



THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 336-2013

ARLINGTON OVERPASS (CPR YARDS) – 2013 BRIDGE DECK REPAIRS

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CPR Minimum Safety Requirements for Contractors Working on CP Property in Canada, dated September 2010 (28 pages)

PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 ARLINGTON OVERPASS (CPR YARDS) – 2013 BRIDGE DECK REPAIRS

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 4:00 p.m. Winnipeg time, May 21, 2013.

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

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

B3. SITE INVESTIGATION

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

B3.2 The Bidder is advised that during the site investigation, the Arlington Bridge will remain open to traffic.

B4. ENQUIRIES

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

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

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

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

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

B5. ADDENDA

B5.1 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.

B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B5.2.1 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/>

B5.2.2 The Bidder is responsible for ensuring that he/she has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

B5.2.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 8 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6. SUBSTITUTES

B6.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:

- (a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;
- (b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;
- (c) identify any anticipated cost or time savings that may be associated with the substitute;
- (d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;
- (e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.

B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his/her sole discretion grant approval for the use of a substitute as an "approved equal" or as an "approved alternative", or may refuse to grant approval of the substitute.

B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he/she wishes to inform.

B6.7 If the Contract Administrator approves a substitute as an "approved equal", any Bidder may use the approved equal in place of the specified item.

B6.8 If the Contract Administrator approves a substitute as an "approved alternative", any Bidder bidding that approved alternative may base his/her Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B14.

B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B6.10 Notwithstanding B6.2 to B6.9, and in accordance with B7.6, deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B14.1(a).

B7. BID COMPONENTS

B7.1 The Bid shall consist of the following components:

- (a) Form A: Bid;
- (b) Form B: Prices;

B7.2 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Bid.

B7.3 The Bid Submission may be submitted by mail, courier or personal delivery, or by facsimile transmission.

B7.4 If the Bid Submission is submitted by mail, courier or personal delivery, it shall be enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address, and shall be submitted to:

The City of Winnipeg
Corporate Finance Department
Materials Management Division
185 King Street, Main Floor
Winnipeg, MB R3B 1J1

B7.4.1 Samples or other components of the Bid Submission which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder's Bid Submission.

B7.5 Bidders are advised not to include any information/literature except as requested in accordance with B7.1.

B7.6 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).

B7.7 If the Bid Submission is submitted by facsimile transmission, it shall be submitted to 204 949-1178.

B7.7.1 The Bidder is advised that the City cannot take responsibility for the availability of the facsimile machine at any time.

B7.7.2 Bids submitted by internet electronic mail (e-mail) will not be accepted.

B8. BID

B8.1 The Bidder shall complete Form A: Bid, making all required entries.

B8.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, his/her name shall be inserted;
- (b) if the Bidder is a partnership, the full name of the partnership shall be inserted;
- (c) if the Bidder is a corporation, the full name of the corporation shall be inserted;
- (d) if the Bidder is carrying on business under a name other than his/her own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.

B8.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B8.2.

B8.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

B8.4 Paragraph 10 of Form A: Bid shall be signed in accordance with the following requirements:

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

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

B8.4.2 All signatures shall be original.

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

B9. PRICES

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

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

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

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

B10. QUALIFICATION

B10.1 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.

B10.2 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>

B10.3 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);
- (d)

B10.4 Further to B10.3(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/Subcontractors has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

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

B10.5 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.

B10.6 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.

B11. OPENING OF BIDS AND RELEASE OF INFORMATION

B11.1 Bids will not be opened publicly.

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/bidopp.asp>

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 9 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 for the time period specified in Paragraph 9 of Form A: Bid.

B13. WITHDRAWAL OF BIDS

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

- 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 10 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 10 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/her Bid after the Submission Deadline but before his/her 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.

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 there from (pass/fail);
 - (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B10 (pass/fail);
 - (c) Total Bid Price;
 - (d) economic analysis of any approved alternative pursuant to B6.
- 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/her Bid or in other information required to be submitted, that he/she 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.

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/her Bid upon written request to the Contract Administrator.
- B15.4 Notwithstanding C4, the City will issue a Purchase Order to the successful Bidder in lieu of the execution of a Contract.
- B15.5 The Contract, as defined in C1.1, in its entirety shall be deemed to be incorporated in and to form a part of the Purchase Order notwithstanding that it is not necessarily attached to or accompany said Purchase Order.

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 partial steel decking and toping replacement and other structural steel deck repairs on the Arlington Overpass.

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

- (a) Remove existing asphalt and concrete overlay on the bridge deck
- (b) Remove sections of steel decking and support channels where necessary
- (c) Supply and install new channels sections and steel decking panels
- (d) Place reinforcing bar, and supply and install Concrete Overlay to match existing elevations

D3. CONTRACT ADMINISTRATOR

D3.1 The Contract Administrator is:

Damir Muhurdarevic, P.Eng.
Bridge Maintenance Engineer
106-1155 Pacific Ave
Winnipeg, Manitoba, R3E 3P1

Telephone No. 204 986-3712
Facsimile No. 204 986-5302

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

D3.3 Bids Submissions must be submitted to the address in B7.4.

D4. CONTRACTOR'S SUPERVISOR

D4.1 At the pre-construction meeting, the Contractor shall identify his/her designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D5. OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON DISCLOSURE

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

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

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

- (a) information provided to the Contractor by the City or acquired by the Contractor during the course of the Work;

- (b) the Contract, all deliverables produced or developed; and
- (c) any statement of fact or opinion regarding any aspect of the Contract.

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

D6. NOTICES

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

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

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

The City of Winnipeg
Chief Financial Officer

Facsimile No.: 204 949-1174

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

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

Facsimile No.: 204 947-9155

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 should be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/Safety/default.stm>

D9. 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 (\$5,000,000.00) inclusive, with The City of Winnipeg added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;
- (b) if applicable, Automobile Liability Insurance covering all motor vehicles, owned and operated and used or to be used by the Contractor directly or indirectly in the performance of the Work. The Limit of Liability shall not be less than \$2,000,000 inclusive for loss or damage including personal injuries and death resulting from any one accident or occurrence;
- (c) all risks 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 Contract Administrator 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 seven (7) Calendar Days from notification of the award of Contract by Purchase Order.

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 If the Contract Price exceeds twenty-five thousand dollars (\$25,000.00), 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 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 Purchase Order and prior to the commencement of any Work on the Site.

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 least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than seven (7) Calendar Days from notification of the award of Contract.

SCHEDULE OF WORK

D12. COMMENCEMENT

- D12.1 The Contractor shall not commence any Work until he/she is in receipt of a Purchase Order from the Award Authority authorizing the commencement of the Work.
- D12.2 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 Safe Work Plan specified in D8;
 - (iv) evidence of the insurance specified in D9;
 - (v) the performance security specified in D10; and
 - (vi) the Subcontractor list specified in D11.
 - (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.
- D12.3 The Contractor shall not commence the Work on the Site before July 01, 2013 . Work will be undertaken during a maximum six (6) week closure of the overpass as outlined in E3.

D13. SUBSTANTIAL PERFORMANCE

- D13.1 The Contractor shall achieve Substantial Performance within 40 calendar days of commencement of the bridge closure, outlined in D12.3, but no later than August 29, 2013.
- D13.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.
- D13.3 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a certificate of Substantial Performance is the date on which Substantial Performance has been achieved.

D14. TOTAL PERFORMANCE

- D14.1 The Contractor shall achieve Total Performance within 42 calendar days of commencement of the bridge closure, outlined in D12.3, but no later than August 31, 2013.
- D14.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.
- D14.3 The date on which the Work has been certified by the Contract Administrator as being totally performed to the requirements of the Contract through the issue of a certificate of Total Performance is the date on which Total Performance has been achieved.

D15. LIQUIDATED DAMAGES

- D15.1 If the Contractor fails to achieve Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for same, the Contractor shall pay the City the following amounts per Calendar Day for each and every Calendar Day following the days fixed herein for same during which such failure continues:

- (a) Substantial Performance – five hundred dollars (\$500);
- (b) Total Performance – five hundred dollars (\$500).

D15.2 The amounts specified for liquidated damages in D15.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve Substantial Performance or Total Performance by the days fixed herein for same.

D15.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D16. JOB MEETINGS

D16.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

D16.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he/she deems it necessary.

D17. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D17.1 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).

D18. THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA) – QUALIFICATIONS

D18.1 Further to B10.4, the Contractor/Subcontractor must, throughout the term of the Contract, have a Workplace Safety and Health Program meeting the requirements of The Workplace Safety and Health Act (Manitoba). At any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require updated proof of compliance, as set out in B10.4.

D19. COORDINATION OF REPAIRS WITH CPR YARDS

D19.1 General Requirements

- (a) The Contractor shall be required to notify the Canadian Pacific Railway (CPR) Company by contacting Mr. Garth McGinn (Telephone (204) 946-3469) at least thirty (30) days before commencing any work over the tracks and shall be governed by their requirements. The Contractor shall then give a minimum of 21 days' notice to request closure of any specific tracks. The Contractor shall be responsible for any damage, disruptions, and/or inconvenience caused by his equipment, or operations of work to the tracks, the railway's operation, or their property.
- (b) The CPR tracks shall be open to traffic at all times unless prior written permission is obtained by the Contractor from CPR for its closure and written approval granted by the Contract Administrator.
- (c) The Contractor shall at all times strictly adhere to any minimum clearance requirements as shown on the drawings.

D19.2 Flagman Requirement

- (a) The Contractor shall observe extreme caution when working over the CPR yards. A Flagman will be required at all times when work is being performed over active tracks. The CPR will provide flagmen, at the City's cost, to assist the Contractor in coordinating requested track closures and to warn of any moving trains. The Contractor's personnel

shall observe the instructions of the flagmen at all times. All costs associated with providing flagmen shall be borne by the City

D19.3 Protection of CPR Yards and Adjacent Properties

- (a) The Contractor shall take all the necessary precautions to prevent construction material from the overpass falling on the railway or adjacent properties. Any materials, which do fall into these areas, shall be removed by the Contractor to the satisfaction of the Contract Administrator.

D19.4 Costs Associated with CPR Coordination

- (a) All costs associated with the coordination of repairs with CPR, as set out in this Bid Opportunity, whether specifically described or not, shall be the responsibility of the Contractor, no separate payment will be made for this coordination.

D20. ADDITIONAL CPR SAFETY REQUIREMENTS FOR CONTRACTORS WORKING ON RAILWAY PROPERTY

D20.1 The following CPR document is applicable

- (a) CPR Minimum Safety Requirements for Contractors Working on CP Property in Canada, dated September 2010 (28 pages) – included in Appendix A.

MEASUREMENT AND PAYMENT

D21. PAYMENT

- D21.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

WARRANTY

D22. WARRANTY

- D22.1 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. 336-2013

ARLINGTON OVERPASS (CPR YARDS) – 2013 BRIDGE DECK REPAIRS

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

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

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

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

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

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

_____ day of _____, 20____ .

SIGNED AND SEALED
in the presence of:

(Witness as to Principal if no seal)

(Name of Principal)

Per: _____ (Seal)

Per: _____

(Name of Surety)

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

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

(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 336-2013

ARLINGTON OVERPASS (CPR YARDS) – 2013 BRIDGE DECK REPAIRS

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

(Name of Contractor)

(Address of Contractor)

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

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

(Address)

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

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

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

(Date)

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

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

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

(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

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>
B106-12-01	Design Data and Drawing List - Cover Sheet
B106-13-02	General Arrangement and Typical Deck Repairs
B106-13-03	Existing Deck
B106-13-04	Proposed Deck Repairs

E2. MOBILIZATION AND DEMOBILIZATION

- E2.1 Description
- This Specification shall cover all operations relating to the mobilization and demobilization of the Contractor to the Site, as specified herein
 - The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all works as hereinafter specified.
- E2.2 Materials
- The Contractor shall be responsible for the supply, safe storage and handling of all materials as set forth in this Specification.
- E2.3 Construction Methods
- The Contractor shall obtain written permission from private property owners for any use of private property. A copy of written permission shall be provided to the Contract Administrator prior use of the property in question.
 - The Contractor's Site supervisor is required to carry, at all times, a cellular telephone, with voice mail.
 - This section also includes travel and accommodation, set-up and demobilization of site offices, storage conveniences and other temporary facilities, construction plant, and other items not required to form part of the permanent works and not covered by other prices.
- E2.4 Measurement and Payment
- Mobilization and demobilization will be paid for on a Lump Sum basis under "Mobilization and Demobilization," which price will be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

- (b) Mobilization and demobilization will be paid for at a percentage of the Contract Lump Sum Price for "Mobilization and Demobilization" specified as follows:
 - (i) 30% when the Contract Administrator is satisfied that construction has commenced.
 - (ii) 70% when Total Performance has been met.

E3. TRAFFIC AND PEDESTRIAN CONTROL

E3.1 Description

- (a) The Work covered under this item shall include all items relating to traffic and pedestrian control at the Site.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E3.2 Notification

- E3.2.1 The Contractor shall notify the City of Winnipeg Customer Service at 986-5640, one day in advance of any traffic closures.

E3.3 General

- E3.3.1 The Contractor will be responsible for traffic control at the Site acceptable to the Contract Administrator.
- E3.3.2 For traffic control in the immediate Work area, the Contractor shall erect and maintain all applicable traffic control devices in accordance with the provision contained in the latest edition of the "Manual of Temporary Traffic Control in Work Areas on City Streets", issued by the City of Winnipeg.
- E3.3.3 The Contractor shall provide and maintain flagmen as required in accordance with the above-mentioned manual.
- E3.3.4 The Contractor shall take all other safety measures necessary to cope with any peculiar or unusual circumstances that have not been set out in the above mentioned manual and shall, at all times, ensure that maximum protection is afforded to the road user and that his operations in no way interfere with the safe operation of traffic.
- E3.3.5 Improper signing will be sufficient reason for the Contract Administrator or Inspector to immediately shut down the entire job.
- E3.3.6 Barricades shall be supplied and installed by the Contractor and include the telephone number(s) at which he can be reached twenty-four (24) hours per day, seven (7) days per week.
- E3.3.7 During the hours when the Contractor is not working, equipment and stockpiled materials shall be left in such a location as not to interfere with or present a hazard to motorists or pedestrians.

E3.4 Specific Traffic Control

- E3.4.1 Single lane closures outside of weekdays from 7:00 to 9:00 and 15:30 to 18:00 will be allowed with flagging operations to undertake preparatory and finishing work, subject to the Contract Administrator's approval.
- E3.4.2 A complete bridge closure to vehicular traffic will be allowed to accommodate the repairs. This closure is anticipated to last a maximum of six (6) weeks during the months of July and August, 2013. The bridge closure will be undertaken by the City of Winnipeg Traffic Services. A minimum of **two (2) weeks notice** is required to schedule the closure.
- E3.4.3 Pedestrian sidewalk and cycling traffic must be maintained at all times.

E3.4.4 The Contractor is advised that other work will be taking place on the south approach ramp to the structure during the bridge closure, for up to three (3) weeks. During that time the Contractor will only have access from the north end of the overpass.

E3.5 Measurement and Payment

E3.5.1 Traffic control will be incidental to the work of Specification E2 "Mobilization and Demobilization". No additional measurement and payment will be made.

E4. DEMOLITION

E4.1 Description

- (a) The Work covered under this item shall include all items relating to the Removal of all Asphalt and Concrete Overlay, and Corrugated Steel Decking, as laid out and specified by the Contract Administrator.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E4.2 Materials

E4.2.1 General

- (a) The Contractor shall be responsible for the safe removal and disposal of the existing asphalt and concrete and for safe storage and handling of all Materials as set forth in the Specification. All Materials shall be handled in a careful and workman like manner, to the satisfaction of the Contract Administrator.

E4.2.2 Handling, Storage and Delivery of Materials

- (a) All Materials shall be handled in a careful and workmanship-like manner, to the satisfaction of the Contract Administrator. Storage and disposal of materials shall be in accordance with the CISC Code of Standard Practice for Structural Steel, except as otherwise specified herein.

E4.2.3 Asphalt and Concrete Overlay

- (a) Existing asphalt topping and parts of existing cast-in-place concrete curb are to be removed according to the layout set out by the Contract Administrator and as shown on the Drawings

E4.2.4 Corrugated Steel Decking

- (a) Sections of Corrugated Steel Decking Plates to be removed as shown on the Drawings.

E4.3 Construction Methods

E4.3.1 Removals and Disposal

- (a) The Contractor shall only use methods of removal that will not damage the existing structure to remain.

E4.3.2 Details of Existing Structure

- (a) The applicable details and structure dimensions of the existing structure are shown on the Drawings for the information of the Contractor in establishing the limits of removal and determining the cost of the work from his examination of the site
- (b) The information shown has been obtained from existing drawings, measurements, and observations at the site. The accuracy of this information is not guaranteed and the Contractor must verify all information before commencing work

E4.3.3 Existing Deck Topping (Asphalt and Concrete overlay)

- (a) All laid out Asphalt and Concrete overlay to be removed. The Contractor shall saw-cut sections of deck and use jack hammers to break up the material into smaller pieces. All Concrete and Asphalt shall be removed by the Contractor to a pre-designated storage container, before being disposed off site. The existing Corrugated Steel Decking plates shall be swept and cleaned off all debris. Other methods require written approval by the Contract Administrator prior to the start of any demolition.
- (b) Upon inspection of the corrugated deck plate, the Contract Administrator may direct that additional areas of asphalt or concrete be removed to extend the repair area.

E4.3.4 Existing Corrugated Steel Decking

- (a) All laid out Corrugated Steel Decking plate sections to be removed. The Contractor shall cut the steel decking into sections and lift them out of place. Plate sections to remain in place adjacent to them shall be free of corrosion and rust, as determined by the Contract Administrator. Other methods require written approval by the Contract Administrator prior to the start of any removals.

E4.3.5 Protection of CPR Yards

- (a) The Contractor shall take special precautions during demolition operations of the CPR Yards to ensure that no materials fall into this area. The contractor shall coordinate all work that will affect any railway operation in accordance with Supplementary Condition D19.

E4.3.6 Disposal

- (a) All material removed shall become the responsibility of the Contractor except as otherwise indicated herein. The Contractor shall promptly remove all material from the site. No long term storage of any materials on-site shall be allowed. It shall be the Contractor's responsibility to find suitable disposal areas away from the site.

E4.4 Quality Control

E4.4.1 Inspection

- (a) All workmanship and all materials removed under this specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations 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 or Works, which are not in accordance with the requirements of this Specification.

E4.4.2 Access

- (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times to determine whether it is carried out in accordance with this Specification.

E4.5 Measurement and Payment

E4.5.1 Demolition

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

Items of Work:

- (i) Removal of existing Asphalt and Concrete overlay
- (ii) Removal of existing Corrugated Steel Decking

E5. STRUCTURAL STEEL REPAIRS

E5.1 Description

- (a) This Specification shall cover the structural steel repairs to superstructure deck components, as well as supply, delivery, and installation of corrugated steel decking, on the Arlington Bridge as shown on the Drawings and as specified herein.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplied and all things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

E5.2 Materials

E5.2.1 General

- (a) All Materials supplied under this Specification shall be of a type approved by the Contract Administrator, and shall be subject to inspection and testing by the Contract Administrator. All materials used for fabrication of the corrugated steel decking and structural steel channels, shall be new, previously unused material.
- (b) The Contractor shall be responsible for the supply, safe storage and handling of all Materials as set forth in the Specification. All Materials shall be handled in a careful and workman like manner, to the satisfaction of the Contract Administrator.

E5.2.2 Handling, Storage and Delivery of Materials

- (a) All Materials shall be handled in a careful and workmanship-like manner, to the satisfaction of the Contract Administrator. Storage and delivery of materials shall be in accordance with the CISC Code of Standard Practice for Structural Steel, except as otherwise specified herein.

E5.2.3 Structural Steel

- (a) All general structural steel and corrugated steel decking shall conform to the requirements of CSA Standard CAN/CSA-G40.21-M-92, Grade 300W or 350W.

E5.2.4 High Strength Bolts, Nuts and Washers

- (a) High strength bolts shall conform to the requirements of ASTM Specification A325, Type 1. Nuts shall conform to the requirements of ASTM Specification A563, Grade DH. Washers shall conform to the requirements of ASTM Specification F436, Type 1.

E5.2.5 Abrasive for Blast Cleaning

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

E5.2.6 Welding Consumables

- (a) Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59-M1984 and the following Specifications:
 - (i) Manual shielded metal arc welding (SMAW): All electrodes shall be basic-type electrodes conforming to CSA W48.1-M1991 or W48.3-M1992, classification E480XX, or imperial equivalent.
 - (ii) Gas metal arc welding (GMAW): All electrodes shall conform to CSA W48.4-M1980, classification ER480S-X, or imperial equivalent.
 - (iii) Flux cored arc welding (FCAW): all electrodes shall conform to CSA W48.5-M1982, classification E480XT-X, or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation.
 - (iv) Submerged arc welding (SAW): All electrodes shall conform to CSA W48.6-M1980, classification F480X-EXXX, or imperial equivalent.

- (v) Shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of -46 C.
- (vi) All electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules of -18 C.

E5.2.7 Incidental Materials

- (a) All incidental and miscellaneous materials required for the undertaking the works of this Specification shall be as approved by the Contract Administrator.

E5.3 Construction Methods

E5.3.1 Scope of Work

- (a) The scope of Work shall include the following items, as indicated on the Drawings and as specified herein:
 - (i) Supply of Corrugated Steel Decking Plates
 - (ii) Remove and Replace all specified Corrugated Steel Decking
 - (iii) Place all specified new Deck Steel Channels adjacent to existing Deck Steel Channels, which are to remain in place

E5.3.2 Scheduling and Methods

- (a) At least five (5) days prior to the commencement of any scheduled Work on the Site, the Contractor shall submit to the Contract Administrator for review and approval a proposed schedule, including methods and sequence of operations.

E5.3.3 Details of Existing Structure

- (a) The applicable details and structure dimensions of the existing structure are shown on the Drawings for the information of the Contractor in establishing the methods and limits of removal and determining the cost of the Work from his examination of the Site.
- (b) The information shown has been obtained from existing drawings, measurements, and observations at the Site. The accuracy of this information is not guaranteed and the Contractor must verify all information before commencing Work.

E5.3.4 Removals and Disposal of Debris

- (a) The Contractor shall only use methods of steel removal that will not damage the existing structure to remain or new structures.

E5.3.5 Supply of Corrugated Steel Decking

- (a) Full size corrugated steel deck sheets shall be fabricated to the dimensions shown on the drawing, fabricated in accordance with E5.3.9.
- (b) The Contractor is advised that the City has forty (40) sheets in its inventory, which can be used in cases where delivery of new plates is delayed. New plates shall be delivered to the City to restock its inventory. The plates are located at the City Bridge Yard. Contact Mike Terleski, CET, at (204) 794-8510 to arrange suitable pick-up and delivery time.
- (c) Surplus sheets fabricated as part of this Contract shall be delivered to the City Bridge Yard as noted above.

E5.3.6 Installation of Corrugated Steel Decking

- (a) Corrugated Steel Decking shall be cut to fit from the supplied fabricated sheets as shown on the drawings or as directed by the Contract Administrator.
- (b) Plug weld to existing new sheet deck channels.

E5.3.7 Preparation of Existing Steel Deck Channels

- (a) Following removal of the existing corrugated steel decking, the existing steel deck channels shall be cleaned by wire brush or other suitable method to remove rust scale, such that they can be inspected by the Contract Administrator.
- (b) The top flange shall be thoroughly cleaned to accept plug welding of the new corrugated steel plate.

E5.3.8 Supply and Installation of the New Steel Deck Channels

- (a) After inspection of the existing deck channels, the Contract Administrator will advise the locations where new deck channels shall be installed.
- (b) Fabrication of New Deck Channels and connections shall be in accordance with E5.3.9
- (c) New Steel Deck Channels shall be cut to length in the field

E5.3.9 Fabrication and Installation of New Structural Steel and Corrugated Steel Decking

- (a) General
 - (i) Except as otherwise specified herein, steelwork shall be fabricated in accordance with the latest A.W.S. Specification D1.1 and subsequent revisions.
 - (ii) No fabrication shall commence until permission to do so has been received from the Contract Administration.
 - (iii) The repair of any members damaged during fabrication shall be approved by the Contract Administrator.
- (b) Submissions
 - (i) At five (5) days prior to the scheduled commencement of any fabrication, the operator's qualifications, the shop drawings and mill certificates shall be submitted to the Contract Administrator for review and approval.
- (c) Preparation of Material
 - (i) Prior to being used in fabrication, all structural steel and corrugated steel decking shall be straight and free from kinks or bends. If straightening is necessary, it shall be done by methods that will not injure the metal. The steel shall not be heated unless permission is given by the Contract Administrator. Sharp kinks and bends will be cause for rejection of the steel.
 - (ii) Steel may be cut to size by sawing, shearing, flame-cutting or machining. All steel after cutting shall be marked by a method agreed to by the Contract Administrator so that it's specification may be immediately identified.
 - (iii) Sheared edges of plates more than 16mm in thickness shall be planed to a depth of 6mm.
 - (iv) Special attention shall be given to the cutting of cover plates or flange plates. Occasional gouges not in excess of 6mm deep will be accepted in areas of low stress at the discretion of the Contract Administrator. The repair or removal of such gouges shall be to the Contract Administrator's instructions.
 - (v) Edges of flame cut edges shall be ground to a radius of 2mm. Re-entrant cuts shall be filleted to a radius of not less than 19mm.
 - (vi) Cut edges shall be free from excessive burrs or ragged breaks.
 - (vii) Corrugations in the steel decking shall be achieved by rolling or cold bending
- (d) Bolt Holes
 - (i) All bolt holes for high strength bolts shall be drilled and shall be of a nominal diameter not more than 2mm in excess of the nominal bolt diameter.
 - (ii) Drilling shall be done with twist drills. Burrs on the outside surface shall be removed.
 - (iii) Poor matching of holes will be cause for rejection.
- (e) Material Storage and Care

- (i) Structural steel, either plain or fabricated shall be stored above the ground on platforms, skids or other supports. It shall be kept free from dirt and other foreign matter, and shall be protected, as far as practical, from corrosion. Long members shall be supported on skids placed near enough together to prevent injury from deflection.
- (ii) Prior to fabrication, all steel shall be marked for identification by heat number and specification by a marking system approved by the Contract Administrator.
- (f) Field Assembly
 - (i) The new structural steel shall be snug tight to the underside of the steel plate or steel deck plate. Steel shims shall be installed where necessary as shown on the Drawings. The new channels shall be used as a template to drill bolt holes in the existing steel channels.
 - (ii) All corrugated steel decking shall be customized and installed to match the removed sections and placed snug adjacent to decking left in place.
 - (iii) All field connections shall be bolted with high strength bolts. Bolting with high strength bolts shall be carried out in accordance with "AASHTO Standard Specifications for Highway Bridges-1996 Division II, Clause 11.5-Assembly – turn of nut method."
- (g) Straightening of Bent Material
 - (i) The straightening of plates and angles or other shapes shall be done by methods that will not produce fracture or injury. The metal shall not be heated unless permitted by the Contract Administrator, in which case the heating shall not be a higher temperature than that producing a "dark cherry red" colour. After heating, the metal shall be cooled as slowly as possible.
 - (ii) Following the straightening of a bend or buckle, the surface of the metal shall be carefully inspected for evidence of fractures and if necessary, replaced or repaired to the satisfaction of the Contract Administrator.
- (h) Misfits
 - (i) The correction of minor misfits involving harmless amounts of reaming, cutting and chipping as determined by the Contract Administrator will be considered a legitimate part of erection. However, any error in shop fabrication, which prevents the proper assembling and fitting up of parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be cause for rejection and shall be corrected by the Contractor to the satisfaction of the Contract Administrator.

E5.3.10 Welding

- (a) Welding of steel structures shall be in accordance with CSA W59, "Welded Steel Construction".

E5.4 Quality Control

E5.4.1 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.

E5.4.2 Access

- (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator

or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E5.5 Measurement and Payment

E5.5.1 Supply and Installation of New Steel Deck Channels

- (a) Structural steel channels added will be measured on a unit basis and paid for at the Contract Unit Price per linear metre for "Supply and Installation of New Steel Deck Channels". The item to be paid for will be the total number of channels supplied and installed in accordance with this Specification, accepted and measured by the Contract Administrator.

E5.5.2 Supply of New Corrugated Steel Decking

- (a) The supply of new corrugated steel decking will be measured on a unit basis and paid for at the Contract Unit Price for "Supply of New Corrugated Steel Decking", performed in accordance with this Specification and accepted by the Contract Administrator.

E5.5.3 Installation of New Corrugated Steel Decking

- (a) Installation of new corrugated steel decking will be measured and paid for at the Contract Unit Price per square metre for "Installation of New Corrugated Steel Decking", performed in accordance with this Specification, and accepted by the Contract Administrator.

E6. REINFORCING STEEL

E6.1 Description

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

E6.2 Referenced Specifications and Drawings

- (a) The latest edition and subsequent revisions of the following:
 - (i) ASTM A615M – Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement;
 - (ii) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
 - (iii) CAN/CSA G30.18 – Billet-Steel Bars for Concrete Reinforcement;
 - (iv) Reinforcing Steel Institute of Canada – Reinforcement Steel Manual of Standard Practice.
 - (v) CAN/CSA G164-M92 (R2003) – Hot Dip Galvanizing of Irregularly Shaped Articles

E6.3 Scope of Work

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

E6.4 Materials

E6.4.1 General

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

E6.4.2 Handling and Storage of Materials

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

E6.4.3 Reinforcing Steel

- (a) Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) Reinforcing steel for the bridge deck slab shall be black steel as shown on the Drawings and shall conform to the requirements of CAN/CSA G30.18, Grade 400W.
- (c) If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete Works exhibit flaws in manufacture or fabrication, such material shall be immediately removed from the site and replaced with acceptable reinforcing steel.
- (d) All reinforcing steel shall be straight and free from paint, oil, millscale, and injurious defects. Rust, surface seams, or surface irregularities will not be cause for rejection, provided that the minimum dimensions, cross sectional area, and tensile properties of a hand-wire-brushed specimen are not less than the requirements of ASTM A955M.

E6.4.4 Bar Accessories

- (a) Bar accessories shall be of types suitable for each type of reinforcing and acceptable to the Contract Administrator. They shall be made from a non-rusting material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (b) Bar chairs, bolsters, and bar supports shall be made from cementitious material. No plastic or PVC, or galvanized bar supports shall be used.
- (c) The use of pebbles, pieces of broken stone or brick, plastic, metal pipe, and wooden blocks, will not be permitted.
- (d) Placing of bar supports shall be done to meet the required construction loads.
- (e) Tie wire shall be the following:
 - (i) Black, soft-annealed 1.6 mm diameter wire for black steel reinforcing;
 - (ii) Nylon-, epoxy-, or plastic-coated wire for black steel reinforcing; and
- (f) Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices that may be approved by the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

E6.5 Equipment

E6.5.1 General

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

E6.6 Construction Methods

E6.6.1 Fabrication of Reinforcing Steel

- (a) All reinforcing steel shall be fabricated in accordance with the latest edition of the Reinforcement Steel Manual of Standard Practice by the RSIC, to the lengths and shapes as shown on the Drawings.
- (b) Reinforcing Steel may be cut in the field.

E6.6.2 Placing and Fastening of Reinforcing Steel

(a) General

- (i) Reinforcing steel shall be placed accurately in the positions shown on the Drawings and shall be retained in such positions by means of a sufficient number of bar accessories so that the bars shall not be moved out of alignment during or after the depositing of concrete. The Contract Administrator's decision in this matter shall be final.
- (ii) Reinforcing steel shall be free of all foreign material in order to ensure a positive bond between the concrete and steel. The Contractor shall also remove any dry concrete which has been deposited on the steel from previous pouring operations before additional concrete may be placed. Intersecting bars shall be tied positively at each intersection.
- (iii) Splices in reinforcing steel shall be made only where indicated on the Drawings. Prior acceptance by the Contract Administrator shall be obtained where other splices must be made. Welded splices shall not be permitted.
- (iv) Reinforcing steel shall be placed to provide a clear space between the reinforcing bars as shown on the Drawings to accurately place preformed holes where necessary.
- (v) Reinforcing steel shall not be straightened or re-bent in a manner that will injure the metal. Bars with bends not shown on the Drawings shall not be used. Heating of reinforcing steel shall not be permitted without prior acceptance by the Contract Administrator.
- (vi) Reinforcing steel shall be placed within the tolerances specified in CAN/CSA A23.1.
- (vii) The Contractor shall supply and place all necessary support accessories to ensure proper placement of reinforcing steel. All reinforcement shall be accurately placed in the positions shown on the Drawings, and firmly tied and chaired before placing the concrete.
- (viii) Distances from the forms shall be maintained by means of stays, spacers, or other approved supports. Spacers and supports for holding reinforcing steel at the required location and ensuring the specified concrete cover over the reinforcing steel shall be as specified in E11.5.4 "Bar Accessories".
- (ix) Welding or tack welding is not permitted.
- (x) Unless otherwise shown on the Drawings, the minimum distance between bars shall be 40 mm.

E6.6.3 Splicing

(a) General

- (i) Splices shall only be provided as shown on the Drawings. Splices other than as shown on the Drawings will not be permitted without the written approval of the Contract Administrator.

- (ii) For lapped splices, the bars shall be placed in contact and wired together in such a manner as to maintain a clearance of not less than the required minimum clear distance to other bars, and the required minimum distance to the surface of the concrete. In general, suitable lap lengths shall be supplied as detailed on the Drawings. If this information is not detailed on the Drawings, a minimum of thirty-five (35) bar diameters lap length shall be provided.

E6.7 Quality Control

E6.7.1 Inspection

- (a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.
- (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
- (c) A minimum of one (1) Business Day advance notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for inspection of the reinforcing steel.
- (d) After all reinforcing steel has been placed, a final inspection shall be made prior to the placement of concrete to locate any damage or deficiencies. All visible damage or any deficiencies shall be repaired to the satisfaction of the Contract Administrator before concrete is placed.

E6.7.2 Access

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

E6.8 Quality Assurance

E6.8.1 Testing

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

E6.9 Measurement and Payment

E6.9.1 Black Reinforcing Steel

- (a) The supply and placement of reinforcing steel shall be incidental to Supply and Placement of Structural Concrete and no additional measurement and payment will be made.

E7. STRUCTURAL CONCRETE

E7.1 Description

- (a) This Specification shall cover all operations relating to the preparation of Portland Cement structural concrete for, and all concreting operations related to, the construction of structural concrete works as specified herein and as shown on the Drawings.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools,

supplies, and all things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

E7.2 Referenced Specifications and Drawings

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

E7.3 Scope of Work

- (a) The Work under this Specification shall involve the following structural concrete Works:
 - (i) Concrete Deck Works: Deck slab portions to be replaced by new cast-in-place concrete as determined by Contract Administrator and laid out during construction.

E7.4 Submittals

E7.4.1 General

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

E7.4.2 Concrete Mix Design Requirements

- (a) The Contractor shall submit a concrete mix design statement to the Contract Administrator for each of the concrete types specified herein that reflects the specified performance properties of the concrete. The mix design statement shall contain all the information as outlines on the concrete mix design statement as shown on the Manitoba Ready Mix Concrete Association website (www.mrmca.com). In addition, the mix design statement must indicate the expected method of placement (buggies or chute) methods are to be used.
- (b) The Supplier shall submit directly, in confidence, to the City of Winnipeg, the concrete mix designs for each of the concrete types specified herein. The purpose of this confidential submission will be for record keeping purposes only. The concrete mix design shall contain a description of the constituents and proportions, and at the minimum the following:
 - (i) Cementitious content in kilograms per cubic metre or equivalent units, and type of cementitious materials;
 - (ii) Designated size, or sizes, of aggregates, and the gradation;
 - (iii) Aggregate source location(s);
 - (iv) Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis;
 - (v) Maximum allowable water content in kilograms per cubic metre or equivalent units and the water/cementitious ratio;
 - (vi) The limits for slump;
 - (vii) The limits for air content; and
 - (viii) Quantity of other admixtures.
- (c) The concrete mix design statements must be received by the Contract Administrator a minimum of ten (10) Business Days prior to the scheduled commencement of concrete placement for each of the concrete types.
- (d) The mix design statement shall also include the expected slump measurement for each concrete type. The tolerances for acceptance of slump measurements in the field, by the Contract Administrator, shall be in accordance with the requirements of the CAN/CSA A23.1 Clause 4.3.2.3.2.
- (e) Any change in the constituent materials of any approved mix design shall require submission of a new concrete mix design statement, mix design, and mix design test data. If, during the progress of the Work, the concrete supplied is found to be unsatisfactory for any reason, including poor workability, the Contract Administrator may require the Contractor to make any necessary adjustments and associated resubmissions.

E7.4.3 Concrete Mix Design Test Data

- (a) Concrete
 - (i) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, test data showing that the concrete to be supplied will meet the performance criteria stated in this Specification for each concrete type.
 - (ii) The Contractor shall submit at a minimum, the test data to prove that the minimum compressive strength, flexural strength for Fibre Reinforced Concrete

- (FRC) only, air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. In addition, test data shall be submitted to support requirements for post-cracking residual strength index (R_i) and fibre dispersion in accordance with the requirements of the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6, Section 15, Fibre Reinforced Structures, Clause 16.6.
- (iii) All tests shall be based on the concrete samples taken from the point of discharge into the formwork. For example, at the concrete chute from the delivery truck if being placed by buggies, or at the end of the pump line should the Contractor choose to pump the concrete into place.
- (b) Aggregates
- (i) The Contractor shall furnish, in writing to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, the location of the sources where aggregate will be obtained in order that some may be inspected and tentatively accepted by the Contract Administrator. Contract shall not be permitted without notification in writing to and the expressed approval of the Contract Administrator.
- (ii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on sieve analysis of fine and coarse aggregates in accordance with CSA Standard Test Method A23.2-2A.
- (iii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on tests for organic impurities in fine aggregates for concrete, in accordance with CSA Standard Test Method A23.2-7A.
- (iv) The Contractor shall submit to the Contract Administrator for review and approval recent test information on relative density and absorption of coarse aggregate, in accordance with CSA Standard Test Methods A23.2-12A.
- (v) The Contractor shall submit to the Contract Administrator for review and approval recent test information on petrographic examination of aggregates for concrete, in accordance with CSA Standard Test Methods A23.2-15A. The purpose of the petrographic analysis is to ensure the aggregates provided are of the highest quality for use in the production of concrete and will produce a durable overlay. An acceptable aggregate will have an excellent rating as judged by an experienced petrographer, with a (weighted) petrographic number typically in the range of 100 to 120.
- (vi) The Contractor shall submit to the Contract Administrator for review and approval recent test information on resistance to degradation of large-size coarse aggregate by abrasion and impact in the Los Angeles Machine, in accordance with CSA Standard Test Method A23.2-16A.
- (vii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on potential alkali reactivity of cement aggregate combinations (mortar bar method), in accordance with CSA Standard Test Method A23.2-27A.
- (c) The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

E7.4.4 Notification of Ready Mix Supplier

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

E7.5 Materials

E7.5.1 General

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

E7.5.2 Handling and Storage of Materials

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

E7.5.3 Concrete

- (a) Concrete materials susceptible to frost damage shall be protected from freezing.
- (b) Concrete shall have nominal compressive strengths (f'c) and meet the requirements for hardened concrete as specified in the following Table E7.1.

TABLE E7.1 REQUIREMENTS FOR HARDENED CONCRETE							
Type of Concrete	Location	Nominal Compressive Strength MPa	Class of Exposure	Air Content Category	Max Aggregate Size	Special Requirements	Minimum Post Residual Cracking Index
Type 1	Deck Slab	35 @ 28 Days	C-1	1	20 mm	Synthetic Fibres	0.15

E7.5.4 Aggregates

(a) General

- (i) All aggregates shall be handled to prevent segregation and inclusion of any foreign substances, and to obtain uniformity of materials. The two sizes of coarse and fine aggregates, and aggregates secured from different sources, shall be piled in separate stockpiles. The site of the stockpiles shall be cleaned of all foreign materials and shall be reasonably level and firm or on a built up platform. If the aggregates are placed directly on the ground, material shall not be removed from the stockpile within 150 mm of the ground level. This material shall remain undisturbed to avoid contaminating the aggregate being used with the ground material.
- (ii) The potential for deleterious alkali-aggregate reactivity shall be assessed in accordance with CSA Standard Test Method A23.2-27A. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA Standard Test Method A23.2-1 4A or CSA A23.2-25A is required.
- (iii) Petrographic analysis when performed shall be in accordance with MTO (Ministry of Transportation Ontario) Lab Test Method LS 609. The (weighted) petrographic number shall not exceed 130.

(b) Fine Aggregate

- (i) Fine aggregate shall meet the grading requirements of CAN/CSA A23.1, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75 um sieve. Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong,

durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.

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

(c) Coarse Aggregate - Standard

- (i) The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CAN/CSA A23.1, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 2% shall pass a 75 um sieve. Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; shall have a minimum of two fractured faces; and shall have an absorption not exceeding 3%.
- (ii) 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.
- (iii) Course aggregate when tested for abrasion in accordance with the requirements of the ASTM C131 shall not have a loss greater than 30%.
- (iv) Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CAN/CSA A23.1, Table 12, for concrete exposed to freezing and thawing.

E7.5.5 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.

E7.5.6 Cementitious Materials

- (a) Cementitious materials shall conform to the requirements of CAN/CSA A3001 and shall be free from lumps.
- (b) Should the Contractor choose to include a silica fume admixture in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of cement.
- (c) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class CI or F and the substitution shall not exceed 30% by mass of cement.
- (d) Cementitious materials shall be stored in a suitable weather-tight building that shall protect these materials from dampness and other destructive agents. Cementitious materials that have been stored for a length of time resulting in the hardening, or the formation of lumps, shall not be used in the Work.

E7.5.7 Water

- (a) Water to be used for all operations in the Specification, including mixing and curing of concrete or grout, surface texturing operations, and saturating the substrate shall conform to the requirements of CAN/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.

E7.5.8 Corrosion Inhibitor

- (a) Corrosion inhibitor shall be MCI 2005 NS at a dosage of 1 L/m³, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".

- E7.5.9 Formwork
- (a) All formal formwork will be placed, if necessary, structural steel components, incidental to the Work, will be used.
- E7.5.10 Synthetic Fibres
- 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 CHBDC CAN/CSA S6, "Fibre-Reinforced Structures", Clause 16.6.
- E7.5.11 Curing Blankets
- (a) Curing blankets for wet curing shall be 100 percent polyester, 3 mm thick, white in colour. An approved product is "Mirafi Geotextile P150". Alternately, a 10 oz burlap, 5 mil polyethylene, curing blanket white in colour shall be used; "Curelap" manufactured by Midwest Canvas, together with a second layer of burlap, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".
- E7.5.12 Epoxy Adhesive
- (a) Epoxy adhesive for bonding concrete to steel shall be one of the following approved products: Sternson ST432 or ST433, Dural Duralbond, Capper Capbond E, Sikadur 32 Hi-bond, Concessive 1001 LPL, Meadows Rezi-Weld 1000, or equal as accepted by the Contract Administrator, in accordance with B6, "Substitutes".
- E7.5.13 Precompressed Foam Joint Filler
- (a) Preformed sealant shall be preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, polymer-modified 100% acrylic dispersion.
- (b) Precompressed sealant to be installed recessed from the substrate faces and to receive a field-applied coating of low-modulus liquid sealant (by others) not to exceed 1 inch, (25mm) thick.
- E7.6 Equipment
- E7.6.1 General
- (a) All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- E7.6.2 Vibrators
- (a) The Contractor shall have sufficient numbers of internal concrete vibrators and experienced operators on site to properly consolidate all concrete in accordance with ACI 309. The type and size of vibrators shall be appropriate for the particular application, the size of the pour, and the amount of reinforcing and shall conform to standard construction procedures.
- (b) The Contractor shall have standby vibrators available at all times during the pour.
- E7.7 Construction Methods
- E7.7.1 General
- (a) It is intended that this Section cover all construction Work associated with Structural Concreting operations.
- E7.7.2 Concrete Construction Joints
- (a) Concrete construction joints shall be located only as directed in writing by the Contract Administrator. Concrete construction joints shall be formed at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints.

- (b) Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.
- (c) After the forms are stripped off the construction joint, the entire face of the joint, including the reinforcing steel, shall be thoroughly cleaned down to sound concrete and the surface roughened.
- (d) Refer to, E7.7.4, "Preparation for Concreting Against Hardened Concrete", for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

E7.7.3 Supply of Structural Concrete

- (a) All structural concrete shall be supplied from a plant certified by the Manitoba Ready Mix Concrete Association. The Contractor, upon request from the Contract Administrator, shall furnish proof of this certification.
- (b) All mixing of concrete must meet the provisions of CAN/CSA A23.1, Clause 5.2, Production of Concrete.
- (c) Time of Hauling
 - (i) The maximum time allowed for all types of concrete to be delivered to the Site of the Work, including the time required to discharge, shall not exceed 120 minutes after batching. Batching of all types of concrete is considered to occur when any of the mix ingredients are introduced into the mixer, regardless of whether or not the mixer is revolving. For concrete that includes silica fume and fly ash, this requirement is reduced to 90 minutes.
 - (ii) Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of batching. In hot or cold weather, or under conditions contributing to quick stiffening of the concrete, a time less than 120 and/or 90 minutes may be specified by the Contract Administrator. The Contractor will be informed of this requirement 24 hours prior to the scheduled placing of concrete.
 - (iii) To avoid the reduction of delivery and discharge time in hot weather, the Contractor will be allowed to substitute crushed ice for a portion of the mixing water provided the specified water/cementitious ratio is maintained. All of the ice shall be melted completely before discharging any of the concrete at the delivery point.
 - (iv) Unless otherwise noted in Table E7.1, "Requirements for Hardened Concrete", no retarders shall be used.
 - (v) The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water. If the slump of the concrete is less than that designated by the mix design statement, then water can be added on site provided the additional water meets the requirements of CAN/CSA A23.1 5.2.4.3.2. If additional water is to be added on site, it must be done under the guidance of the Suppliers' designated quality control person. The Supplier shall certify that the addition of water on site does not change the Mix Design for the concrete supplied. Any other water added to the concrete without such control will be grounds for rejection of the concrete by the Contract Administrator.
 - (vi) A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the Owner upon request.
- (d) Delivery of Concrete
 - (i) The Contractor shall satisfy himself that the Concrete Supplier has sufficient plant capacity and satisfactory transporting equipment to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such that the development of cold joints will not occur. The

methods of delivering and handling the concrete shall facilitate placing with a minimum of rehandling, and without damage to the structure or the concrete.

(e) Concrete Placement Schedule

- (i) The Contractor shall submit to the Contract Administrator the proposed concrete placement schedule for all concrete placements for review and approval. If, in the opinion of the Contract Administrator, the volume of the placement is deemed larger than can be placed with the facilities provided, the Contractor shall either:
 - i. Limit the amount to be placed at any time (using adequate construction joints);
 - ii. Augment his facilities and Plant in order to complete the proposed placement;
 - iii. In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting; and
- (ii) The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

E7.7.4 Preparation for Concreting Against Hardened Concrete

- (a) All hardened concrete against which new concrete is to be placed shall be prepared in the following manner:
 - (i) Concrete shall be removed to sound concrete or to the limits as shown on the Drawings, whichever is greater. The resulting surface shall be roughened to remove latent cement and miscellaneous debris.
 - (ii) All existing surfaces and exposed reinforcing steel are to be sandblasted to reveal a clean substrate and kept clean until concrete placement. Sandblasting shall be followed by a high pressure water wash to remove all residues.
 - (iii) Immediately prior to placing new concrete, bonding grout shall be thoroughly brushed onto the entire surface of the existing hardened concrete in a thin and even coating that will not run or puddle.

E7.7.5 Placing Structural Concrete

(a) General

- (i) The Contractor shall notify the Contract Administrator at least one (1) Working day prior to concrete placement so that an adequate inspection may be made of formwork, reinforcement, joints, and related Works. No concrete pour shall be scheduled without the prior written approval of the Contract Administrator.

(b) Placing Structural Concrete

- (i) Equipment for mixing or conveying concrete shall be thoroughly flushed with clean water before and after each pour. Water used for this purpose shall be discharged outside the forms. All equipment and processes are subject to acceptance by the Contract Administrator.
- (ii) Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation and a marked change in consistency.
- (iii) Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.
- (iv) Before depositing any concrete, all debris shall be removed from the space to be occupied by the concrete, and any mortar splashed upon the reinforcement or forms shall be removed.
- (v) Formwork liners shall be cooled immediately prior to placing concrete by spraying with cold water.
- (vi) Placing of concrete, once started, shall be continuous. No concrete shall be placed on concrete which has sufficiently hardened to cause the formation of seams or "cold joints" within the section. If placing must be interrupted, construction joints shall be located where shown on the Drawings or as accepted by the Contract Administrator.
- (vii) Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.

- (viii) 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.
- (ix) 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 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.
- (x) Vibrators shall be inserted systematically into the concrete at intervals such that the zones of influence of the vibrator overlap (generally 300 to 900 mm). Apply the vibrator at any point until the concrete is sufficiently compacted (5 to 15 seconds), but not long enough for segregation to occur. The vibrators shall be inserted vertically and withdrawn out of the concrete slowly. Spare vibrators in good working condition shall be kept on the job site during all placing operations.
- (xi) Concrete shall not be placed during rain or snow unless adequate protection is provided for formwork and concrete surfaces, to the satisfaction of the Contract Administrator.
- (xii) Before any concrete is placed for the median barriers, the Contractor shall demonstrate to the satisfaction of the Contract Administrator before each pour that all necessary adjustments have been made to provide the required slab thickness and concrete cover.

E7.7.6 Finishing of Concrete Surfaces

- (a) Finishing Operations for Unformed Surfaces
 - (i) The Contractor shall ensure that sufficient personnel are provided for the finishing of the slab surfaces. In the event that the depositing, vibrating, and screeding operations progress faster than the concrete finishing, the Contractor shall reduce the rate of concrete placement or cease the depositing of concrete until the exposed area of unfinished concrete has been satisfactorily minimized. The Contract Administrator's judgement in this matter shall be final and binding on the Contractor. All loads of concrete that exceed the 120 minute discharge time limit during the delay, while the finishing operations catch up, shall be rejected.
- (b) Type 2 Finish – Unformed Surfaces
 - (i) All unformed concrete surfaces shall be finished as outlined hereinafter.
 - (ii) Screeding of all unformed concrete surfaces shall be performed by the sawing movement of a straightedge along wood or metal strips or form edges that have been accurately set at required elevations.
 - (iii) Screeding shall be done on all concrete surfaces as a first step in other finishing operations. Screeding shall be done immediately after the concrete has been vibrated.
 - (iv) After screeding, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared. Concrete surfaces after floating shall have a uniform, smooth, granular texture.

E7.7.7 General Curing Requirements

- (a) Refer to E7.7.8, "Cold Weather Concreting" for cold weather curing requirements and E7.7.9, "Hot Weather Concreting" of this Specification for hot weather curing requirements.
- (b) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, running water, vibration, and mechanical shock. No machinery shall

travel in the vicinity of freshly placed concrete for a period of 24 hours. Concrete shall be protected from freezing until at least 24 hours after the end of the curing period.

- (c) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3°C in one hour or 20°C in 24 hours.
- (d) Freshly finished concrete shall be moist cured by immediately applying wet curing blankets to the exposed concrete surface immediately following finishing operations for at least seven (7) consecutive days thereafter. Construction joints shall be cured by means of wet curing blankets only. Water shall be applied as necessary to keep the concrete and curing blankets saturated. The Contractor must ensure the concrete and curing blankets are kept saturated with water for the entire seven (7) days.
- (e) 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. Formed surfaces shall receive, immediately after stripping and patching, the same curing as finished surfaces.
- (f) For curing of barriers, formwork shall remain in place for six (6) consecutive days following concreting. The top surface of the concrete surface shall be moist cured during this timeframe.

E7.7.8 Cold Weather Concreting

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

E7.7.9 Hot Weather Concreting

(a) General

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

(b) Hot-Weather Curing

- (i) When the air temperature is at or above 25°C, curing shall be accomplished by fog misting and by using saturated absorptive fabric, in order to achieve cooling by evaporation.

- (ii) Mass concrete shall be water cured for the eleven (11) days when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.
- (c) Job Preparation
 - (i) When the air temperature is forecast to rise to 25°C or higher during the placing period, provisions shall be made by the Contractor for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by mist fogging and evaporation, to the satisfaction of the Contract Administrator.
- (d) Concrete Temperature
 - (i) The temperature of the concrete as placed shall be as low as practicable and in no case greater than the following temperatures, as shown in Table E7.2, "Acceptable Concrete Temperatures", for the indicated size of the concrete section.

TABLE 7.2: ACCEPTABLE CONCRETE TEMPERATURES		
THICKNESS OF SECTION, m	TEMPERATURES °C	
	MINIMUM	MAXIMUM
Less than:		
< 0.3	10	35
0.3-1	10	30
1-2	5	25
>2	5	20

- E7.7.10 Cleanup
 - (a) The Contractor shall cleanup equipment and construction debris on at least a weekly basis to the satisfaction of the Contract Administrator.
- E7.7.11 Concrete Quality
- E7.7.12 Inspection
 - (a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.
 - (b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
 - (c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.
- E7.7.13 Access
 - (a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.
- E7.7.14 Materials
 - (a) All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator or by the Quality Assurance Testing Laboratory designated by the Contract Administrator. There shall be no charge to the City of Winnipeg for any materials taken by the Contract Administrator for testing purposes.

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

E7.7.15 Quality Assurance and Quality Control

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

E7.7.16 Concrete Testing

- (a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits in E7.4.2, "Concrete Mix Design Requirements" of this Specification, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.
- (b) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E7.4.2, "Concrete Mix Design Requirements" of this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.
- (c) Rapid chloride permeability testing shall be performed in accordance with ASTM C1202.
- (d) Testing for post-cracking residual strength index (Ri) of FRC shall be tested as follows. One set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure using the same test set up in ASTM C1609-10. The average of the peak loads is the cracking load of the concrete (Pcr), and shall be provided to the Contract Administrator. A second set of five concrete beam specimens shall be tested to failure in accordance with ASTM C1399-07. The average of the peak loads during the reloading is the post cracking load of the concrete (Ppcr). The Ri is equal to the ratio of Ppcr over Pcr. The Contractor shall submit a summary of the results of all post-cracking residual strength index tests, including all load deflection

curves. Tests conducted in accordance to ASTM C1399-07 will be considered invalid by the Engineer if the initial crack in the specimen has occurred after 0.5mm deflection. Specimens shall be sampled in accordance with E7.8.5(e).

- (e) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method A23.2-1C, "Sampling Plastic Concrete".
- (f) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C, "Making and Curing Concrete Compression and Flexure Test Specimens".
- (g) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which will be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.
- (h) Compressive strength tests on specimens cured under the same conditions as the concrete Works shall be made to check the strength of the in-place concrete so as to determine if the concrete has reached the minimum allowable working compressive strength as specified in Table E7.1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

E7.7.17 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.

E7.8 Measurement and Payment

E7.8.1 Structural Concrete

- (a) Supplying and placing structural concrete will be measured and paid for at the Contract Unit Price per square metre, for "Supply and Placement of Structural Concrete", performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work.