by the Contract Administrator.

E9.3.6 Splicing

(a) General

- (i) Contractor shall provide shop drawings indicating splices and lap lengths.

(b) GFRP Reinforcement

- (i) Lap splices shall be used where continuity is required in the reinforcement. The use of mechanical connection or welded splices is not permitted.

E9.4 Quality Control/Quality Assurance

E9.4.1 Access

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

E9.4.2 Quality Testing

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

E9.5 Measurement and Payment

E9.5.1 GFRP Reinforcing Bars

- (a) Supplying and Placing GFRP reinforcing bars will be measured on a length basis. The length to be paid for (for each bar size) shall be the total number of metres of GFRP bars (for that size) supplied and placed in accordance with this Specification, as computed from the drawings.
- (b) Supplying and Placing GFRP reinforcing bars will be paid for at the Contract Unit Price per metre for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

Items of Work: Supply and Place GFRP Reinforcing Bars

- (i) 19 mm Diameter (#6)
- (ii) 25 mm Diameter (#8)
- (c) Bar accessories will be considered incidental to the Works and will not be measured or separately paid for.

E9.5.2 Hot-dip Galvanized Reinforcing Steel

- (a) The supplying and placing reinforcing steel will be measured on a mass basis. The mass to be paid for shall be the total number of kilograms of reinforcing steel installed in accordance with this Specification, acceptable to the Contract Administrator, as computed from the approved reinforcing layout shown on the drawings, excluding the mass of bar accessories.

- (b) The supplying and placing of reinforcing steel shall be paid for at the Contract Unit Price per kilogram for the "Hot-dip Galvanized Reinforcing Steel", measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E9.5.3 Galvanized Dowels and Galvanized Expansion Sleeves

- (a) No measurement or payment will be made for Galvanized Expansion Sleeves.
- (b) The supplying and placing galvanized dowels will be measured on a per unit basis. The amount to be paid for shall be the total number of Hot-dip Galvanized Steel Dowels installed in accordance with this Specification, acceptable to the Contract Administrator.
- (c) The supplying and placing of galvanized dowels shall be paid for at the Contract Unit Price per unit for the "Hot-dip Galvanized 25mm Steel Dowels", measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E10. STRUCTURAL CONCRETE

E10.1 Description

- E10.1.1 This Specification shall cover the preparation of portland cement concrete for structural concrete slab repairs.
- E10.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E10.2 Submittals

- E10.2.1 Concrete mix design(s) that meets the minimum performance criteria for the various types of concretes as shown on the drawings and described in Clause 5.3.22 "Concrete" of this Specification. The concrete mix design shall be sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba. Any changes to the concrete mix design(s) shall be reviewed by the Contract Administrator prior to the Contractor implementing the change.
- E10.2.2 The concrete mix design(s) for the required type(s) of concrete shall specify the following:
 - (a) Cementitious content in kilograms per cubic metre or equivalent units, and type of cementitious materials.
 - (b) Designated size, or sizes, of aggregates, and the gradation.
 - (c) Aggregate source location(s).
 - (d) Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis.
 - (e) Maximum allowable water content in kilograms per cubic metre or equivalent units and the water/cementitious ratio.
 - (f) The limits for slump.
 - (g) The limits for air content.
 - (h) Quantity of other admixtures.
- E10.2.3 The concrete mix shall be designed for a minimum compressive strength of 20% above the nominal 28 day compressive strength specified in Clause E10.3.9 "Concrete" of this Specification. The intended method of placement shall be taken into consideration in the development of the concrete mix design as concrete to be pumped must be designed accordingly.

- E10.2.4 Any change in the constituent materials of the concrete shall require a new concrete mix design. If, during the progress of the Work, the mix design is found to be unsatisfactory for any reason, including poor workability, the Contract Administrator may require the Contractor to make the necessary adjustments.
- E10.2.5 The Contractor shall also submit test data showing that the concrete supplied will meet the performance criteria stated in this Specification for each concrete type. At a minimum, the test data shall prove that the minimum compressive strength, flexural strength (Fibre Reinforced Concrete only), air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. All tests shall be based on the concrete samples taken from the point of discharge into the formwork. For example, at the concrete chute from the delivery truck if being placed by buggies, or at the end of the pump should the Contractor wish to pump the concrete into place.
- E10.2.6 Notification of Ready Mix Supplier
- (a) The Contractor shall advise the Contract Administrator of the qualified Ready Mix Concrete Supplier that he is proposing to use at least 21 days prior to placing concrete. The Contract Administrator will verify the acceptability of the Supplier and the concrete mix design requirements. Acceptance of the Supplier and the concrete mix design(s) by the Contract Administrator does not relieve or reduce the responsibility of the Contractor or Supplier from the requirements of this Specification.
- E10.2.7 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 accepted 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.
- E10.2.8 Copies of all material quality control test results.
- E10.3 Materials
- E10.3.1 General
- (a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials set forth in this Specification.
- E10.3.2 Handling and Storage of Materials
- (a) All materials shall be handled and stored in a careful and workmanship like manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA-A23.1.
- E10.3.3 Testing
- (a) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. There shall be no charge to the Owner for any materials taken by the Contract Administrator for testing purposes.
- (b) All materials shall conform to CSA Standard CAN/CSA-A23.1.
- (c) All testing of materials shall conform to CSA Standard CAN/CSA-A23.2.
- (d) All materials shall be accepted by the Contract Administrator at least twenty-one (21) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.
- E10.3.4 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.
- E10.3.5 Curing Compound

- (a) Curing compounds shall be liquid membrane-forming and conform to the requirements of ASTM Standard C309. Rate of application shall be the rate required to meet the requirements of ASTM C309 for the texture of concrete the curing compound is being applied to.

- (b) Curing compound for structural slabs shall be resin-based and white-pigmented.

E10.3.6 Fibre Joint Filler

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

E10.3.7 Low Density Styrofoam

- (a) Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B5.

E10.3.8 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.

E10.3.9 Concrete

- (a) Concrete

- (i) Concrete Materials susceptible to frost damage shall be protected from freezing.
- (ii) Concrete shall have nominal compressive strengths (f'c) and meet the requirements for hardened concrete as specified in the following Table.

Type of Concrete	Nominal Compressive Strength at 28 Days [MPA]	Class of Exposure	Air Content Category	Post-Cracking Residual Strength Index	Special Requirements
Structural Concrete	35	C-1	1	0.15	Synthetic Fibres

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

- (b) Aggregates

- (iv) General

- ◆ All aggregates shall be handled to prevent segregation and inclusion of any foreign substances, and to obtain uniformity of materials. The two sizes of coarse and fine aggregates, and aggregates secured from different sources, shall be piled in separate stockpiles. The site of the stockpiles shall be cleaned of all foreign materials and shall be reasonably level and firm or on a built up platform. If the aggregates are placed directly on the ground, material shall not be removed from the stockpile within 150 mm of the ground level. This material shall remain undisturbed to avoid contaminating the aggregate being used with the ground material.
- ◆ The potential for deleterious alkali-aggregate reactivity shall be assessed in accordance with CSA A23.2-27A. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA A23.2-14A or CSA A23.2-25A is required.
- ◆ Petrographic analysis when performed shall be in accordance with MTO (Ministry of Transportation Ontario) Lab Test Method LS 609. The (weighted) petrographic number shall not exceed 130.

- (v) Coarse Aggregate
- ◆ The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CSA A23.1, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 1% shall pass a 75 µm sieve. Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; shall have a minimum of two fractured faces; and shall have an absorption not exceeding 3 percent.
 - ◆ The aggregate retained on the 5 mm sieve shall consist of clean, hard, tough, durable, angular particles with a rough surface texture, and shall be free from organic material, adherent coatings of clay, clay balls, an excess of thin particles or any other extraneous material.
 - ◆ Course aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than 30%.
 - ◆ When the thickness of deck overlay concrete is specified as 50 mm or less, the nominal maximum top size of aggregate shall be 12 mm.
 - ◆ Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1, Table 12, for concrete exposed to freezing and thawing.
- (vi) Fine Aggregate
- ◆ Fine aggregate shall meet the grading requirements of CSA A23.1, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75 µm sieve. Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.
 - ◆ Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1, Table 12.
- (c) Admixtures
- (i) Air-entraining admixtures shall conform to the requirements of ASTM C260.
 - (ii) Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.
 - (iii) All admixtures shall be compatible with all other constituents. The addition of calcium chloride, accelerators and air-reducing agents, will not be permitted, unless otherwise approved by the Contract Administrator.
- (d) Cementitious Materials
- (i) Cementitious materials shall conform to the requirements of CAN/CSA-A3001 and shall be free from lumps.
 - (ii) Should the Contractor choose to include a silica fume admixture in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of cement.
 - (iii) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class CI and the substitution shall not exceed 25% by mass of cement.
 - (iv) Cementitious materials shall be stored in a suitable weather-tight building that shall protect these materials from dampness and other destructive agents. Cementitious materials that have been stored for a length of time resulting in the hardening or the formation of lumps shall not be used in the Work.
- (e) Water

- (i) Water to be used for mixing and curing concrete or grout and saturating the substrate shall conform to the requirements of CSA A23.1 and shall be free of oil, alkali, acidic, organic materials or deleterious substances. The Contractor shall not use water from shallow, stagnant or marshy sources.

(f) Synthetic Fibres

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

E10.4 Equipment

E10.4.1 General

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

E10.4.2 Vibrators

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

E10.4.3 Miscellaneous Equipment

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

E10.5 Construction Methods

E10.5.1 Scope of Work

- (a) It is intended that this Specification cover the construction of the structural concrete roadway slabs, as indicated on the drawings:

E10.5.2 Supplying Concrete

- (a) Proportions of Concrete Materials
 - (i) Coarse and fine aggregate materials shall be separated and measured separately by weighing, except as otherwise specified in the Special Provisions or where other methods are approved by the Contract Administrator. The apparatus provided for weighing the aggregates and cement shall be suitably designed and constructed for this purpose. The coarse and fine aggregate and the cement shall be weighed separately. The accuracy of all weighing devices shall be such that successive quantities can be measured to within one percent of the desired amount. The mixing water shall be measured by volume or by weight. The water measuring device shall be capable of control accurate to $\pm 0.5\%$ of the design quantity. All measuring devices will be subject to approval by the Contract Administrator Unless otherwise approved, air entraining agent and other admixtures shall be added to the mix in a water-diluted solution. The dilution of the solution shall meet the Manufacturer's requirements. For mix

adjustments at the Site, the Contractor shall maintain facilities and equipment to control the amount of superplasticizer and air entrainment so that the required tolerances can be met.

- (ii) The Contractor shall ensure that all scaling devices have been calibrated within one year. They shall be tested and approved for accuracy prior to the commencement of batching operations. Scaling devices shall be subject to testing by the Contract Administrator at any time. The standard masses used for the testing of scaling devices shall be supplied to the Contract Administrator upon request. No adjustments to scaling devices shall be made without the Contract Administrator's approval.
- (b) Mixing Concrete
- (i) General
 - ◆ Ready-mix concrete shall be mixed and delivered by one of the following operations:
 - ◆ Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in a truck agitator or in a truck mixer operating at agitating speed, or
 - ◆ Mixed completely in a truck mixer.
 - ◆ Continuous mixers used in conjunction with volumetric proportioning will not be approved. Concrete shall not be mixed and delivered without first obtaining the approval of the Contract Administrator.
 - (ii) Stationary Mixer
 - ◆ The mixing of concrete shall be done in a batch mixer of a size and type approved by the Contract Administrator. Mobile continuous mixers or other such concrete supply equipment will not be approved for use.
 - ◆ Each mixer and agitator shall have attached by the Manufacturer in a prominent place, a metal plate or plates on which it is plainly marked the various uses for which the equipment is designed, the capacity of the drum or container in terms of the volume of concrete that can be mixed or agitated and the speed of rotation of the mixing drum or blades.
 - ◆ All concrete shall be mixed thoroughly until it is uniform in appearance, with all ingredients uniformly distributed. In no case shall the mixing time per batch be less than one minute for mixers of one cubic metre capacity or less. The "batch" is considered as the quantity of concrete inside the mixer. This figure shall be increased by 15 seconds for each additional half cubic metre capacity or part thereof. The mixing period shall be measured from the time all materials are in the mixer drum.
 - ◆ Stationary mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed.
 - ◆ Batches shall be used that do not require fractional bags of cement.
 - ◆ Each batch shall be entirely discharged from the mixer before any of the ingredients for a following batch shall be placed in the drum of the mixer.
 - ◆ All water used for cleaning the inside of the drum of the mixer shall be entirely drained before ingredients for a batch of concrete shall be placed in the drum.
 - ◆ The Contractor shall in no case load the mixer above its rated capacity. The Contractor shall maintain the mixer in good condition. Inner surfaces of the mixer shall be kept free of hardened concrete and mortar. Mixer blades that are bent or worn down so as to affect the mixing efficiency shall be repaired. Any mixer leaking mortar or causing waste of materials through faulty charging shall be taken out of service until repaired. The Contractor shall, at all times, operate the mixer at the speed recommended

by the Manufacturer and shall, if requested, supply the Manufacturer's certification of the mixing capacity of the machine in use.

- ◆ The mixer shall be fitted with an accurate and dependable means for measuring the water added that is not affected by variation in pressure in the water supply line. All joints, valves and other parts shall be maintained so that there is no leakage of water into the mixer drum. Failure of the Contractor to have an accurately working and dependable water gauge on a mixer shall be cause for the Contract Administrator to prohibit the mixer to be used.
- ◆ Water shall be released first and continue to flow while the solid materials are entering the mixer. The water discharge pipe shall be so arranged and be of such size that the flow into the mixer is completed within the first quarter of the mixing time, and the water is delivered well within the mixer where it will be quickly mixed with the entire batch.
- ◆ Air entraining agents and admixtures shall be placed in the mixer after the initial water is in the mixer drum but before the remaining materials are added. Superplasticizer shall be added after initial mixing and as per the Manufacturer's recommendation.
- ◆ A record of the actual proportions used for each batch shall be kept by the Contractor and a copy of this record shall be submitted to the Contract Administrator after each pour.
- ◆ The Contract Administrator may, from time to time, make slump tests of individual batches in order to determine the uniformity of the concrete consistency at approximately one-quarter and three-quarter points of the load. If these tests indicate a variation in the slump exceeding 50 mm, the mixer or agitator shall not be used until the condition is corrected.

(iii) Truck Mixing

- ◆ Truck mixers, unless otherwise approved by the Contract Administrator, shall be of the revolving drum type, watertight, and constructed so that the concrete can be mixed to ensure uniform distribution of materials throughout the mass. All materials for the concrete shall be accurately measured, and charged concurrently at the proportions that satisfy the approved mix design into the drum at the proportioning plant. Increases in water/cementitious ratio will not be permitted.
- ◆ The maximum size of batch in truck mixers shall not exceed the maximum rated capacity of the mixer as stated by the Manufacturer and stamped in metal on the mixer. Truck mixing shall commence immediately upon introduction of ingredients into the drum and be continued for not less than 50 revolutions. The speed shall not be less than 4 revolutions per minute (rpm), nor more than a speed resulting in a peripheral velocity of the drum of 70 m per minute. Not more than 100 revolutions of mixing shall be at a speed in excess of 6 rpm.
- ◆ When adjustment to the mix by adding water, air entrainment or superplasticizer at the Site is approved by the Contract Administrator, the mixer shall be run for a minimum of 20 additional revolutions to ensure homogeneity of the concrete before discharge.
- ◆ Discharge chutes shall be kept clean and free from hardened concrete and shall be wetted down prior to use.

(c) Time of Hauling

- (i) The maximum time allowed for all types of concrete to be delivered to the Site of the Work, including the time required to discharge, shall not exceed 120 minutes after batching. Batching of all types of concrete is considered to occur when any of the mix ingredients are introduced into the mixer, regardless of whether or not the mixer is revolving. For concrete that includes silica fume and fly ash, this requirement is reduced to 90 minutes.

- (ii) Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of **batching**. In hot or cold weather, or under conditions contributing to quick stiffening of the concrete, a time less than **120 and/or 90 minutes** may be specified by the Contract Administrator. The Contractor will be informed of this requirement 24 hours prior to the scheduled placing of concrete.
 - (iii) To avoid the reduction of delivery and discharge time in hot weather, the Contractor will be allowed to substitute crushed ice for a portion of the mixing water provided the specified water/cementitious ratio is maintained. All of the ice shall be melted completely before discharging any of the concrete at the delivery point.
 - (iv) Under no circumstances shall the Contractor add retarders to the concrete mix without first obtaining the approval of the Contract Administrator.
 - (v) The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water.
 - (vi) A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the owner upon request.
- (d) Delivery
- (i) The Contractor shall satisfy himself that the Concrete Supplier has sufficient plant capacity and satisfactory transporting equipment to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such that the development of cold joints will not occur. The methods of delivering and handling the concrete shall facilitate placing with a minimum of rehandling, and without damage to the structure or the concrete.

E10.5.3 Placing Structural Concrete

- (a) Equipment for mixing or conveying concrete shall be thoroughly flushed with clean water before and after each pour. Water used for this purpose shall be discharged outside the forms. Pumping of concrete will be allowed for all substructure concrete. All equipment and processes are subject to acceptance by the Contract Administrator.
- (b) Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation and a marked change in consistency.
- (c) Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.
- (d) Before depositing any concrete, all debris shall be removed from the space to be occupied by the concrete, and any mortar splashed upon the reinforcement or forms shall be removed.
- (e) Placing of concrete, once started, shall be continuous. No concrete shall be placed on concrete which has sufficiently hardened to cause the formation of seams or "cold joints" within the section. If placing must be interrupted, construction joints shall be located where shown on the drawings or as accepted by the Contract Administrator.
- (f) Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.
- (g) The maximum free drop of concrete into the forms shall not be greater than 1.5 m otherwise rubber tubes or pouring ports spaced not more than 1.5 m vertically and 2.5 m horizontally shall be used. The Contractor shall obtain the Contract Administrator's acceptance, prior to pouring concrete, of all placing operations.
- (h) All concrete, during and immediately after depositing, shall be consolidated by mechanical vibrators so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into the corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness.

Mechanical vibrators shall have a minimum frequency of 7000 revolutions per minute immersed.

- (i) Vibrators shall be inserted systematically into the concrete at intervals such that the zones of influence of the vibrator overlap (generally 300 to 900 mm). Apply the vibrator at any point until the concrete is sufficiently compacted (5 to 15 seconds), but not long enough for segregation to occur. Spare vibrators in good working condition shall be kept on the job Site during all placing operations.
- (j) Concrete shall not be placed during rain or snow unless adequate protection is provided for formwork and concrete surfaces.
- (k) After verification that the surface meets acceptable limits and after final floating, the top surface shall be given Type 2 Finish – Unformed Surfaces.

E10.5.4 General Curing

- (a) Refer to Clause E5.5.10 (Hot Weather Concreting) 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.
- (h) Concrete shall cure for seven (7) consecutive days prior to allowing vehicular traffic on it.
- (i) Field-cured test specimens, representative of the in-place concrete being stripped, may be tested to verify the concrete strength.

E10.5.5 Form Removal

- (a) The Contract Administrator must be notified at least 24 hours prior to opening to traffic.

E10.5.6 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°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 E10.5.7 (Hot Weather Concreting). 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.

E10.5.7 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 water sprays 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 water sprays.
 - (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 it's 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 E5.6.8(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

E10.5.8 Cleanup

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

E10.5.9 Protection From Drying

- (a) Placement of deck concrete will not be permitted when the surface moisture evaporation exceeds 0.75 kg/m²/h. Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator. The chart, Figure D.1, Annex D of CSA Standard CAN/CSA-A23.1 shall be used to estimate surface moisture evaporation rates.

E10.6 Quality Control

E10.6.1 Inspection

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

E10.6.2 Access

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

E10.6.3 Materials

- (a) All materials supplied under this Specification shall be subject to testing and acceptance by the Contract Administrator in accordance with this Specification.

E10.6.4 Concrete Quality

- (a) Quality control tests will be used to determine the acceptability of the concrete supplied by the Contractor.
- (b) The Contractor shall provide, without charge, the samples of concrete and the constituent materials required for quality control tests and provide such assistance and use of tools and construction equipment as is required.
- (c) The frequency and number of concrete quality control tests shall be in accordance with the requirements of CSA Standard CAN/CSA-A23.1.
- (d) An outline of the quality tests is as follows:
 - (i) Slump tests shall be made in accordance with CSA Standard Test Method CAN/CSA-A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits specified in this Specification, a second test shall be made.
 - (ii) In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.
 - (iii) Air content determinations shall be made in accordance with CSA Standard Test Method CAN/CSA-A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits specified in this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.
 - (iv) The air-void system shall be proven satisfactory by data from tests performed in accordance with CSA Test Method CAN/CSA A23.1-17C. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method CAN/CSA-A23.2-3C, shall be determined prior to the start of construction on cylinders of concrete made with the same materials, mix proportions, and mixing procedures as intended for the project. If deemed necessary by the Contract Administrator to further check the air-void system during construction, testing of cylinders may be from concrete as delivered to the job Site and will be carried out by the Contract Administrator. The concrete will be considered to have a satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.
 - (v) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CAN/CSA-A23.2-1C, "Sampling Plastic Concrete".

- (vi) Test specimens shall be made and cured in accordance with CSA Standard Test Method CAN/CSA-A23.2-3C, "Making and Curing Concrete Compression and Flexure Test Specimens".
- (vii) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method CAN/CSA-A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which will be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.
- (viii) Compressive strength tests on specimens cured under the same conditions as the concrete works shall be made to check the strength of the in-place concrete so as to determine if the concrete has reached the minimum allowable working compressive strength as specified in Clause SP:12.3.2 and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens will be taken to verify strength of the in-place concrete. For each field-cured strength test, the strength of a single field-cured test specimen shall be determined in accordance with CSA Standard Test Method CAN/CSA-A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.
- (ix) Notwithstanding CSA A23.2, cores taken from deck must achieve the concrete design strength as a minimum.

E10.6.5 Corrective Action

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

E10.7 Measurement and Payment

E10.7.1 Structural Concrete

- (a) The supply and placement of structural concrete, in accordance with this Specification and accepted by the Contract Administrator, will be paid for at the Contract Unit Price per cubic metre for "Structural Concrete", measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E11. PARTIAL DEPTH STRUCTURAL CONCRETE REPAIRS

E11.1 Description

E11.1.1 This Specification shall cover all partial depth structural concrete repairs.

E11.1.2 The Work to be done under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E11.2 Materials

E11.2.1 General

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

E11.2.2 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 accepted by the Contract Administrator at least five (5) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

E11.2.3 Concrete Repair Material

- (a) Concrete repair material shall be compatible with the concrete substrate and shall be of a rapid cure type to limit the overall length of the time of the lane closures.
- (b) The Contractor shall be responsible for the design and performance of all concrete mixes supplied under this Specification. Either ready mix concrete or proprietary repair mortars may be used having the following minimum properties to meet a Class C-1 exposure in accordance with CSA A23.1-04:
 - (i) Compressive Strength @ 28 days = 35 MPa
 - (ii) Compressive Strength @ 1 day = 20 MPa
 - (iii) Water / Cementing Materials Ratio = 0.4
 - (iv) Air Content: Category 1 per Table 4 of CSA A23.1-04.
- (c) Mix design for ready-mix concrete shall be submitted to Contract Administrator at least two weeks prior to concrete placing operations.
- (d) Any proposed proprietary repair mortar shall be subject to the approval of the Contract Administrator.

E11.2.4 Aggregates

- (a) The Contractor shall be responsible for testing the fine and coarse aggregates to establish conformance to these Specifications, and the results of these tests shall be provided to the Contract Administrator if requested. All aggregates shall comply with CSA A23.1.
- (b) Coarse Aggregate
 - (i) The maximum nominal size of coarse aggregate shall be 10 to 14 mm to suit the Contractor's mix design. Gradation shall be in accordance with CSA A23.1, Table 11, Group 1. The coarse aggregate shall satisfy the Standard Requirements specified in CSA A23.1, Table 12, "Concrete exposed to freezing and thawing.
 - (ii) Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; and shall have an absorption not exceeding 2.25%.
 - (iii) The aggregate retained on the 5mm sieve shall consist of clean hard, tough, durable, angular particles with a rough surface texture, and shall be free from organic material, adherent coatings of clay, clay balls, an excess of thin particles or any other extraneous material.
 - (iv) Coarse aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than 30%.

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

(c) Fine Aggregate

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

E11.2.5 Cementing Materials

- (a) Cementing materials shall conform to the requirements of CSA A3001.
- (b) Silica Fume
 - (i) Should the Contractor choose to include silica fume in the concrete mix design, it shall not exceed 8% by mass of cement.
- (c) Fly Ash
 - (i) Fly ash shall be Type C1 or Type F and shall not exceed 25% by mass of cement.
- (d) Cementious materials shall be stored in a suitable weather-tight building that shall protect these materials from dampness and other destructive agents. Cementious materials that have been stored for a length of time resulting in the hardening or formation of lumps shall not be used in the Work.

E11.2.6 Admixtures

- (a) Air entraining admixtures shall conform to the requirements of ASTM C260.
- (b) Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.
- (c) All admixtures shall be compatible with all other constituents. The addition of calcium chloride, accelerators, and air-reducing agents will not be permitted, unless otherwise approved by the Contract Administrator.
- (d) Appropriate low range water reducing and/or superplasticizing admixtures shall be used in concrete containing silica fume. Approved retarders or set controlling admixtures may be used for concrete containing silica fume.

E11.2.7 Water

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

E11.2.8 Concrete Supply

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

E11.3 Equipment

E11.3.1 All equipment shall be a type approved by the Contract Administrator and shall be kept in good working order.

E11.4 Construction Methods

E11.4.1 Concrete Removal and Surface Preparation

- (a) The areas requiring concrete repairs are shown on the drawings.
- (b) Concrete is to be removed a minimum of 50 mm or to the depth of deterioration, whichever is greater. Concrete shall be further removed a minimum of 20 mm behind reinforcing steel bars if more than half the bar diameter is exposed. The resulting surface is to be rough with a minimum amplitude of 6 mm and a maximum frequency of 15 mm.
- (c) Limits of the repair area are to be saw cut (undercut) 20 mm deep to provide a well-defined interface and bonding surface with the existing sound concrete.
- (d) All reinforcing steel and prepared concrete surfaces shall be sandblasted.
- (e) Epoxy coated reinforcing steel shall be touched up with approved epoxy paint.

E11.4.2 Mixing and Placing Concrete

- (a) The Contract Administrator must be notified at least twenty-four (24) hours prior to placing concrete so that an adequate inspection may be made of the prepared concrete substrate surface and related works. Placement without required prior notification will not be allowed.
- (b) Equipment for mixing or conveying the concrete shall be thoroughly flushed with clean water prior to commencement of the repair operation. All equipment and processes are subject acceptance by the Contract Administrator.

E11.4.3 Curing

- (a) All patches shall be wet cured and in accordance with CSA A 23.1-04, unless otherwise approved by the Contract Administrator.

E11.5 Quality Control

E11.5.1 All workmanship and materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator, including all operations from the selection and production of materials through to final acceptance of the specified Work. The Contractor shall be wholly responsible for the control of all operations incidental hereto notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

E11.6 Measurement and Payment

E11.6.1 Partial Depth Structural Concrete Repairs

- (a) The partial depth structural concrete repairs will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Partial Depth Structural Concrete Repairs". The area to be paid for will be the total number of square metres of concrete deck surface repairs and concrete nosings installed in accordance with the Specification, accepted and measured by the Contract Administrator.

E12. EMBEDDED GALVANIC ANODES

E12.1.1 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.

E12.1.2 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

E12.2 Embedded Anodes for Concrete Surface Repairs

E12.2.1 Materials

- (a) Embedded galvanic anodes shall be supplied by the City.
- (b) 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. Contact Mike Terleski, CET at 794-8510 to arrange a suitable time and date for pick up. Provide 24 hours minimum notice 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.
- (c) Low resistivity bed grout shall be Portland cement-based material with suitable electrical conductivity, supplied by the Contractor. Non-conductive repair materials such as epoxy, urethane, or magnesium phosphate shall not be permitted.
- (d) Deliver, store, and handle all materials in accordance with manufacturer's instructions.

E12.2.2 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. If significant reduction in the cross section of the reinforcing steel has occurred, replace or install supplemental reinforcement as directed by the Contract Administrator.
 - (ii) 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 600 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.
 - (vi) Set the anode in a bed of low resistivity grout if the patch grout material to be used by the Contractor is determined by the anode supplier to have too high an electrical resistance.
- (c) Electrical Continuity

- (i) Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm, Ω) 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 Ω .
- (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 E4 for concrete surface repair Specifications.

E12.2.3 Clean Up

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

E12.3 Measurement and Payment

E12.3.1 Embedded Galvanic Anodes

- (a) The installation of embedded galvanic anodes will be measured on a unit basis and paid for at the Contract Unit Price for "embedded galvanic anodes", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator.

E13. PARTIAL DEPTH CONCRETE REPAIRS

E13.1 Description

E13.1.1 General

- (a) This Specification shall cover all operations relating to partial depth concrete repairs of concrete pavement joints. The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E13.1.2 Referenced Standard Construction Specifications

- (a) CW 3310 – Portland Cement Concrete Pavement Works.

E13.2 Materials

E13.2.1 Concrete Repair Materials

- (a) Acceptable material to be used for the partial depth repairs is Five Star Highway Patch. This material shall be covered and kept out of direct sunlight when being stored. No substitutions are allowed for this material.
- (b) Clean and potable water is to be used for mixing of the patching material. Water used for mixing must not exceed 25° Celsius.
- (c) 10 mm gravel in accordance with the following gradation:

<u>Sieve</u>	<u>% Passing</u>
10	100%
5	0 – 15%
2.5	0 – 5%
80 micron	0 – 1%

- (d) Curing Compound will be Type 2, white-pigmented and water based liquid membrane-forming curing in accordance with ASTM C309.

E13.2.2 Bond Breaker

- (a) Bond Breaker shall be Styrofoam (6.5 ± .5 mm thick) or waxed cardboard or other suitable product approved by the Contract Administrator.

E13.3 Equipment

- E13.3.1 Chipping hammers shall be either Hilti TE 905 electric driven or if using air driven hammers, shall be less than or equal to 13.5 kg, combined with sharp chipping tempered hammer bits.
- E13.3.2 Sand blasting equipment shall be air compressor operated with a nozzle size matched to the air compressor pressure. Preferred equipment is:
 - (a) Clemco Model 2020 with a #4 nozzle on a dolly using Black Diamond 20/40 grit at an operating pressure of 110 PSI.
- E13.3.3 Acceptable sand blasting equipment is:
 - (a) Clemco Model 1042 using fine silica sand at an operating pressure of 100 PSI.
- E13.3.4 An oil free jetted air compressor shall be used to blow out repairs, vacuum will not be acceptable.
- E13.3.5 Quickie Saw, capable of holding 2-14" diamond tip blades and must be used in conjunction with a cart to make long straight cuts.
- E13.3.6 A mason's hammer for sounding concrete.
- E13.3.7 Calibrated 3 litre (2.84 quart) water container.

E13.4 Construction Methods

- E13.4.1 Remove any existing AMZ or asphaltic material if applicable from the concrete surface adjacent to the area to be repaired.
- E13.4.2 Saw cut the repair edge a minimum width of 50 mm beyond the edge of the deteriorated concrete, to a minimum depth of 25 mm. Saw cuts shall be made parallel to the joint. No diagonal cuts are allowed. For pavements where deterioration is observed 50 mm or less in depth, a 12 mm edge saw cut can be utilized.
- E13.4.3 For repairs located at joints, saw cut the repair edge a minimum width of 150mm beyond the edge of the joint.
- E13.4.4 For longitudinal joint repairs, if the repair requires exposure of the keyway, the keyway shall be saw cut and removed.
- E13.4.5 Remove existing sealant 100 mm beyond the ends of the repair
- E13.4.6 Remove all loose or deteriorated concrete with either an electric or air driven 13.5 kg chipping hammer without damaging the saw cut or existing joint. If during removal, damage occurs beyond the saw cut, remove the concrete at a 45° angle down to the joint. A new saw cut is not required.
- E13.4.7 Sound the concrete using sight, sound and feel with a mason's hammer to determine the presence of additional deteriorated concrete. Complete additional removal of any unsound concrete, as stated above.
- E13.4.8 If any of the following conditions are present in a concrete joint, repairs should be completed as a full depth repair:
 - (a) Vertical displacement of the concrete slab by more than 5mm.
 - (b) Corrosion of the tie bars or dowels.
 - (c) Concrete deterioration is present to the bottom or around the existing tie bars or dowels.
 - (d) Improper layout of original pavement joints.

- E13.4.9 Saw cut 6 mm wide along the existing joint, to a depth of 10 mm below the deepest part of the deteriorated concrete or to the depth of the steel. The saw cut shall extend the full length of the repair area. Do not cut the steel.
- E13.4.10 Sandblast the concrete surface of the repair area, the saw cut run-outs and 25mm beyond the perimeter of the repair area to ensure that the concrete surface is rough and clean. The Contractor shall be responsible for protecting traffic during sandblasting.
- E13.4.11 Use compressed air that has an oil free air jet having sufficient volume and pressure to remove dust and loose particles.
- E13.4.12 Place a 6 mm bond breaker to the full length and depth of the saw cut to match the pavement surface. The bond breaker shall extend 50 mm beyond the edge of the repair.
- E13.4.13 Mix the concrete repair material in accordance with the manufacturer's guidelines and according to the following instructions:
- (a) Material and water are to be stored in an enclosed vehicle or facility.
 - (b) Water for mixing must be no more than 25° Celsius and must be clean and potable. If the mix temperature is greater than 25° Celsius bags of cubed ice shall be used for mixing in the water. Bags shall remain intact to keep the ice cubes from mixing in the water.
 - (c) Remove old mix material from the pail by scraping the bucket after every batch.
- E13.4.14 The existing concrete surface shall be misted until immediately prior to placement of the repair material. If the temperature of the concrete is to high place ice in the hand sprayer to reduce the temperature.
- E13.4.15 Place the concrete repair material according to the following instructions:
- (a) Place the repair material on both sides of the bond breaker at the same time. The bond breaker must remain straight during placement of the repair material.
 - (b) Start placing repair material on the high side of the joint if possible. Plan the placement so there will be a minimum number of ends of active material where continuous placement is happening.
 - (c) Do not do partial fill with a layer on the bottom between batches. Only bulkhead a cold joint. If a cold joint is placed, sand blast before butting new material against the bulkhead. Create a cold joint by striking off vertically and removing excess repair material. To keep more than one joint active when more than one head of material is being worked on, use part of each succeeding batch to extend the working time of each active repair material head.
 - (d) To finish a repair, strike off material with the edge of a trowel flush with the existing concrete and finish with a steel trowel.
 - (e) Do not add additional water during mixing or after mixing as it will result in strength loss of the repair material.
 - (f) Use minimal motions to finish the surface. Overworking will result in scaling or spalling of the repair surface.
 - (g) The finished concrete shall be flush with the adjacent existing concrete with a tolerance of 6 mm high and 0 mm low.
- E13.4.16 Saw cut run-outs shall be filled with concrete repair material.
- E13.4.17 Uniformly apply water based white pigmented curing compound once the material has set up.
- E13.4.18 Saw cut the width and depth to match the existing pavement joint reservoir and reseal.
- E13.5 Measurement & Payment
- E13.5.1 Partial Depth Concrete Repairs

- (a) Construction of Partial Depth Concrete Repairs will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Partial Depth Concrete Repairs". The area to be paid for will be the total number of square metres of partial depth concrete repairs supplied and placed in accordance with this Specification and accepted by the Contract Administrator, including all materials and operations herein described and all other items incidental to the Work included in this Specification. Any partial depth repair that is less than 0.03 m² shall be measured as 0.03 m².

E14. CURB INLET FRAME

E14.1 Description

E14.1.1 General

- (a) The Specification shall cover the supply and installation of curb inlet frames.

E14.2 Materials

- E14.2.1 Curb inlet frame shall be TF-111 as supplied by Titan Foundry of Winnipeg Manitoba. The TF-111 can be found at the following link:
<http://www.trojanindustries.com/cms/doc/Titan%20-%20Miscellaneous.pdf>

E14.3 Construction Methods

- E14.3.1 Contractor to place curb inlet frame as per CW 3210 and Contract drawings.

E14.4 Measurement and Payment

- E14.4.1 The supply and installation of curb inlet frames will be measured on a unit basis and paid for at the Contract Unit Price for "Curb Inlet Frame", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator

E15. THIN BITUMINOUS OVERLAY

E15.1 Description

- E15.1.1 The City of Winnipeg, Public Works, Streets Maintenance Division will be completing the thin bituminous overlay works for this project.
- E15.1.2 The Contractor will notify the Contract Administrator two (2) weeks prior to the completion of the concrete works.
- E15.1.3 It will be the Contractor's responsibility to coordinate and cooperate to the fullest extent possible to maintain seamless construction works.

E15.2 Construction Methods

- E15.2.1 The Contractor will be responsible for traffic control during the thin bituminous overlay works.
- E15.2.2 All concrete works, boulevard grading, and sodding works shall be completed prior to the thin bituminous overlay works.

E15.3 Measurement and Payment

- E15.3.1 No measurement or payment will be made for this item of work.