THE CITY OF WINNIPEG

BID OPPORTUNITY

291-2007 BID OPPORTUNITY

2007 CAPITAL PROGRAM – ANNABELLA STREET UNDERPASS – RETAINING WALL REHABILITATION AND ROADWORKS

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 2007 CAPITAL PROGRAM – ANNABELLA STREET UNDERPASS – RETAINING WALL REHABILITATION AND ROADWORKS

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, June 7, 2007.

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

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

B3. ENQUIRIES

B3.1 All enquiries shall be directed to the Contract Administrator identified in D3.1.

B3.2 If the Bidder finds errors, discrepancies or omissions in the Bid Opportunity, or is unsure of the meaning or intent of any provision therein, the Bidder shall notify the Contract Administrator of the error, discrepancy or omission, or request a clarification as to the meaning or intent of the provision at least five (5) Business Days prior to the Submission Deadline.

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

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

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

B4. ADDENDA

B4.1 The Contract Administrator may, at any time prior to the Submission Deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.

B4.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B4.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

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

B4.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B5. SUBSTITUTES

B5.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

B5.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B5.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

B5.4 The Bidder shall ensure that any and all requests for approval of a substitute:

(a) Provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;

(b) Identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;

(c) Identify any anticipated cost or time savings that may be associated with the substitute;

(d) Certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;

(e) Certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.

B5.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an “approved equal” or as an “approved alternative”, or may refuse to grant approval of the substitute.

B5.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B5.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.

B5.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.

B5.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B14.

B5.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B6. BID COMPONENTS

B6.1 The Bid shall consist of the following components:

(a) Form A: Bid;

(b) Form B: Prices;

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

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

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

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

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

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

B6.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, may result in the Bid being determined to be non-responsive.

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

B6.8 Bids shall be submitted to:

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

B7. BID

B7.1 The Bidder shall complete Form A: Bid, making all required entries.

B7.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

(a) If the Bidder is a sole proprietor carrying on business in his own name, his name shall be inserted;

(b) If the Bidder is a partnership, the full name of the partnership shall be inserted;

(c) If the Bidder is a corporation, the full name of the corporation shall be inserted;

(d) If the Bidder is carrying on business under a name other than his own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.

B7.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B7.2.

B7.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

B7.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:

(a) If the Bidder is a sole proprietor carrying on business in his own name, it shall be signed by the Bidder;

(b) If the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;

(c) If the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;

(d) If the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

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

B7.4.2 All signatures should be witnessed, except where a corporate seal has been affixed.

B7.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid and the Contract, when awarded, shall be both joint and several.

B8. PRICES

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

B8.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.

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

B9. QUALIFICATION

B9.1 The Bidder shall:

(a) Undertake to be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba; and

(b) Be financially capable of carrying out the terms of the Contract; and

(c) Have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract.

B9.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

(a) Be responsible and not be suspended, debarred or in default of any obligations to the City (a list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt).

B9.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

(a) Have successfully carried out work similar in nature, scope and value to the Work; and

(b) Be fully capable of performing the Work required to be in strict accordance with the terms and provisions of the Contract; and

(c) Have a written workplace safety and health program if required pursuant to The Workplace Safety and Health Act (Manitoba);

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

(a) A valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association or by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or

(b) A report or letter to that effect from an independent reviewer acceptable to the City (a list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt).

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

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

B10. BID SECURITY

B10.1 The Bidder shall provide bid security in the form of:

(a) A bid bond, in the amount of at least ten percent (10%) of the Total Bid Price, and agreement to bond of a company registered to conduct the business of a surety in Manitoba, in the form included in the Bid Submission (Form G1: Bid Bond and Agreement to Bond); or

(b) An irrevocable standby letter of credit, in the amount of at least ten percent (10%) of the Total Bid Price, and undertaking issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form included in the Bid Submission (Form G2: Irrevocable Standby Letter of Credit and Undertaking); or

(c) A certified cheque or draft payable to "The City of Winnipeg", in the amount of at least fifty percent (50%) of the Total Bid Price, drawn on a bank or other financial institution registered to conduct business in Manitoba.

B10.1.1 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

B10.1.2 All signatures on bid securities shall be original, and shall be witnessed or sealed as required.

B10.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

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

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

B10.3 The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

B11. OPENING OF BIDS AND RELEASE OF INFORMATION

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

B11.1.1 Bidders or their representatives may attend.

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

B11.2 Following the submission deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B11.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract Amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B11.4 The Bidder is advised that any information contained in any Bid may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B12. IRREVOCABLE BID

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

B12.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

B13. WITHDRAWAL OF BIDS

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

B13.1.1 Notwithstanding C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B13.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

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

(a) Retain the Bid until after the Submission Deadline has elapsed;

(b) Open the Bid to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and

(c) If the notice has been given by any one of the persons specified in B13.1.3(b), declare the Bid withdrawn.

B13.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B12.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

B14. EVALUATION OF BIDS

B14.1 Award of the Contract shall be based on the following bid evaluation criteria:

(a) Compliance by the Bidder with the requirements of the Bid Opportunity (pass/fail);

(b) Qualifications of the Bidder and the Subcontractors, if any, pursuant to B9 (pass/fail);

(c) Total Bid Price;

(d) Economic analysis of any approved alternative pursuant to B5.

B14.2 Further to B14.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.

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

B14.4 Further to B14.1(c), the Total Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.

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

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 Subject to B15.2, 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.

B15.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

C0.1 The *General Conditions for Construction* (Revision 2006 12 15) are applicable to the Work of the Contract.

C0.1.1 The *General Conditions for Construction* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

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 Annabella Street Underpass – Retaining Wall Rehabilitation and Roadworks.

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

(a) Demolition and excavation

(b) Concrete forming and placing

(c) Roadway intersection improvements

(d) Roadway Renewal

D3. CONTRACT ADMINISTRATOR

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

Mr. Mark Doucet, EIT
200-895 Waverley Street, Winnipeg, MB R3T 5 P4

Telephone No. (204) 453-2301
Facsimile No. (204) 452-4412

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

D4. CONTRACTOR'S SUPERVISOR

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

D5. NOTICES

D5.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D5.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D5.3, D5.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D3.1.

D5.3 All notices of appeal to the Chief Administrative Officer shall be sent to the following address or facsimile number:

The City of Winnipeg
Chief Administrative Officer Secretariat
Attn: Chief Administrative Officer
Administration Building, 3rd Floor

510 Main Street
Winnipeg MB R3B 1B9

Facsimile No.: (204) 949-1174

D5.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

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

Facsimile No.: (204) 947-9155

D6. FURNISHING OF DOCUMENTS

D6.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. Drawings will be 11" x 17" size. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

SUBMISSIONS

D7. AUTHORITY TO CARRY ON BUSINESS

D7.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D8. SAFE WORK PLAN

D8.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D8.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template, which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

D9. INSURANCE

D9.1 The Contractor shall provide and maintain the following insurance coverage:

(a) Commercial general liability insurance, in the amount of at least two million dollars ($2,000,000.00) inclusive, with The City of Winnipeg added as an additional insured, with a cross-liability clause, such liability policy to also contain a contractual liability, unlicensed motor vehicle liability, non-owned automobile liability and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;

(b) Automobile liability insurance for owned automobiles used for or in connection with the Work in the amount of at least two million dollars ($2,000,000.00) at all times during the performance of the Work and until the date of Total Performance;

D9.2 Deductibles shall be borne by the Contractor.

D9.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in C4.1 for the return of the executed Contract.

D9.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator.

D10. PERFORMANCE SECURITY

D10.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

(a) A performance bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H1: Performance Bond), in the amount of fifty percent (50%) of the Contract Price; or

(b) An irrevocable standby letter of credit issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form attached to these Supplemental Conditions (Form H2: Irrevocable Standby Letter of Credit), in the amount of fifty percent (50%) of the Contract Price; or

(c) A certified cheque or draft payable to “The City of Winnipeg”, drawn on a bank or other financial institution registered to conduct business in Manitoba, in the amount of fifty percent (50%) of the Contract Price.

D10.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D10.2 If the bid security provided in his Bid was not a certified cheque or draft pursuant to B10.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

SCHEDULE OF WORK

D11. COMMENCEMENT

D11.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D11.2 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;

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

D11.3 The Contractor shall not commence the Work on the Site before July 1, 2007.

D12. SUBSTANTIAL PERFORMANCE

D12.1 The Contractor shall achieve Substantial Performance by August 24, 2007.

D12.2 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.

D12.3 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.

D13. TOTAL PERFORMANCE

D13.1 The Contractor shall achieve Total Performance by August 31, 2007.

D13.2 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.

D13.3 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.

D14. LIQUIDATED DAMAGES

D14.1 If the Contractor fails to achieve Total Performance in accordance with the Contract by the day fixed herein for Total Performance, the Contractor shall pay the City seven hundred dollars ($700) per Working Day for each and every Working Day following the day fixed herein for Total Performance during which such failure continues.

D14.2 The amount specified for liquidated damages in D14.1 is based on a genuine pre-estimate of the City's damages in the event that the Contractor does not achieve Total Performance by the day fixed herein for same.

D14.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D15. SCHEDULED MAINTENANCE

D15.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

(a) Sod maintenance as specified in CW3510-R9;

(b) Reflective crack maintenance as specified in CW3250-R6;

D15.2 Determination of Substantial Performance and Total Performance shall be exclusive of scheduled maintenance identified herein. All scheduled maintenance shall be completed prior to the expiration of the warranty period. Where the scheduled maintenance cannot be completed during the warranty period, the warranty period shall be extended for such period of time as it takes the Contractor to complete the scheduled maintenance.

CONTROL OF WORK

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

D16.1 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).

MEASUREMENT AND PAYMENT

D17. PAYMENT

D17.1 Further to C12, effective January 1, 2007 the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

WARRANTY

D18. WARRANTY

D18.1 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.

D19. COOPERATION WITH OTHERS

D19.1 The Contractor's attention is directed to the fact that other Contractors, the personnel of Utilities and the staff of the City may be working on the structure, approach roadways, adjacent roadways or rights-of-way. The activities of these agencies may coincide with the Contractor's execution of the Work, and it will be the Contractor's responsibility to cooperate to the fullest extent with the other personnel working in the area, and such cooperation is an obligation of the Contractor under the terms of this Contract.

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 dated the

_____ day of _____ , 20____ , for:

BID OPPORTUNITY NO. 291-2007

2007 CAPITAL PROGRAM – ANNABELLA STREET UNDERPASS – RETAINING WALL REHABILITATION AND ROADWORKS

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

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

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

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

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

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

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

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

_____
(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 291-2007

2007 CAPITAL PROGRAM – ANNABELLA STREET UNDERPASS – RETAINING WALL REHABILITATION AND ROADWORKS

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

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

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

_____

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

_____
(Address)

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

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

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

_____ .
(Date)

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

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

This credit is subject to the Uniform Customs and Practice for Documentary Credit (1993 Revision), International Chamber of Commerce Publication Number 500.

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS 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 Branch internet site at http://www.winnipeg.ca/matmgt.

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:

Specification No.	Specification Title
	Table of Contents
	Manual of Temporary Traffic Control in Work Areas on City Streets.
CSA A23.1/A23.2	Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
CSA B182.1	Plastic Drain and Sewer Pipe and Pipe Fittings.
CSA B182.2	PVC Sewer Pipe and Fittings (PSM Type).
CSA O121-M1978	Douglas Fir Plywood.
CSA W186	Welding of Reinforcing Bars in Reinforced Concrete Construction.
CSA W59	Welded Steel Construction.
CAN/CSA G164	Hot Dip Galvanizing of Irregularly Shaped Articles.
CAN/CSA G30.18	Billet-Steel Bars for Concrete Reinforcement.
CAN/CSA G40.20/G40.21	General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
CAN/CSA-A3001	Cementitious Materials for Use in Concrete.
CAN/CSA-S6	Canadian Highway Bridge Design Code.
ASTM A276	Stainless Steel Bars and Shapes.
ASTM A780	Repair of Damaged and Uncoated Areas of Hot-Dip GalvanizedCoatings.
ASTM C131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C260	Air-Entraining Admixtures for Concrete.
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C494	Chemical Admixtures for Concrete.
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete.
ASTM D1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.

Drawing No.	Drawing Name/Title
U223-07-01	Cover Sheet
U223-07-02	Roadworks 1
U223-07-03	Roadworks 2
U223-07-04	Existing Concrete Sidewalk & Retaining Wall 1 of 2
U223-07-05	Existing Concrete Sidewalk & Retaining Wall 2 of 2
U223-07-06	Proposed Concrete Sidewalk & Retaining Wall 1 of 2
U223-07-07	Proposed Concrete Sidewalk & Retaining Wall 2 of 2
U223-07-08	Southbound Sidewalk Retaining Wall & Pedestrian Handrail Layout
U223-07-09	Northbound Sidewalk Retaining Wall & Pedestrian Handrail Layout
U223-07-10	Concrete Sidewalk & Retaining Wall Details
U223-07-11	Pedestrian Handrail Details
U223-07-12	Reinforcing Steel Schedule

E2. DETAILED TRAFFIC CONTROL

E2.1 Description

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

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

E2.2 Notification

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

E2.3 Construction Methods

E2.3.1 General

(a) The Contractor will be responsible for pedestrian and traffic control at the Site acceptable to the Contract Administrator.

(b) For traffic control in the immediate Work area, the Contractor shall erect and maintain all applicable traffic control devices in accordance with the provision contained in the latest edition of the “Manual of Temporary Traffic Control in Work Areas on City Streets,” issued by the City of Winnipeg.

(c) The Contractor shall provide and maintain flagmen in accordance with the above-mentioned manual.

(d) The Contractor shall take all other safety measures necessary to cope with any peculiar or unusual circumstances that have not been set out in the above-mentioned manual and shall, at all times, ensure that maximum protection is afforded to the road-user and that his operations in no way interfere with the safe operation of traffic.

(e) Improper signing will be sufficient reason for the Contract Administrator or Inspector to immediately shut down the entire job.

(f) Barricades supplied and installed by the Contractor and the telephone number(s) at which he can be reached twenty-four (24) hours per day, seven (7) days per week.

(g) During the hours when the Contractor is not working, equipment and stockpiled materials shall be left in such a location so as not to interfere with or present a hazard to motorists or pedestrians.

E2.3.2 Specific

(a) Close the underpass lanes in two phases; Phase 1 - the shoulder lane and sidewalk on one side and Phase 2 - the shoulder lane and sidewalk on the other side.

(b) Maintain one sidewalk safely open at all times.

(c) Maintain one traffic lane of minimum 3.4 m wide in each direction at all times.

E2.4 Measurement and Payment

(a) Traffic and pedestrian control will not be measured. This item of Work will be paid for at the Contract Lump Sump Price for “Traffic and Pedestrian Control” performed in accordance with this Specification and accepted by the Contract Administrator.

E3. STRUCTURAL CONCRETE AND OTHER REMOVALS

E3.1 Description

(a) This Specification shall cover all operations related to removal of existing roadway asphalt 300 mm wide along the face of the retaining walls, steel sidewalk guardrail, and concrete

retaining wall and sidewalk. It also includes excavation for the new retaining wall and sidewalk.

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

E3.2 Materials

E3.2.1 General

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

E3.2.2 Excavation

(a) Excavated material shall be unclassified excavation and shall include the excavation and satisfactory disposal of all surplus earth, gravel, sandstone, loose detached rock, shale, cemented gravel or hard pan, disintegrated stone, rock in ledge or mass formation, and dry or all other material of whatever character that may be encountered.

E3.3 Construction Methods

E3.3.1 General

(a) The Work comprises of:

(i) The removal and disposal of all existing asphalt on the roadway in a strip along the retaining wall.

(ii) The removal and disposal of all designated concrete, including the existing sidewalk retaining wall and sidewalk and steel pedestrian guardrail.

(iii) The excavation of material of whatever nature, to the limits shown on the Drawings for the sidewalk retaining walls.

(iv) The off-site disposal of surplus and unsuitable material.

E3.4 Measurement and Payment

(a) Structural concrete and other removals will not be measured. This item of work will be paid for at the Contract Lump Sum Price for “Structural Concrete and Other Removals” performed in accordance with this Specification and accepted by the Contract Administrator.

E4. SUPPLYING AND PLACING REINFORCING STEEL

E4.1 Description

(a) This Specification covers the supply, fabrication, and placement of all reinforcing steel.

(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 supply, safe storage, and handling of all materials set forth in this Specification.

E4.2.2 Handling and Storage of Materials

(a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the latest edition of CSA Standard CAN3-A23.1, Storage of Materials, except as otherwise specified herein.

E4.2.3 Reinforcing Steel

(a) Unless otherwise indicated on the Drawings, all reinforcing steel shall be hot-dip galvanized after fabrication in accordance with CSA Standard G164 to a minimum retention of 600 g/m^2. The galvanizer shall safeguard against hydrogen embrittlement using recommended practices from applicable standards. Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.

(b) All reinforcing steel shall conform to the requirements of CSA Standard G30.18, Grade 400W, Billet-Steel Bars for concrete reinforcement. If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete works exhibits flaws in manufacture or fabrication, such material shall be immediately removed from the Site and replaced with acceptable reinforcing steel.

(c) All galvanized reinforcing steel shall be straight and free from paint, oil, mill-scale, and injurious defects. Surface seams or surface irregularities will not be cause for rejection, provided that the minimum dimensions, cross section area, and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA Standard G30.18.

E4.2.4 Field-Applied Galvanizing

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

E4.2.5 Bar Accessories

(a) Bar accessories shall be of a type approved by the Contract Administrator and shall be non-rusting. They shall be made from Type 316 stainless steel or hot-dip galvanized steel, or, in the case of chairs, from High Performance Concrete (HPC). An approved HPC rebar support is supplied by Con Sys Inc. of Pinawa, Manitoba, phone: 753-2404, fax: 753-8329. They shall not stain, blemish, or spall the concreted surface for the life of the concrete.

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

E4.2.6 Bonding Agent

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

(b) Bonding agents for bonding reinforcing steel into holes in hardened concrete other than epoxy resin may be permitted provided that they develop a minimum pullout resistance of 50 kN within 48 hours after installation. Alternative bonding agents are listed in the approved products list.

E4.3 Construction Methods

E4.3.1 Fabrication of Reinforcing Steel

(a) Fabricate reinforcing steel in accordance with CSA Standard G30.18 to the lengths and shapes as shown on the Drawings.

E4.3.2 Placing of Reinforcing Steel

(a) Place reinforcing steel accurately in the positions shown on the Drawings and retain in such positions by means of a sufficient number of bar accessories so that the bars shall not be moved out of alignment during or after the depositing of concrete. The Contract Administrator's decision in this matter shall be final.

(b) Reinforcing steel shall be free of all foreign material in order to ensure a positive bond between the concrete and steel. Remove any dry concrete, which may have been deposited on the steel from previous concrete placement, before additional concrete may be placed. Intersecting bars shall be tied positively at each intersection.

(c) Make splices in reinforcing steel only where indicated on the Drawings. Obtain prior approval of the Contract Administrator where other splices must be made. Welded splices shall conform to CSA Standard W186, and are subject to prior written approval of the Contract Administrator.

(d) Reinforcing steel shall not be straightened or rebent in a manner that will injure the metal. Bars with bends not shown on the Drawings shall not be used. Heating of reinforcing steel will not be permitted without the prior approval of the Contract Administrator. Give a minimum of twenty-four (24) hours' advance notice to the Contract Administrator prior to the placing of any concrete to allow for inspection of the reinforcement.

(e) All field cut ends of galvanized steel and damaged galvanizing shall have one coat of a field-applied galvanizing coating applied.

E4.3.3 Existing Reinforcing Steel Electrical Isolation

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

E4.3.4 Installing Reinforcing Steel into Hardened Concrete

(a) If shown on the Drawings, the Contractor shall drill holes into adjacent slabs for dowels and tie bars of the diameters and depths shown on the Standard Details. Drill bits shall have a diameter no larger than 2 mm larger than the nominal dowel or tie bar diameter.

(b) Holes shall be located to the correct depth and alignment as indicated on the Drawings.

(c) Drilling equipment shall be operated so as to ensure that no damage to the pavement results from such drilling operation. Coring of holes is not permitted. In the event that existing reinforcing steel bars are hit during the drilling operations, that hole shall be abandoned and a new hole shall be drilled nearby to the correct depth. All abandoned holes shall be filled with non-shrink grout.

(d) Holes for reinforcing steel shall be blown clean with compressed air. Bonding agent shall be placed in the back of the drilled hole. The reinforcing steel shall be worked back into the holes for complete coverage around the portion of the bar that extends into the hole, such that bonding agent is squeezed from the hole.

(e) Once all reinforcing steel is in position, it shall be inspected and approved by the Contract Administrator before any new concrete is placed. Otherwise, the concrete may be rejected by the Contract Administrator and shall be removed by the Contractor at his own expense.

E4.4 Quality Control/Quality Assurance

E4.4.1 Inspection

(a) After all concrete reinforcement 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.

E4.4.2 Access

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

E4.4.3 Quality Testing

(a) Quality control testing will be used to determine the acceptability of the reinforcing steel supplied by the Contractor.

(b) The Contractor shall provide, without charge, the samples of reinforcing steel required for quality control tests and provide such assistance and use of tools and construction equipment, as is required.

E4.5 Method of Measurement

E4.5.1 Supplying and Placing Reinforcing Steel

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

E4.6 Basis of Payment

E4.6.1 Supplying and Placing Reinforcing Steel

(a) The supplying and placing of reinforcing steel shall be paid for at the Contract Unit Price per kilogram for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

Items of Work: Supply and Place Reinforcing Steel

(i) Hot-Dip Galvanized

(ii) Plain

E5. STRUCTURAL CONCRETE

E5.1 Description

(a) This Specification shall cover the preparation of portland cement concrete for, and all concreting operations related to, the construction of Portland Cement Concrete Works as specified herein.

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

E5.2 Submittals

(a) Concrete mix design(s) that meets the minimum performance criteria for the various types of concretes as shown on the Drawings and described in Clause 5.3.22 "Concrete" of this Specification. The concrete mix design shall be sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba. Any changes to the concrete mix design(s) shall be reviewed by the Contract Administrator prior to the Contractor implementing the change.

The concrete mix design(s) for the required type(s) of concrete shall specify 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.

(viii) Quantity of other admixtures.

The concrete mix shall be designed for a minimum compressive strength of 20% above the nominal 28 day compressive strength specified in Clause 5.3.22 “Concrete” of this Specification. The intended method of placement shall be taken into consideration in the development of the concrete mix design as concrete to be pumped must be designed accordingly.

Any change in the constituent materials of the concrete shall require a new concrete mix design. If, during the progress of the Work, the mix design is found to be unsatisfactory for any reason, including poor workability, the Contract Administrator may require the Contractor to make the necessary adjustments.

(b) The Contractor shall also submit test data showing that the concrete supplied will meet the performance criteria stated in this Specification for each concrete type. At a minimum, the test data shall prove that the minimum compressive strength, flexural strength (Fibre Reinforced Concrete only), air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. All tests shall be based on the concrete samples taken from the point of discharge into the form work. For example, at the concrete chute from the delivery truck if being placed by buggies, or at the end of the pump should the Contractor wish to pump the concrete into place.

(c) Notification of Ready Mix Supplier

The Contractor shall advise the Contract Administrator of the qualified Ready Mix Concrete Supplier that he is proposing to use at least 21 days prior to placing concrete. The Contract Administrator will verify the acceptability of the Supplier and the concrete mix design requirements. Acceptance of the Supplier and the concrete mix design(s) by the Contract Administrator does not relieve or reduce the responsibility of the Contractor or Supplier from the requirements of this Specification.

(d) Detailed design calculations and Shop Drawings for any temporary works, including falsework and form work, that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba. **Shop Drawings are to be submitted to the Contract Administrator prior to the Contractor proceeding with the Work.**

For timber formwork and falsework, the Shop Drawings shall specify the type and grade of lumber and show the size and spacing of all members. The Shop Drawings shall also show the type, size and spacing of all ties or other hardware, and the type, size and spacing of all bracing.

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

(f) Copies of all material quality control test results.

E5.3 Materials

E5.3.1 General

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

E5.3.2 Handling and Storage of Materials

(a) All materials shall be handled and stored in a careful and workmanship like manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA-A23.1.

E5.3.3 Testing

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

(b) All materials shall conform to CSA Standard CAN/CSA-A23.1.

(c) All testing of materials shall conform to CSA Standard CAN/CSA-A23.2.

(d) All materials shall be accepted by the Contract Administrator at least twenty-one (21) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

E5.3.4 Bonding Agents

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

E5.3.5 Curing Compound

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

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

E5.3.6 Flexible Joint Sealant

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

E5.3.7 Form Coating

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

E5.3.8 Fibre Joint Filler

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

E5.3.9 Patching Mortar

(a) The patching mortar shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be

omitted and the mortar shall consist of not more than l part cement to 2 parts sand by damp loose volume. White Portland Cement shall be substituted for a part of the grey Portland Cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling or placing.

E5.3.10 Formwork

(a) Formwork materials shall conform to CSA Standard CAN/CSA-A23.1, and American Concrete Publication SP:4, “Formwork for Concrete.”

(b) No "stay-in-place" formwork or falsework is permitted.

(c) Form sheeting plywood to be covered with form liner or to be directly in contact with soil shall be exterior Douglas Fir, concrete form grade, conforming to CSA Standard O121-M1978, a minimum of 20 mm thick.

(d) Where form liner is not being used, form sheeting shall be Douglas Fir, overlay form liner type conforming to CSA Standard O121-M1978. Approved manufacturers are "Evans" and "C-Z".

(e) Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.

(f) No formwork accessories will be allowed to be left in place within 50 mm of the surface following form removal. Items to be left in place, must be made from a non-rusting material or galvanized steel; and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.

(g) Forms for exposed surfaces that do not require a form liner may be either new plywood or steel as authorized by the Contract Administrator.

(h) Studding shall be spruce or pine and shall have such dimensions and spacing that they shall withstand without distortion, all the forces to which the forms will be subjected.

(i) Walers shall be spruce or pine, with minimum dimensions of 100 mm x 150 mm. Studding shall be spruce or pine, with minimum dimensions of 50 x 150.

(j) Stay-in-place forms are not acceptable and will not be accepted unless shown on the Drawings.

(k) All forms are incidental to these Works and must be removed by the Contractor once adequate strength and curing of the concrete has been achieved.

E5.3.11 Permeable Formwork Liner

(a) Form Liner shall be “Drainform,” “Hyroform,” or equal as accepted by the Contract Administrator. This form liner shall be used on all exposed formed surfaces, except soffit surfaces, or where a normal form finish is specified.

(b) Paper-lined forms shall be used on all soffit surfaces.

E5.3.12 Galvanized Dowels and Expansion Sleeves

(a) Dowels and expansion sleeves shall be fabricated in accordance with CSA Standard CAN/CSA-G30.18.

(b) The dowels shall be plain 25 mm diameter bars, 550 mm in length, and shall be epoxy-coated or galvanized.

(c) The expansion sleeves shall be 1.6 mm gauge, 32 mm in outer diameter, 300 mm in length, and shall be galvanized in accordance with CSA Standard G164, to a retention of 600 g/m^2.

E5.3.13 Epoxy Adhesive

(a) Where epoxy adhesive for concrete to concrete and to steel is used, it shall be Sternson ST432 or ST433, Dural Duralbond, Capper Capbond E, Sikadur 32 Hi-bond, Concressive 1001 LPL, Meadows Rezi-Weld 1000, or equal as accepted by the Contract Administrator.

E5.3.14 Non-Shrink Cementitous Grout

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

E5.3.15 Epoxy Grout

(a) Where epoxy grout is used, it shall be Sternson Talygrout 100, Sika Sikadur 42, CPD Epoxy Grout by Specialty Construction Products, Meadows Rezi-Weld EG-96, or equal as accepted by the Contract Administrator.

E5.3.16 Backup Rod

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

E5.3.17 Low Density Styrofoam

(a) Low density styrofoam shall be the type specified on the Drawings or as accepted by the Contract Administrator.

E5.3.18 Precompressed Foam Joint Filler

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

E5.3.19 Pedestrian Handrail Anchor Units

(a) Pedestrian handrail anchor units shall be hot-dip galvanized. They shall be comprised of a Grade 300W steel template with 4-Grade 307 bolts, nuts, and washers.

E5.3.20 Concrete Surface Retarder

(a) Concrete surface retarder shall be used on all surfaces indicated as “exposed aggregate” on the drawings. Concrete surface retarder shall achieve 6 to 10 mm depth of exposed aggregate. Approved products are “MBT EAC-S 50/50 Blend,” by BASF.

E5.3.21 Miscellaneous Materials

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

E5.3.22 Concrete

(a) Concrete

(i) Concrete Materials susceptible to frost damage shall be protected from freezing.

(ii) Concrete shall have nominal compressive strengths (f'c) and meet the requirements for hardened concrete as specified in the following Table.

Type of Concrete	Nominal Compressive Strength at 28 Days [MPa]	Class of Exposure	Air Content Category	Post-Cracking Residual Strength Index	Special Requirements
Structural Concrete	35	C-1	1		
Exposed Aggregate Concrete	32	C-2			-Use exposed aggregate concrete mix. -Apply surface retarder

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

(b) Aggregates

(iv) General

All aggregates shall be handled to prevent segregation and inclusion of any foreign substances, and to obtain uniformity of materials. The two sizes of coarse and fine aggregates, and aggregates secured from different sources, shall be piled in separate stockpiles. The site of the stockpiles shall be cleaned of all foreign materials and shall be reasonably level and firm or on a built up platform. If the aggregates are placed directly on the ground, material shall not be removed from the stockpile within 150 mm of the ground level. This material shall remain undisturbed to avoid contaminating the aggregate being used with the ground material.

The potential for deleterious alkali-aggregate reactivity shall be assessed in accordance with CSA A23.2-27A. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA A23.2-14A or CSA A23.2-25A is required.

Petrographic analysis when performed shall be in accordance with MTO (Ministry of Transportation Ontario) Lab Test Method LS 609. The (weighted) petrographic number shall not exceed 130.

(v) Coarse Aggregate

The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CSA A23.1, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 1% shall pass a 75 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 percent.

The aggregate retained on the 5 mm sieve shall consist of clean, hard, tough, durable, angular particles with a rough surface texture, and shall be free from organic material, adherent coatings of clay, clay balls, an excess of thin particles or any other extraneous material.

Course aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than 30%.

When the thickness of deck overlay concrete is specified as 50 mm or less, the nominal maximum top size of aggregate shall be 12 mm.

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

(vi) Fine Aggregate

Fine aggregate shall meet the grading requirements of CSA A23.1, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75 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.

Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1, Table 12.

(c) Admixtures

(i) Air-entraining admixtures shall conform to the requirements of ASTM C260.

(ii) Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.

(iii) All admixtures shall be compatible with all other constituents. The addition of calcium chloride, accelerators and air-reducing agents, will not be permitted, unless otherwise approved by the Contract Administrator.

(d) Cementitious Materials

(i) Cementitious materials shall conform to the requirements of CAN/CSA-A3001 and shall be free from lumps.

(ii) Should the Contractor choose to include a silica fume admixture in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of cement.

(iii) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class CI and the substitution shall not exceed 25% by mass of cement.

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

(e) Water

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

(f) Synthetic Fibres

(i) The synthetic fibres for bridge deck and bridge barrier concrete, only, shall consist of 100% virgin polypropylene as supplied by Grace (Microfibre) or Master Builders (Fibre Mesh MD), or equal as accepted by the Contract Administrator. The dosage shall be designed by the Contractor to meet the requirements for post-cracking residual strength and fibre dispersion in accordance to the Canadian Highway Bridge Design Code, CAN/CSA-S6, Section 16, Fibre-Reinforced Structures, Clause 16.6.

E5.4 Equipment

E5.4.1 General

(a) All equipment shall be of a type accepted by the Contract Administrator. The equipment shall be in good working order, kept free from hardened concrete or foreign materials, and shall be cleaned at frequent intervals.

(b) The Contractor shall have sufficient standby equipment available on short notice at all times.

E5.4.2 Vibrators

(a) The Contractor shall have sufficient numbers of internal concrete vibrators and experienced operators on site to properly consolidate all concrete in accordance with ACI 309. The type and size of vibrators shall be appropriate for the particular application, the size of the pour, and the amount of reinforcing and shall conform to standard construction procedures.

(b) The Contractor shall use rubber coated vibrators for consolidating concrete containing epoxy-coated reinforcing steel.

(c) The Contractor shall have standby vibrators available at all times during the pour.

E5.4.3 Miscellaneous Equipment

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

E5.5 Construction Methods

E5.5.1 Scope of Work

(a) It is intended that this Specification cover the construction of the following items, as indicated on the Drawings:

(i) Sidewalk retaining walls.

(ii) Structural reinforced sidewalk.

(b) Replacement of existing curb and plain sidewalk are covered by the applicable standard City of Winnipeg specifications.

E5.5.2 Supplying Concrete

(a) Proportions of Concrete Materials

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

(ii) The Contractor shall ensure that all scaling devices have been calibrated within one year. They shall be tested and approved for accuracy prior to the commencement of batching operations. Scaling devices shall be subject to testing by the Contract Administrator at any time. The standard masses used for the testing of scaling devices shall be supplied to the Contract Administrator upon request. No adjustments to scaling devices shall be made without the Contract Administrator's approval.

(b) Mixing Concrete

(i) General

Ready-mix concrete shall be mixed and delivered by one of the following operations:

(1) Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in a truck agitator or in a truck mixer operating at agitating speed, or

(2) Mixed completely in a truck mixer.

Continuous mixers used in conjunction with volumetric proportioning will not be approved. Concrete shall not be mixed and delivered without first obtaining the approval of the Contract Administrator.

(ii) Stationary Mixer

The mixing of concrete shall be done in a batch mixer of a size and type approved by the Contract Administrator. Mobile continuous mixers or other such concrete supply equipment will not be approved for use.

Each mixer and agitator shall have attached by the Manufacturer in a prominent place, a metal plate or plates on which it is plainly marked the various uses for which the equipment is designed, the capacity of the drum or container in terms of the volume of concrete that can be mixed or agitated and the speed of rotation of the mixing drum or blades.

All concrete shall be mixed thoroughly until it is uniform in appearance, with all ingredients uniformly distributed. In no case shall the mixing time per batch be less than one minute for mixers of one cubic metre capacity or less. The “batch” is considered as the quantity of concrete inside the mixer. This figure shall be increased by 15 seconds for each additional half cubic metre capacity or part thereof. The mixing period shall be measured from the time all materials are in the mixer drum.

Stationary mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed.

Batches shall be used that do not require fractional bags of cement.

Each batch shall be entirely discharged from the mixer before any of the ingredients for a following batch shall be placed in the drum of the mixer.

All water used for cleaning the inside of the drum of the mixer shall be entirely drained before ingredients for a batch of concrete shall be placed in the drum.

The Contractor shall in no case load the mixer above its rated capacity. The Contractor shall maintain the mixer in good condition. Inner surfaces of the mixer shall be kept free of hardened concrete and mortar. Mixer blades that are bent or worn down so as to affect the mixing efficiency shall be repaired. Any mixer leaking mortar or causing waste of materials through faulty charging shall be taken out of service until repaired. The Contractor shall, at all times, operate the mixer at the speed recommended by the Manufacturer and shall, if requested, supply the Manufacturer's certification of the mixing capacity of the machine in use.

The mixer shall be fitted with an accurate and dependable means for measuring the water added that is not affected by variation in pressure in the water supply line. All joints, valves and other parts shall be maintained so that there is no leakage of water into the mixer drum. Failure of the Contractor to have an accurately working and dependable water gauge on a mixer shall be cause for the Contract Administrator to prohibit the mixer to be used.

Water shall be released first and continue to flow while the solid materials are entering the mixer. The water discharge pipe shall be so arranged and be of such size that the flow into the mixer is completed within the first quarter of the mixing time, and the water is delivered well within the mixer where it will be quickly mixed with the entire batch.

Air entraining agents and admixtures shall be placed in the mixer after the initial water is in the mixer drum but before the remaining materials are added. Superplasticizer shall be added after initial mixing and as per the Manufacturer’s recommendation.

A record of the actual proportions used for each batch shall be kept by the Contractor and a copy of this record shall be submitted to the Contract Administrator after each pour.

The Contract Administrator may, from time to time, make slump tests of individual batches in order to determine the uniformity of the concrete consistency at approximately one-quarter and three-quarter points of the load. If these tests indicate a variation in the slump exceeding 50 mm, the mixer or agitator shall not be used until the condition is corrected.

(iii) Truck Mixing

Truck mixers, unless otherwise approved by the Contract Administrator, shall be of the revolving drum type, watertight, and constructed so that the concrete can be mixed to ensure uniform distribution of materials throughout the mass. All materials for the concrete shall be accurately measured, and charged concurrently at the proportions that satisfy the approved mix design into the drum at the proportioning plant. Increases in water/cementitious ratio will not be permitted.

The maximum size of batch in truck mixers shall not exceed the maximum rated capacity of the mixer as stated by the Manufacturer and stamped in metal on the mixer. Truck mixing shall commence immediately upon introduction of ingredients into the drum and be continued for not less than 50 revolutions. The speed shall not be less than 4 revolutions per minute (rpm), nor more than a speed resulting in a peripheral velocity of the drum of 70 m per minute. Not more than 100 revolutions of mixing shall be at a speed in excess of 6 rpm.

When adjustment to the mix by adding water, air entrainment or superplasticizer at the Site is approved by the Contract Administrator, the mixer shall be run for a minimum of 20 additional revolutions to ensure homogeneity of the concrete before discharge.

Discharge chutes shall be kept clean and free from hardened concrete and shall be wetted down prior to use.

(c) Time of Hauling

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

(ii) Each batch of concrete delivered to the Site shall be accompanied by a time slip issued at the batching plant, bearing the time of **batching**. In hot or cold weather, or under conditions contributing to quick stiffening of the concrete, a time less than **120 and/or 90 minutes** may be specified by the Contract Administrator. The Contractor will be informed of this requirement 24 hours prior to the scheduled placing of concrete.

(iii) To avoid the reduction of delivery and discharge time in hot weather, the Contractor will be allowed to substitute crushed ice for a portion of the mixing water provided the specified water/cementitious ratio is maintained. All of the ice shall be melted completely before discharging any of the concrete at the delivery point.

(iv) Under no circumstances shall the Contract Administrator allow the Contractor to add retarders to the concrete mix without first obtaining the approval of the Contract Administrator.

(v) The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water.

(vi) A record of the actual proportions used for each concrete placement shall be kept by the Supplier and a copy of this record shall be submitted to the owner upon request.

(d) Delivery

(i) The Contractor shall satisfy himself that the Concrete Supplier has sufficient plant capacity and satisfactory transporting equipment to ensure continuous delivery at the rate required. The rate of delivery of concrete during concreting operations shall be such that the development of cold joints will not occur. The methods of delivering and handling the concrete shall facilitate placing with a minimum of rehandling, and without damage to the structure or the concrete.

(e) Placement Schedules

(i) The Contractor shall provide to the Contract Administrator the proposed placement schedule for all concrete placements. 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:

(1) Limit the amount to be placed at any time (using adequate construction joints), or

(2) Augment his facilities and Plant in order to complete the proposed placement, or

(3) In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting.

(ii) The Contractor shall adhere strictly to the concrete placement schedule, if shown on the Drawings or otherwise specified.

(f) Falsework and Formwork

(i) General

The Contractor shall construct the formwork and falsework in accordance with the submitted Shop Drawings. Variations from the formwork and falsework Shop Drawings will not be permitted unless the Contract Administrator is provided with revised Shop Drawings that have been sealed, signed and dated by the Professional Engineer.

(ii) Design

All forms shall be of wood, metal or other materials as approved by the Contract Administrator, and shall be designed and built mortar-tight. The forms shall be sufficiently rigid to prevent distortion due to the pressure of vibrated concrete and other loads incidental to the construction operations. The forms shall be substantial and unyielding, and shall be designed so that finished concrete will conform to the design dimensions and contours. The shape, strength, rigidity, watertightness and inner surface smoothness of re-used forms shall be maintained at all times. Any warped or bulged formwork shall be not be used. Forms that are deemed unsatisfactory by the Contract Administrator in any respect shall not be used.

All forms shall be oiled or otherwise treated to facilitate stripping.

The tying of forms with wires or welded ties or the driving of bolts or nails by hand or by power tools into exposed and finished concrete surfaces will not be permitted.

For narrow walls and columns, where the bottom of the form is inaccessible, or wherever necessary, removable panels shall be provided in the bottom form panel

to enable cleaning out of extraneous material immediately before placing the concrete.

The supporting of formwork on mudsills on the ground will not be permitted.

All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads without appreciable settlement or deformation.

Falsework shall be set to give the completed structure the camber specified on the Drawings, and allowance shall be made for dead load deflection and form crushing.

(g) Forms for Exposed Surfaces

(i) All form material for exposed surfaces shall be full-sized sheets in good condition, and approved by the Contract Administrator. The re-use of any forms shall be approved by the Contract Administrator.

(ii) All forms for exposed surfaces shall be mortar-tight, filleted at all sharp corners, and given a bevel or draft in the case of all projections. At the top edges of exposed surfaces, the chamfers are to be formed by chamfer strips. Where fillets have been omitted, the concrete shall be thoroughly worked into the corners of the forms and, upon removal of the forms, the sharp edges of the concrete shall be carefully rubbed down to a 6 mm radius. The form lumber for filleted corners shall be a hard grade lumber which will leave a sharp, straight edge.

(iii) Metal bolts or anchorages within the forms shall be so constructed as to permit their removal to a depth of at least 50 mm from the concrete surface. Break-back type form ties shall have all spacing washers removed and the tie shall be broken back a distance of at least 20 mm from the concrete surface. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest possible size. Torch cutting of steel hangers and ties will not be permitted. Formwork hangers for exterior surfaces of decks and curbs shall be an acceptable break-back type with surface cone, or removable threaded type. Cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in color.

(h) Architectural Concrete Finish Formwork Liner

(i) The Contractor shall supply and install the architectural concrete finish formwork liner as shown on the Drawings in accordance with the Manufacturer's recommended procedures.

(ii) The architectural concrete finish formwork liner shall be replaced after each use unless it is specifically allowed to be reused by the manufacturer.

E5.5.3 Permeable Formwork Liner

(a) Form liners shall be used on all exposed surfaces, except soffit surfaces, or where a normal form finish is specified.

(b) The supply and use of the plain form liner finish shall be considered incidental to the Works of this Specification, and no additional payment will be made.

(c) The form liner shall be used for only one (1) application.

E5.5.4 Placing Structural Concrete

(a) Equipment for mixing or conveying concrete shall be thoroughly flushed with clean water before and after each pour. Water used for this purpose shall be discharged outside the forms. Pumping of concrete will be allowed for all substructure concrete. All equipment and processes are subject to acceptance by the Contract Administrator.

(b) Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation and a marked change in consistency.

(c) Runways for concrete buggies and all pumping equipment shall be supported directly by the formwork and not on reinforcement.

(d) Before depositing any concrete, all debris shall be removed from the space to be occupied by the concrete, and any mortar splashed upon the reinforcement or forms shall be removed.

(e) Form liners shall be cooled immediately prior to placing concrete by spraying with cold water.

(f) 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.

(g) Concrete shall be placed as nearly as possible in its final position. Rakes or mechanical vibrators shall not be used to transport concrete.

(h) 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.

(i) All concrete, during and immediately after depositing, shall be consolidated by mechanical vibrators so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into the corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Mechanical vibrators shall have a minimum frequency of 7000 revolutions per minute immersed.

(j) Vibrators shall be inserted systematically into the concrete at intervals such that the zones of influence of the vibrator overlap (generally 300 to 900 mm). Apply the vibrator at any point until the concrete is sufficiently compacted (5 to 15 seconds), but not long enough for segregation to occur. Spare vibrators in good working condition shall be kept on the job site during all placing operations.

(k) Concrete shall not be placed during rain or snow unless adequate protection is provided for formwork and concrete surfaces.

(l) After verification that the surface meets acceptable limits and after final floating, the top surface shall be given Type 2 Finish – Unformed Surfaces.

E5.5.5 Placing Exposed Aggregate Concrete

(a) Place exposed aggregate concrete and use concrete surface retarder according to manufactures recommended procedures. Depth of exposed aggregate shall be 6 to 10 mm.

E5.5.6 General Curing

(a) Refer to Clause E5.5.10 (Hot Weather Concreting) for hot weather curing requirements.

(b) The use of curing compound will not be allowed on concrete areas that are to receive additional concrete or waterproofing.

(c) Unformed concrete surfaces shall be covered and kept moist by means of wet polyester blankets for seven (7) consecutive days immediately following finishing operations or otherwise approved by the Contract Administrator and shall be maintained at above 10^{o}C for at least seven (7) consecutive days. Construction joints

shall only be covered and kept saturated by means of wet polyester curing blankets for the curing period.

(d) Unformed surfaces shall have curing compound applied immediately after the wet curing period.

(e) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, or running water, vibration, and mechanical shock. Concrete shall be protected from freezing until at least twenty-four hours after the end of the curing period.

(f) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3° in any one hour period or 20° in any twenty-four hour period.

(g) Care shall be exercised to ensure that the polyester curing blanket is well drained and that it is placed as soon as the surface will support it without deformation. The Contractor shall ensure that water from the polyester curing blankets does not run into areas where concrete placement and finishing operations are underway. If this occurs, concrete placement shall stop until the problem is corrected satisfactory to the Contract Administrator.

E5.5.7 Form Removal

(a) All forms shall remain in place for a minimum of seven (7) days. The Contract Administrator must be notified at least 24 hours prior to any form removal. The Contractor must receive approval from the Contract Administrator prior to beginning Work.

(b) The minimum strength of concrete in place for safe removal of soffit forms for horizontal or inclined members, as well as vertical forms shall be 20 MPa, with the added provisions that the member shall be of sufficient strength to carry safely its own weight, together with superimposed construction loads, and that the forms shall stay in place a minimum of three days unless otherwise approved by the Contract Administrator.

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

E5.5.8 Patching of Formed Surfaces

(a) Immediately after forms have been removed, but before any repairing or surface finishing is started, the concrete surface shall be inspected by the Contract Administrator. Any repair or surface finishing started before this inspection may be rejected and required to be removed.

(b) All formed concrete surfaces shall have bolts, ties, struts, and all other timber or metal parts not specifically required for construction purposes cut back fifty (50) mm from the surface before patching.

(c) Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter, and voids left by strutting, and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched and then applying patching mortar. A slurry grout consisting of water and cement, shall be thoroughly brushed onto the area to be patched. When the slurry grout begins to lose the water sheen, the patching mortar shall be applied. It shall be struck-off slightly higher than the adjacent surface and left for one hour before final finishing to permit initial shrinkage of the patching mortar and it shall be touched up until it is satisfactory to the Contract Administrator. The patch shall be cured as specified in this Specification, and the final colour shall match the surrounding concrete.

(d) All objectionable fins, projections, offsets, streaks, or other surface imperfections shall be removed by approved means to the Contract Administrator's satisfaction. Cement washes of any kind shall not be used.

(e) Concrete shall be cast against forms that will produce plane surfaces with no bulges, indentations, or protuberances other than those shown on the Drawings. The arrangement of panel joints shall be kept to a minimum. Panels containing worn

edges, patches, or other defects that will impair the texture of concrete surfaces shall not be used. All fins on the concrete surfaces shall be removed.

E5.5.9 Cold Weather Concreting

(a) The requirements of this section shall be applied to all concreting operations during cold weather; i.e., if the mean daily temperature falls below 5°C during placing or curing.

(b) The Contract Administrator will advise the Contractor, in writing, as to the degree of heating of water and aggregates.

(c) Supplementary equipment, as required below, shall be at the job site if concrete is likely to be placed in cold weather.

(d) Formwork and reinforcing steel shall be heated to at least 5°C before concrete is placed.

(e) The temperature of the concrete shall be maintained at not less than 10°C for seven days or 15°C for five days or 20°C for three days after placing. The concrete shall be kept above freezing temperature for at least a period of seven days. In no case shall the heating be removed until the concrete has reached a minimum compressive strength, which will be specified by the Contract Administrator for Work under construction, and as determined from compressive strength tests for specimens secured under the same conditions as the concrete works in question.

(f) Aggregates shall be heated to a temperature of not less than 20°C and not more than 65°C. Water shall be heated to a temperature between 55°C and 65°C. The temperature of the concrete at the time of placement shall be within the range specified in CSA Standard CAN/CSA-A23.1 for the thickness of the section being placed.

(g) When the mean daily temperature may fall below 5°C, a complete hoarding of the Work, together with supplementary heat, shall be provided.

(h) When the ambient temperature is below -15°C, the hoarding shall be constructed so as to allow the concrete to be placed without the hoarding having to be opened. If the mixing is done outside of the hoarding, the concrete shall be placed by means of hoppers installed through the hoarding. The hoppers are to be plugged when not in use.

(i) When the ambient temperature is equal to or above -15°C, the Contractor will be permitted to open small portions of the hoarding for a limited time to facilitate the placing of the concrete.

(j) Before depositing any of the concrete, the Contractor shall show that enough heating equipment is available to keep the air temperature surrounding the forms within the specified range. This shall be accomplished by bringing the temperature inside of the hoarding to the specified 20°C, at least 12 hours prior to the start of the concrete placing.

(k) The Contractor shall supply all required heating apparatus and the necessary fuel. When dry heat is used, a means of maintaining atmospheric moisture shall be provided. The relative humidity within the heated enclosure shall be maintained at a minimum of 40 percent during concrete placing and finishing operations. Surface moisture evaporation rates shall not exceed the limits specified in E5.5.10(b) (Hot Weather Concreting). Following finishing operations, exposed concrete surfaces shall be protected from excessive drying by applying curing compound, covering the surfaces with polyethylene, or providing water curing.

(l) Sufficient standby heating equipment must be available to allow for any sudden drop in outside temperatures and any breakdowns which may occur in the equipment.

(m) Combustion-type heaters may be used if their exhaust gases are vented outside the enclosures and not allowed to come into contact with concrete surfaces. Fire extinguishers must be readily at hand wherever combustion-type heaters are used.

(n) The Contractor shall keep a curing record of each concrete pour. The curing record shall include: date and location of the pour, mean daily temperature, hoarding relative humidity, temperatures above and below the concrete surface at several points, and notes regarding the type of heating, enclosure, unusual weather conditions, etc. This record shall be available for inspection by the Contract Administrator at the end of the concrete operations.

E5.5.10 Hot Weather Concreting

(a) General

(i) The requirements of this section shall be applied during hot weather; i.e. air temperatures above 25°C during placing.

(ii) Concrete shall be placed at as low a temperature as possible, preferably below 15°C, but not above 22°C. Aggregate stockpiles may be cooled by water sprays and sunshades.

(iii) Ice may be substituted for a portion of the mixing water, providing it has melted by the time mixing is completed.

(iv) Form and conveying equipment shall be kept as cool as possible before concreting, by shading them from the sun, painting their surfaces white, and/or the use of water sprays.

(v) Sunshades and wind breaks shall be used as required during placing and finishing.

(vi) Work shall be planned so that concrete can be placed as quickly as possible to avoid “cold joints.”

(vii) The Contract Administrator's approval is necessary before the Contractor may use admixtures, such as retardants, to delay setting or water-reducing agents to maintain workability and strength, and these must then appear in the Mix Design Statement submitted to the Contract Administrator.

(viii) Curing shall follow immediately after the finishing operations.

(b) Hot-Weather Curing

(i) When the air temperature is at or above 25°C, curing shall be accomplished by water spray or by using saturated absorptive fabric, in order to achieve cooling by evaporation. Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.

(c) Job Preparation

(i) When the air temperature is at or above 25°C, or when there is a probability of it’s rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, as defined in E5.6.8(b), the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by fogging and evaporation.

(d) Concrete Temperature

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

Thickness of Section (m)	**Temperatures, °C**	
	Minimum	Maximum
Less than 0.3	10	35
0.3 to 1.0	10	30
1.0 to 2.0	5	25

E5.5.11 Cleanup

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

E5.5.12 Protection From Drying

(a) Placement of deck concrete will not be permitted when the surface moisture evaporation exceeds 0.75 kg/m^2/h. Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator. The chart, Figure D.1, Annex D of CSA Standard CAN/CSA-A23.1 shall be used to estimate surface moisture evaporation rates.

E5.5.13 Installation of Dowels and Galvanized Expansion Sleeves in Barriers

(a) Dowels and galvanized expansion sleeves shall be installed across contraction joints exactly parallel to the direction of movement and each other.

(b) The galvanized sleeves shall be installed in the side of the joint which is cast first.

(c) The sleeves and dowels shall be positioned as shown on the Drawings and shall be held in place by positive and satisfactory means, such as a template, so that their correct position will be maintained after the concrete has been placed, vibrated, and finished. If sleeves and/or dowels are displaced during concrete placing operations, concrete placement shall cease and shall not resume until the displaced dowels and/or sleeves have been reset to the correct alignment.

E5.5.14 Pedestrian Handrail Anchor Units

(a) Install the pedestrian handrail where shown on the Drawings.

E5.6 Quality Control

E5.6.1 Inspection

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

E5.6.2 Access

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

E5.6.3 Materials

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

E5.6.4 Concrete Quality

(a) Quality control tests will be used to determine the acceptability of the concrete supplied by the Contractor.

(b) The Contractor shall provide, without charge, the samples of concrete and the constituent materials required for quality control tests and provide such assistance and use of tools and construction equipment as is required.

(c) The frequency and number of concrete quality control tests shall be in accordance with the requirements of CSA Standard CAN/CSA-A23.1.

(d) An outline of the quality tests is as follows:

(e) Slump tests shall be made in accordance with CSA Standard Test Method CAN/CSA-A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits specified in this Specification, a second test shall be made.

(f) In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.

(g) Air content determinations shall be made in accordance with CSA Standard Test Method CAN/CSA-A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits specified in this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.

(h) The air-void system shall be proven satisfactory by data from tests performed in accordance with CSA Test Method CAN/CSA A23.1-17C. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method CAN/CSA-A23.2-3C, shall be determined prior to the start of construction on cylinders of concrete made with he same materials, mix proportions, and mixing procedures as intended for the project. If deemed necessary by the Contract Administrator to further check the air-void system during construction, testing of cylinders may be from concrete as delivered to the job site and will be carried out by the Contract Administrator. The concrete will be considered to have a satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.

(i) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CAN/CSA-A23.2-1C, "Sampling Plastic Concrete".

(j) Test specimens shall be made and cured in accordance with CSA Standard Test Method CAN/CSA-A23.2-3C, "Making and Curing Concrete Compression and Flexure Test Specimens".

(k) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method CAN/CSA-A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the average of the strengths of the two specimens. A compressive strength test at seven (7) days shall be taken, the strength of which will be used only as a preliminary indication of the concrete strength, a strength test being the strength of a single standard cured specimen.

(l) Compressive strength tests on specimens cured under the same conditions as the concrete works shall be made to check the strength of the in-place concrete so as to determine if the concrete has reached the minimum allowable working compressive strength as specified in Clause SP:12.3.2 and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens will be taken to verify strength of the in-place concrete. For each field-cured strength test, the strength of a single field-cured test specimen shall be determined in accordance with CSA Standard Test Method CAN/CSA-A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

(m) Notwithstanding CSA A23.2, cores taken from deck must achieve the concrete design strength as a minimum.

E5.6.5 Corrective Action

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

E5.7 Method of Measurement

E5.7.1 Structural Concrete

(a) The supply and placement of structural concrete shall be measured on a volume basis for each type of structural concrete. The volume to be paid for shall be the total number of cubic metres of structural concrete of each type supplied and placed in accordance with this Specification and accepted by the Contract Administrator, as computed from Drawing dimensions. No deductions will be made for chamfers, reinforcing steel, structural steel, bolts, or voids of seventy-five (75) mm in diameter or less.

E5.7.2 Supply and Install Pedestrian Handrail Anchor Units

(a) The supply and installation of pedestrian handrail and BR1 post anchor units will be paid for on a Lump Sum basis, as accepted by the Contract Administrator, and no measurement will be made of this work.

E5.7.3 Epoxy-Coated Dowels and Galvanized Expansion Sleeves

(a) The supply and installation of epoxy-coated dowels and galvanized expansion sleeves structural retaining wall will be measured on a unit basis. The number of units to be paid for shall be the total number of epoxy-coated dowels and galvanized expansion sleeve units supplied and installed and accepted by the Contract Administrator.

E5.8 Basis of Payment

E5.8.1 Structural Concrete

(a) The supply and placement of structural concrete will be paid for at the Contract Unit Price per cubic metre for the “Items of Work,” listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

Items of Work:

Supply and Placement of Structural Concrete

ii) Retaining Wall
ii) Reinforced Sidewalk
iii) Exposed Aggregate Concrete Slab

E5.8.2 Supply and Install Pedestrian Handrail Anchor Units

(a) The supply and install of pedestrian handrail anchor units will be paid for at the Contract Lump Sum Price for “Supply and Install Pedestrian Handrail Anchor Units,” which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E5.8.3 Epoxy-Coated Dowels and Galvanized Expansion Sleeves

(a) The supply and installation of epoxy-coated dowels and galvanized expansion sleeves will be paid for at the Contract Unit Price per unit for “Epoxy-Coated Dowels and Galvanized Expansion Sleeves,” measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E6. BACKFILL

E6.1 Description

(a) This Specification shall cover all operations related to backfill work as herein specified.

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

E6.2 Materials

E6.2.1 General

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

E6.2.2 Suitable Site Backfill

(a) Suitable site backfill material shall be of a type approved by the Contract Administrator.

E6.2.3 Granular Backfill

(a) Granular backfill shall conform to the requirements of the City of Winnipeg Specification CW 3110-R10 for Sub-base material of maximum 50 mm size.

E6.2.4 Base Course Material

(a) Base course material shall be supplied in accordance with City of Winnipeg Specification CW 3110-R10 and may be either granular or crushed limestone.

E6.2.5 Subdrain Pipe

(a) Subdrain pipe shall be perforated or solid as indicated on the Drawing. It shall conform to the requirements of CSA B182.1 or B182.2. Approved products are PVC drain pipe, supplied by IPEX Inc. and Big “O”, as supplied by Arctec Ltd.

E6.2.6 Subdrain Granular Filter Material

(a) Subdrain pipe granular filter material shall consist of sound, hard crushed stone, free from organic material meeting the following gradation requirements:

Canadian Metric Sieve Size	Percent of Total Dry Weight Passing
25,000	100%
10,000	10% - 30%
5,000	0% - 5%

E6.3 Construction Methods

E6.3.1 General

(a) The Work shall comprise of supply and placement of:

(i) Granular backfill of the retaining walls and sidewalks.

(ii) Subdrains, complete with backfill.

(iii) Base course material directly under the sidewalks for a thickness of 75 mm and under the asphalt replacement strips.

(iv) Asphalt replacement in the strip next to the retaining walls.

E6.3.2 Place Backfill

Place backfill in horizontal layers to a minimum compaction of 100% of Standard Proctor Density.

E6.3.3 Asphalt

(a) Place the asphalt patch on the roadway in accordance with Standard Construction Specification CW 3410-R7.

E6.4 Method of Measurement

(a) Backfill shall be paid for on a Lump Sum basis, as accepted by the Contract Administrator, and no measurement will be made for this Work.

E6.5 Basis of Payment

(a) Backfill will be paid for at the Contract Lump Sum Price for "Backfill," which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification.

E7. GALVANIZED PEDESTRIAN HANDRAIL

E7.1 Description

(a) This Specification covers all operations related to the supply and installation of galvanized pedestrian handrail in accordance with this Specification 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 works as hereinafter specified.

E7.2 Materials

E7.2.1 Fabricators

(a) Fabricators must have extensive demonstrated experience in producing similar railings.

E7.2.2 Structural Steel

(a) Structural steel shall be in accordance with CSA G40.21 Grade 300W. Hollow structural sections shall be in accordance with CSA G40.20 to either Class C or Class H, Grade 350W.

E7.2.3 Fasteners

(a) Miscellaneous fasteners shall be in accordance with ASTM A276 Type 316 stainless steel. Fasteners for the pedestrian railing shall be flat head and countersunk where shown.

E7.2.4 Hot-Dip Galvanizing

(a) All structural steel under this Specification, except stainless steel items, shall be hot-dip galvanized.

(b) All hot-dip galvanizing shall be in accordance with CSA G164 for a minimum net retention of 600 g/m^2.

E7.2.5 Galvanizing Touch-up and Field-Applied Galvanizing

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

161 York Road, Kings Mountain, North Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

E7.3 Construction Methods

E7.3.1 Shop Drawings

(a) Shop drawings will be required of the Contractor's field measurements of the anchor bolt pattern and spacing. No other Shop Drawing information will be required.

(b) The field measurements made by the Contractor and approved by the Contract Administrator shall constitute the measurements used for the fabrication.

(c) The Contractor is advised that this is a metric project. All member sizes shall be shown in metric units (SI) on the Shop Drawings. Any Shop Drawings that do not conform with this requirement will be rejected.

E7.3.2 Fabrication

(a) All fabrication shall be carried out in accordance with this Specification, Contract Drawings, and approved Shop Drawings.

(b) The punching of identification marks on the members will not be allowed.

(c) Any damage to members during fabrication shall be drawn to the attention of the Contract Administrator in order that the Contract Administrator may approve remedial measures.

(d) Dimensions and fabrication details that control the field matching of parts shall receive very careful attention in order to avoid field adjustment.

(e) All portions of the Work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.

(f) Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.

(g) All holes shall be provided by drilling not burning. All holes shall be free of burrs and rough edges. All holes for field installation of fabricated items shall be countersunk to accept flat head fasteners. All welds shall be minimum 6 mm all around fillet welds unless noted otherwise on the Drawings. All welds, except hidden welds, shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

(h) All vertical and horizontal edges of fabricated items shall be ground to 6 mm radius.

E7.3.3 Welding

(a) Welding shall be in accordance with CSA W59, "Welded Steel Construction." All seams shall be continuously welded and free from any slag or splatter. All seam welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing or field galvanizing touch-up.

E7.3.4 Surface Preparation and Cleaning

(a) Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:6, "Commercial Blast Cleaning." All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

(b) The sandblasting and cleaning shall be done in the shop.

(c) After the fabricated materials have been sandblasted and cleaned, the Contract Administrator will carry out a visual inspection of the materials in the shop before they are shipped to the galvanizing plant.

E7.3.5 Hot-Dip Galvanizing

(a) The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association Inc. and certified to CSA G164.

(b) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facility shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.

(c) The galvanizing coating on the outside surfaces of all steel items shall be smooth and free of blisters, lumpiness, and runs.

(d) In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the steel items after hot-dip galvanizing will also be a criteria in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire item shall have a uniform “silver” colour and lustre. Galvanizing with parts of the item having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminium alloy. The metallizing shall be carried out in the shop before the item is installed.

(e) Minor defects in the galvanizing coating shall be repaired by field touch-up galvanizing in accordance with this Specification. The Contract Administrator shall be consulted before repairs are made. Use of cold applied spray-on galvanizing will not be permitted and will be cause for rejection.

(f) Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions, and ash inclusions shall be grounds for rejection of the galvanizing coating system.

(g) The Contractor shall verify the thickness of galvanized coatings as directed by the Contract Administrator.

(h) The steel items shall be stored on timber blocking after hot-dip galvanizing.

E7.3.6 Field-Applied Touch-up Galvanizing.

(a) Any areas of damaged galvanizing on miscellaneous steel items shall receive field-applied touch-up galvanizing.

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

E7.3.7 Installation

(a) The steel pedestrian handrail material shall be carefully handled so that no parts will be bent, broken, or otherwise damaged. Hammering, which will injure or distort the member, is not permitted. The Contractor shall report to the Contract Administrator any failure of members to come properly together before taking any corrective measures.

(b) Except where shown on the Drawings, field welding will not be permitted unless approved by the Contract Administrator. Field welding will be required for the angled wing panels as shown on the Drawings.

(c) Any shims used to level the base plates are to be hot-dip galvanized or stainless steel.

E7.4 Method of Measurement

E7.4.1 Supply of Galvanized Pedestrian Handrail Panels

(a) The supply of galvanized pedestrian handrail panels will be measured on a unit basis. The number of panels to be paid for shall be the total number of panels supplied of each type in accordance with this Specification and accepted by the Contract Administrator.

E7.4.2 Supply of Galvanized Pedestrian Handrail Posts

(a) The supply of galvanized pedestrian handrail posts will be measured on a unit basis. The number of posts to be paid for shall be the total number of posts supplied of each type in accordance with this Specification and accepted by the Contract Administrator.

E7.4.3 Installation of Galvanized Pedestrian Handrail

(a) The installation of galvanized pedestrian handrail will be measured on a linear metre basis. The length to be paid for shall be the total number of metres of pedestrian railing installed in accordance with this Specification and accepted by the Contract Administrator, as computed by measuring the in-place length from end post to end post.

E7.5 Basis of Payment

E7.5.1 Supply of Galvanized Pedestrian Handrail Panels

(a) The supply of galvanized pedestrian handrail panels will be paid for at the Contract Unit Price for the “Items of Work” listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work in this Specification.

Items of Work:

Supply Galvanized Pedestrian Handrail Panels

i) Type H1

E7.5.2 Supply of Galvanized Pedestrian Handrail Posts

(a) The supply of galvanized handrail posts will be paid for at the Contract Unit Price for the “Items of Work” listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

Items of Work:

Supply of Galvanized Pedestrian Handrail Posts

i) Type P1

ii) Type P2R

iii) Type P2L

E7.5.3 Installation of Galvanized Pedestrian Handrail

(a) The installation of galvanized pedestrian handrail will be paid for at the Contract Unit Price per metre for “Installation of Galvanized Pedestrian Handrail,” measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.