



THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 601-2005

KENASTON UNDERPASS PROJECT

**KENASTON BLVD. / CN RIVERS SUBDIVISION MILE 5.18
RAILWAY BRIDGE CONSTRUCTION**



Certificate of Authorization

Stantec Consulting Ltd.

No. 1301 Expiry: April 30, 2006

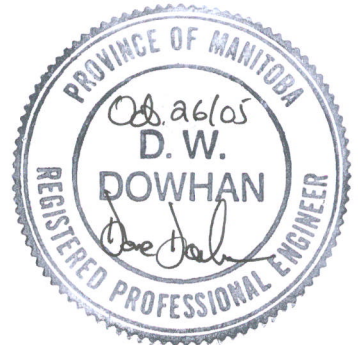


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PART B - BIDDING PROCEDURES

B1. PROJECT TITLE

B1.1 KENATON UNDERPASS BRIDGE CONSTRUCTION

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, November 15, 2005.

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

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

B3. SITE INVESTIGATION

B3.1 Refer to GC:3.1.

B3.2 The Bidder is advised that prior to anyone entering the Site area CN shall be contacted in accordance to Section D22 and the Contractor Orientation Course CN Safety shall be successfully completed. As well all persons shall have on their personnel the Contractor Orientation Course card indicating successful completion and shall fix the supplied sticker, upon successful completion of the safety course, to their hardhat. All items outlined within this training shall be strictly followed during both the Bidding period and construction. The Contractor Orientation Course CN Safety should only take approximately 1 hour to complete. For further information on the safety course contact CN at (719) 647-0337.

B3.3 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B3.1 Further to GC:3.1, the Bidder may view the Site without making an appointment provided CN has been contacted.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D4.1.

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

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

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

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

B5. ADDENDA

- B5.1 The Contract Administrator may, at any time prior to the Submission Deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.
- B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.
- B5.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.
- B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet site for addenda shortly before submitting his Bid.
- B5.3 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.

B6. SUBSTITUTES

- B6.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.
- B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.
- B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.
- B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:
- (a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;
 - (b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;
 - (c) identify any anticipated cost or time savings that may be associated with the substitute;
 - (d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equivalent 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, and shall not affect the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;
 - (e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.
- B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an "approved equal" or as an "approved alternative", or may refuse to grant approval of the substitute.

- B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.
- B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.
- B6.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.
- B6.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative shall base his Total Bid Price upon the substituted item. Such alternatives will be evaluated in accordance with B15.
- B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B7. BID SUBMISSION

- B7.1 The Bid Submission consists of the following components:
- (a) Form A: Bid;
 - (b) Form B: Prices;
 - (c) Form G1: Bid Bond and Agreement to Bond, or Form G2: Irrevocable Standby Letter of Credit and Undertaking, or a certified cheque or draft;
- B7.2 All components of the Bid Submission shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely in ink, to constitute a responsive Bid.
- B7.3 The Bid Submission shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.
- B7.3.1 Samples or other components of the Bid Submission which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder's Bid Submission.
- B7.4 Bid Submissions submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.
- B7.5 Bid Submissions shall be submitted to:
- The City of Winnipeg
Corporate Finance Department
Materials Management Branch
185 King Street, Main Floor
Winnipeg MB R3B 1J1

B8. BID

- B8.1 The Bidder shall complete Form A: Bid, making all required entries.
- B8.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

- (a) if the Bidder is a sole proprietor carrying on business in his 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.

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

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

B8.4 Paragraph 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.

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

B8.4.2 All signatures shall be original and shall be witnessed except where a corporate seal has been affixed.

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

B9. PRICES

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

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

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

B10. QUALIFICATION

B10.1 The Bidder shall:

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

- (b) be responsible and not be suspended, debarred or in default of any obligation to the City;
- (c) be financially capable of carrying out the terms of the Contract;
- (d) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract;
- (e) have successfully carried out work, similar in nature, scope and value to the Work;
- (f) employ only Subcontractors who:
 - (i) are responsible and not suspended, debarred or in default of any obligation to the City (a list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>); and
 - (ii) have successfully carried out work similar in nature, scope and value to the portion of the Work proposed to be subcontracted to them, and are fully capable of performing the Work required to be done in accordance with the terms of the Contract;
- (g) have a written workplace safety and health program in accordance with The Workplace Safety and Health Act (Manitoba);
- (h) employ rock socketed pipe pile installers with at least five (5) years of experience with the complete installation of rock socket foundations.

B10.2 The precast concrete box girder fabricator's must have an established fabrication plant capable of performing the proposed stressing operations. The fabricator must have a minimum of ten (10) years of experience with similar work.

B10.3 Further to B10.1(g), the Bidder shall, within three (3) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

- (a) a valid COR certification number under the Certificate of Recognition (COR) Program - Option 1 administered by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or
- (b) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association; or
- (c) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.)

B10.4 The Bidder shall be prepared to submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B10.5 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B11. BID SECURITY

B11.1 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.

B11.1.1 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.

B11.2 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.

B11.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B11.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B11.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B11.3 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.

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

B12.1 Bid Submissions will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Branch, or in such other office as may be designated by the Manager of Materials.

B12.1.1 Bidders or their representatives may attend.

B12.1.2 Bid Submissions determined by the Manager of Materials, or his designate, to not include the bid security specified in B11 will not be read out.

B12.2 After the public opening, the names of the Bidders and their Total Bid Prices as read out (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.

B12.3 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>.

B12.4 The Bidder is advised that any information contained in any Bid Submission may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B13. IRREVOCABLE BID

- B13.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.
- B13.2 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.

B14. WITHDRAWAL OF BIDS

- B14.1 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.
- B14.1.1 Notwithstanding GC:23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.
- B14.1.2 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.
- B14.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials shall:
- (a) retain the Bid Submission until after the Submission Deadline has elapsed;
 - (b) open the Bid Submission to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and
 - (c) if the notice has been given by any one of the persons specified in B14.1.3(b), declare the Bid withdrawn.
- B14.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B13.2 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.

B15. EVALUATION OF BIDS

- B15.1 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 B10 (pass/fail);
 - (c) Total Bid Price;
 - (d) economic analysis of any approved alternative pursuant to B6.
- B15.2 Further to B15.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid Submission is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements if the interests of the City so require.

B15.3 Further to B15.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid Submission or in other information required to be submitted, that he is responsible and qualified.

B15.4 Further to B15.1(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.

B15.4.1 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.

B16. AWARD OF CONTRACT

B16.1 The City will give notice of the award of the Contract by way of a letter of intent, or will give notice that no award will be made.

B16.2 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.

B16.2.1 Without limiting the generality of B16.2, 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.

B16.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid.

PART C - GENERAL CONDITIONS

C1. GENERAL CONDITIONS

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

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

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. SCOPE OF WORK

- D2.1 The Work to be done under the Contract shall consist of construction of a new precast prestressed concrete box girder railway bridge supported by rock socketed caissons and concrete abutments supported by precast prestressed concrete hexagonal piles.
- D2.2 The major components of the Work are as follows:
- (a) Installation of precast concrete piles
 - (b) Installation of rock socketed steel pipe piles
 - (c) Fabrication of precast prestressed concrete box girders
 - (d) Erection of precast concrete box girders

D3. DEFINITIONS

- D3.1 When used in this Bid Opportunity
- “**CN**” means Canadian National

D4. CONTRACT ADMINISTRATOR

- D4.1 The Contract Administrator is Stantec Consulting Ltd., represented by:
- Mike Boissonneault, P.Eng.
905 Waverley Street
Winnipeg MB
R3T 5P4
- Telephone No. (204) 489-5900
Direct No. (204) 488-5742
Facsimile No. (204) 459-9012
- D4.2 At the pre-construction meeting, Mike Boissonneault, P.Eng. will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D5. CONTRACTOR'S SUPERVISOR

- D5.1 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.
- D5.2 At least two (2) business days prior to the commencement of any Work on the Site, the Contractor shall provide the Contract Administrator with a phone number where the supervisor identified in D5.1 or an alternate can be contacted 24 hours a day to respond to an emergency.

D6. NOTICES

- D6.1 Except as provided for in GC:23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.
- D6.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.3, D6.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D4.1.
- D6.3 All notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following address or facsimile number:
The City of Winnipeg
Chief Administrative Officer Secretariat
Administration Building, 3rd Floor
510 Main Street
Winnipeg MB R3B 1B9
Facsimile No.: (204) 949-1174
- D6.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:
The City of Winnipeg
Corporate Services Department
Legal Services Division
185 King Street, 3rd Floor
Winnipeg MB R3B 1J1
Facsimile No.: (204) 947-9155

D7. FURNISHING OF DOCUMENTS

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

SUBMISSIONS

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 GC:4.1 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 City shall provide and maintain the following Project Insurance Coverages:

D9.1.1 Builder's Risk Insurance in the amount of one hundred percent (100%) of the total project cost.

(a) The Contractor shall be responsible for deductibles up to \$25,000.00 maximum of any one loss

D9.1.2 Wrap-Up Liability Insurance in an amount of no less than 10 million dollars (\$10,000,000.00).

(a) The Contractor shall be responsible for deductibles up to \$25,000.00 maximum of any one loss

D9.1.3 The City of Winnipeg will carry such insurance to cover all parties engaged in the Work in this Contract. Provision of this insurance by the City of Winnipeg is not intended in any way to relieve the Contractor from his obligations under the terms of the Contract. Specifically, losses relating to deductibles for insurance, as well as losses in excess of limits of coverage and any risk of loss that is not covered under the terms of the insurance provided by the City of Winnipeg remains with the Contractor.

D9.2 The Contractor shall provide and maintain the following insurance coverage at all times during the performance of the Work:

D9.2.1 Automobile liability insurance for owned and non-owned automobiles used for or in connection with the work in the amount of at least two million dollars (\$2,000,000.00).

D9.2.2 Deductibles shall be borne by the Contractor;

D9.2.3 The Contractor shall not cancel, materially alter, or cause the policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator;

D9.2.4 The Contractor shall provide the Contract Administrator with evidence of insurance of the policy at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than seven (7) Calendar Days from notification of the award of Contract.

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 Submission was not a certified cheque or draft pursuant to B11.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D11. SUBCONTRACTOR LIST

D11.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D12. REQUIRED SAFETY COURSE COMPLETION

D12.1 Each individual proposed to be on the Site for any reason shall be required to complete the Contractor Orientation Course, CN Safety.

D12.2 The card and sticker supplied to the individual upon completion of the safety training course shall be on the individuals person at all times when on the Site for any reason.

D12.3 The requirements are extended to any person visiting the Site.

D12.4 If the Contractor or Contract Administrator should find any individual(s) on the Site without the proper safety training or proof of training, the individual shall be removed from the Site immediately and not allowed to re-enter the Site until such time as they have successfully completed the Contractor Orientation Course, CN Safety and/or have obtained the required proof of successful completion of the Contractor Orientation Course, CN Safety.

D12.5 Information about the safety-training course is available at www.contractororientation.com or contact CN directly at (719) 647-0337.

D13. EQUIPMENT LIST

D13.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment List) at or prior to a pre-construction meeting, or at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the GC:4.1 for the return of the executed Contract.

D14. DETAILED WORK SCHEDULE

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

D14.2 The detailed Work Schedule shall consist of the following:

- (a) A Gantt chart for the Work

D14.3 Further to D13.2(a), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade , or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

SCHEDULE OF WORK

D15. COMMENCEMENT

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

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

- (a) the Contract Administrator has confirmed receipt and approval of:
 - (i) evidence that the Contractor is in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba;
 - (ii) evidence of the workers compensation coverage specified in GC:6.14;
 - (iii) the Safe Work Plan specified in D8;
 - (iv) evidence of the insurance specified in D9;
 - (v) the performance security specified in D10;
 - (vi) the Subcontractor list specified in D11;
 - (vii) the Equipment list specified in D13;
 - (viii) The detailed Work schedule specified in D14.
- (b) the Contractor has attended a pre-construction meeting with the Contract Administrator, or the Contract Administrator has waived the requirement for a pre-construction meeting.

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

D15.4 The City intends to award this Contract November 30, 2005.

D16. RESTRICTED WORK HOURS

D16.1 Further to clause 3.10 of CW 1130, the Contractor shall require written permission 48 hours in advance from the Contract Administrator for any Work to be performed between 2000 hours and 0700 hours, or on Saturdays, Sundays, Statutory Holidays and or Civic Holidays.

D17. WORK BY OTHERS

D17.1 Work by others on or near the Site will include but not necessarily be limited to:

- (a) CN track and grade work, signals and communications work
- (b) Pump station construction
- (c) Feeder main and water main relocation
- (d) Manitoba Hydro utilities relocation
- (e) MTS utilities relocation
- (f) Group Telecom cable relocation
- (g) Kenaston Blvd. reconstruction

D18. SUBSTANTIAL PERFORMANCE

- D18.1 The Contractor shall achieve Substantial Performance by May 8, 2006.
- D18.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.
- D18.3 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a certificate of Substantial Performance is the date on which Substantial Performance has been achieved.
- D18.4 Substantial Performance shall not be considered to have been achieved until the superstructure is completely installed, furnished with railing and waterproofing membrane, bridge ready for ballast and track.

D19. TOTAL PERFORMANCE

- D19.1 The Contractor shall achieve Total Performance by May 15, 2006.
- D19.2 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.
- D19.3 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.

D20. LIQUIDATED DAMAGES

- D20.1 If the Contractor fails to achieve Substantial Performance in accordance with the Contract by the day fixed herein for Substantial Performance, the Contractor shall pay the City Three Thousand dollars (\$3,000) per Calendar Day for each and every Calendar Day following the day fixed herein for Substantial Performance during which such failure continues.
- D20.2 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

CONTROL OF WORK

D21. JOB MEETINGS

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

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

D22.1 Further to GC:6.26, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

D23. COORDINATION OF CONSTRUCTION WITH CN

D23.1 General Requirements

- (a) The Contractor shall be responsible to meet all CN constraints, requirements and safety measures.
- (b) The Contractor shall be required to notify CN by contacting Christina Cusson, at 231-7805 at least seven (7) working days before commencing any work on the CN right-of-way and shall be governed by their requirements. The Contractor shall be responsible for any damage, delay, disruption and/or inconvenience caused to CN by his equipment or operations of work to the tracks, the railway's operation or their property.
- (c) The CN operating detour tracks north and south track shall be kept free of obstructions and open to traffic at all times (unless prior written permission is obtained by the Contractor from CN for their closure and written acceptance is granted by the Contract Administrator). The CN railway tracks form a vital link in CN's Western Canadian operations. All required precautions shall be taken to avoid interfering with those operations.
- (d) If an emergency occurs, CN can be contacted through it Emergency CN Police Line 1-800-465-9239.
- (e) The Contractor shall follow the requirements of CN as stipulated in the Contractor Safety Orientation attached herein in this Bid Opportunity Appendix D. All employees of the Contractor shall obtain CN Contractor Orientation Identification card prior to working on Site.
- (f) The Contractor shall provide CN with a 24-hour phone number through which the Contractor can be contacted for emergency purposes.

D23.2 Contractor's Use of Site

- (a) The Contractor shall obtain in writing, permission from CN (for area required within the CN right-of-way) for the use of and storage of equipment, materials, and the erection of trailers.
- (b) The Contractor shall confine storage of materials and the operations of equipment and workmen to the limits indicated on the drawings.
- (c) No material or equipment shall be stored closer than 4 metres from the centreline of any operated track. Material shall not be stockpiled higher than 1.5m.
- (d) All costs, liabilities, cleaning up and restoring of Site after completion of the project will be the Contractor's responsibility.

D23.3 Rail Traffic Protection

- (a) As part of the Works adjacent to CN's operating tracks, the Contractor is responsible for providing Flagpersons for the protection of the CN plant and equipment, when required. All costs associated with Rail Traffic Protection shall be borne by the Contractor for their scope of work.
- (b) The Contractor shall give CN 72 hours notice of the hours within which work requiring Flagpersons is to be carried out in order that protection may be provided.
- (c) The Contractor must have a responsible person present at all times to whom CN personnel will issue orders regarding work near the tracks. Such orders and instructions shall be immediately acted upon and complied with by the Contractor.

D23.4 Restrictions on Construction Operations

The Contractor shall abide by the following restrictions when working in or near the CN right-of-way. Any person not complying with these requirements shall not be permitted further access to the Site for the contract duration.

- (a) Expect the movement of a train, engine, rail car, or track at any time, on the track, in either direction. Protect yourself and others from the movement of trains, engines, railcars, and track units, and do not expect them to stop.
- (b) No work or the siting of vehicles or heavy equipment closer than 4 m from the nearest rail is allowed without the prior consent of CN and only during times as there is rail traffic protection provided by CN.
- (c) If near a turnout, when a train is passing, stand at least 6 m from the switch stand, and if possible, on the opposite side of the track.
- (d) Do not crawl under, climb over, or pass through standing railway equipment. Do not cross a track within 6 m of standing railway equipment.
- (e) All equipment within 8 m from the nearest rail of any live line track must stop working on the approach a train and remain stopped until the train has passed.
- (f) Metal measuring tapes or touch metal appliances are not to come into contact with the rail or tracks.
- (g) There will be no interference with the safe movement of trains. Any object waved violently by anyone on or near the track is a signal for trains to stop.
- (h) Walking or stepping on rail, frog, switch, guardrail, interlocking machinery or connection is prohibited.
- (i) No CN, signals, structures, equipment, or property of any kind shall be tampered with, modified, or removed except as set forth in the Specifications.
- (j) Do not cross tracks of CN with mechanical equipment at grade nor place crossing planks except by authority of the Contract Administrator, at a location designated by him.
- (k) Instruction from any CN personnel related to safe traffic movements are to be abided by immediately.
- (l) CSA approved hard hats, safety footwear, and safety glasses for head, foot, and eye protection must be worn at all times while on CN right-of-way. Including any other safety equipment specified in the CN safety course.
- (m) During which times that construction is not in progress in any particular work area, the Contractor shall leave the area from any debris or obstructions which would disrupt operations of CN.

D23.5 Signals and Communication Cables

- (a) The Contractor shall request CN to locate their cables before commencement of any works.
- (b) The Contractor shall use extreme caution when working in the vicinity of any signal and communication cables.
- (c) The Contractor shall supply and maintain any required protection required by CN for all signal and communication cables within the working limits.
- (d) As a result of damage to any cable or associated equipment by his operations, the Contractor shall be held responsible for all costs required to repair the cable, as well as the loss of all revenue incurred by CN.

D23.6 CN Track Closures

At no time will the Contractor be allowed to close CN tracks.

CN recognizes the project will require work to be carried out in the vicinity of the operating track of the Railway, but it is essential that as close to normal as possible train operation be maintained during the construction period. However, to allow for specific construction operations which will restrict safe train movement, the following protection against movements of trains may be available from CN:

- (a) The Railway may, when required be able to provide positive protection against train movements for short time periods, up to three (3) hours, on one track.
- (b) During the block time, no rail traffic shall pass through the construction area on the specified track except in case of emergency.
- (c) Generally the train protection is for construction operations which in the opinion of the Railway, have minimal potential to impede rail traffic or damage the main track. The Contractor shall give the Railway a minimum of 48 hours notice when work requiring such a block is to be carried out.
- (d) If a longer period of time required to curtail rail traffic on one track or for a very short period (one or two hours) on both tracks, CN shall endeavour to review this request. CN shall be given a minimum of seven (7) days notice when work requiring such block is required.

Work shall not commence until confirmation is received from the Railway Flagperson that the block is in effect. During this block time, no rail traffic shall pass through the construction area except in case of emergency. Due to rail traffic at this location, about 50 trains per 24 hours day, it may not be possible to curtail rail traffic on the date requested. However, if so arranged the railway shall notify the Contractor at least seven (7) hours in advance of the approximate hours of commencement and shall be confirmed to the Contractor sixty (60) minutes prior to actual commencement as shall be the hour when the track must be open and ready to receive rail traffic. Time required for clearing debris and protective material, inspection of the track by the Railway and any necessary repairs of the track shall be included in the time block. There may be emergent situations on the Railway from time to time which would affect the foregoing provisions. Should the line be temporarily closed to traffic for any reason, longer time may be available to the Contractor. On the other hand, once the emergent situation is rectified, in order to permit the Railway to clear the traffic backlog, it may be necessary to suspend temporarily those operations of the Contract which encroach upon the track area.

- (e) Also, if CN has planned curtailment of rail traffic for whatever reason, the time and duration will be advised to the Contractor so he may utilize the opportunity as much as possible.

D23.7 Costs Associated with CN Coordination

All costs associated with the coordination of construction with CN as set out in this Bid Opportunity, whether specifically described or not, shall be the responsibility of the Contractor, no separate payment will be made for this coordination.

The Contractor shall pay all costs associated with CN providing Flagman services for works carried out in accordance with this project.

D23.8 Damage to Existing Structures and Property

Special care shall be taken to avoid damage to existing adjacent structures or properties during the course of the work. The Contractor shall limit his activities to the work area limits and construction area routes as coordinated with CN and reviewed by the Contract Administrator.

Any damage caused by the negligence of the Contractor or his Sub-contractors to adjacent structures or properties, shall be promptly repaired by him at his own expenses, to the satisfaction of CN and the Contract Administrator.

D23.9 Barricades

Observe all necessary precautions and provide, erect, and maintain suitable signs, barricades, and lights to protect all persons from injury and all vehicles from damage during the progress of the work, all to the approval of the Contract Administrator or any authority having jurisdiction at this location.

D23.10 CN requirements are included in Appendix D. the Contractor is advised that the requirements are applicable to all of the Contractor's personnel and equipment crossing CN tracks and property.

D24. ENVIRONMENTAL PROTECTION PLAN

D24.1 The Contractor shall plan and implement the Work of this Contract strictly in accordance with the requirements of the Environmental Protection Plan as herein specified.

D24.2 The Contractor is advised that at least the following Acts, Regulations and By-laws apply to the Work and are available for viewing online at the applicable websites or at the office of the Contract Administrator.

D24.3 Federal

- (a) Canadian Labour Code
- (b) Workplace Health and Safety Act
- (c) Canada Transportation Act
- (d) Canadian Environmental Assessment Act and Regulations
- (e) Canadian Environmental Protection Act and Regulations
- (f) Migratory Birds Convention Act and Regulations
- (g) Species at Risk Act
- (h) Railway Safety Act and Notice of Railway Work Regulation
- (i) Transportation of Dangerous Goods Act and Regulations

D24.4 Province of Manitoba

- (a) The Environment Act
- (b) Litter Regulation
- (c) Waste Disposal Grounds Regulation
- (d) Storage and Handling of Gasoline and Associated Products Regulation
- (e) The Dangerous Goods Handling and Transportation Act
- (f) Polychlorinated Biphenyl Storage (PCB) Site Regulation
- (g) Environmental Accident Reporting Regulations
- (h) Generator Registration and Carrier Licensing Regulation
- (i) Manifest Regulation
- (j) The Fires Prevention Act and Regulation
- (k) The Public Health Act
- (l) Collection and Disposal of Wastes Regulation
- (m) The Ozone Depleting Substances Act and Regulations
- (n) The Waste Reduction and Prevention Act and Regulations

- (o) The Workplace Safety and Health Act and Regulations
- (p) The City of Winnipeg Act
- (q) The Contaminated Sites Act
- (r) The Heritage Resources Act
- (s) The Sustainable Development Act
- (t) And current applicable associated regulations (Note: Provincial regulations updated as of September 1999)

D24.5 City of Winnipeg

City of Winnipeg By-Laws (<http://Winnipeg.ca/clerks/docs/bylaws/bylaws.stm>) application to the Kenaston Underpass Bridge Construction includes the following:

- (a) Alarms By-Lay 4676/87
- (b) Anti-Litter By-Law 1075/75
- (c) Development Fees By-Law No. 6965/97
- (d) Electrical Inspections By-Law 7436/99
- (e) Encroachment on Streets By-Law 692/74
- (f) Fire Prevention By-Law 1322/76
- (g) Noise Control By-Law 2480/79
- (h) Sewer By-Law 7070/97
- (i) Pigeon Control By-Law 978/75
- (j) Solid Waste By-Law 1340/76
- (k) Waterworks By-Law 504/73
- (l) Traffic By-Law 1573/77
- (m) City of Winnipeg Noise Policy and Guidelines.

D24.6 The Contractor is advised that the Environmental Approval has been issued for this project.

D24.7 The Contractor is advised that the Environmental Screening Report for the Kenaston Underpass Project, dated March 2005, applies to the Work and is available for viewing at the office of the Contract Administrator. A specific reference of the Environmental Screening Report Table 6.3 is included in Appendix E and describes the mitigation measures to be adhered to by the Contractor.

D24.8 The Contractor is advised that the following environmental protection measures apply to the Work.

D24.9 Materials Handling and Storage

- (i) Storage of construction materials shall be confined to the defined lay down areas as shown on the Contract Drawings.
 - (ii) Construction materials shall not be deposited or stored on or near drainage ditches unless written acceptance from the Contract Administrator is received in advance.
 - (iii) Construction materials and debris shall be prevented from entering the land drainage system. In the event that materials and/or debris inadvertently enter the land drainage system, the Contractor shall be required to remove the material and restore the land drainage system to its original condition.
- Fuel Handling and Storage

- (iv) The Contractor shall obtain all necessary permits from Manitoba Environment for the handling and storage of fuel products and shall provide copies to the Contract Administrator.
- (v) All fuel handling and storage facilities shall comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.
- (vi) Fuels, lubricants, and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act shall be stored and handled within the approved storage areas.
- (vii) The Contractor shall ensure that all fuel storage containers are inspected daily for leaks and spillage.
- (viii) Products transferred from the fuel storage area(s) to specific Work Sites shall not exceed the daily usage requirement.
- (ix) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment shall be collected in a container, a groundsheet of suitable material (such as HDPE) and size shall be spread on the ground to catch the fluid in the event of a leak or spill.
- (x) Refuelling of mobile equipment and vehicles shall take place at least 100 metres from a watercourse.
- (xi) The area around storage Sites and fuel lines shall be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.
- (xii) A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills shall be stored nearby on-Site. The Contractor shall ensure that additional material can be made available on short notice.
- Waste Handling and Disposal
 - (xiii) The construction area shall be kept clean and orderly at all times during and at completion of construction.
 - (xiv) At no time during construction shall personal or construction waste be permitted to accumulate for more than one day at any location on the construction Site, other than at a dedicated storage area as may be approved by the Contract Administrator.
 - (xv) The Contractor shall during and at the completion of construction, clean-up the construction area and all resulting debris shall be deposited at a Waste Disposal Ground operating under the authority of Manitoba Regulation #150/91. Exceptions are liquid industrial and hazardous wastes, which require special disposal methods (refer to Section 30.5.D).
 - (xvi) Indiscriminate dumping, littering, or abandonment shall not take place.
 - (xvii) No on-Site burning of waste is permitted.
 - (xviii) Waste storage areas shall not be located so as to block natural drainage.
 - (xix) Runoff from a waste storage area shall not be allowed to cause siltation of a watercourse.
 - (xx) Waste storage areas shall be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.
 - (xxi) Equipment shall not be cleaned near watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.
- Dangerous Goods/Hazardous Waste Handling and Disposal
 - (xxii) Dangerous goods/hazardous waste are identified by, and shall be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.
 - (xxiii) The Contractor shall be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.

- (xxiv) The Contractor shall have on Site staff that is trained and certified in the handling of the dangerous/hazardous goods, when said dangerous/hazardous goods are being utilized on Site for the performance of the Work.
- (xxv) Different waste streams shall not be mixed.
- (xxvi) Disposal of dangerous goods/hazardous wastes shall be at approved hazardous waste facilities.
- (xxvii) Liquid hydrocarbons shall not be stored or disposed of in earthen pits on Site.
- (xxviii) Used oils shall be stored in appropriate drums, or tankage until shipment to waste oil recycling centres, incinerators, or secure disposal facilities approved for such wastes.
- (xxix) Used oil filters shall be drained, placed in suitable storage containers, and buried or incinerated at approved hazardous waste treatment and disposal facilities.
- (xxx) Dangerous goods/hazardous waste storage areas shall not be located so as to block natural drainage.
- (xxxi) Runoff from a dangerous goods/hazardous waste storage area shall not be allowed to cause siltation of a watercourse.
- (xxxii) Dangerous goods/hazardous waste storage areas shall be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.
- **Emergency Response**
 - (xxxiii) The Contractor shall ensure that due care and caution is taken to prevent spills.
 - (xxxiv) The Contractor shall report all major spills of petroleum products or other hazardous substances with significant impact on the environment and threat to human health and safety (as defined in Table 1 below) to Manitoba Environment, immediately after occurrence of the environmental accident, by calling the 24-hour emergency phone number (204) 945-4888.
 - (xxxv) The Contractor shall designate a qualified supervisor as the on-Site emergency response coordinator for the project. The emergency response coordinator shall have the authority to redirect manpower in order to respond in the event of a spill.
 - (xxxvi) The following actions shall be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on-Site emergency response coordinator:
 - (i) Notify emergency-response coordinator of the accident:
 - identify exact location and time of accident
 - indicate injuries, if any
 - request assistance as required by magnitude of accident (Manitoba Environment 24-hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup)
 - (ii) Attend to public safety:
 - stop traffic, roadblock/cordon off the immediate danger area
 - eliminate ignition sources
 - initiate evacuation procedures if necessary
 - (iii) Assess situation and gather information on the status of the situation, noting:
 - personnel on Site
 - cause and effect of spill
 - estimated extent of damage
 - amount and type of material involved
 - proximity to waterways, sewers, and manholes

- (iv) If safe to do so, try to stop the dispersion or flow of spill material:
 - approach from upwind
 - stop or reduce leak if safe to do so
 - dyke spill material with dry, inert absorbent material or dry clay soil or sand
 - prevent spill material from entering waterways and utilities by dyking
 - prevent spill material from entering manholes and other openings by covering with rubber spill mats or dyking
- (v) Resume any effective action to contain, clean up, or stop the flow of the spilled product.
- (xxxvii) The emergency response coordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to Manitoba Environment according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.
- (xxxviii) When dangerous goods are used on Site, materials for containment and cleanup of spill material (e.g. absorbent materials, plastic oil booms, and oversized recovery drums) shall be available on Site.
- (xxxix) Minor spills of such substances that may be contained on land with no significant impact on the environment may be responded to with in-house resources without formal notification to Manitoba Environment.
- (xl) City emergency response, 9-1-1, shall be used if other means are not available.

Table 1 Spills That Must be Reported to the Manitoba Conservation as Environmental Accidents		
Classification	Hazard	Reportable Quantity/Level
1	Explosives	All
2.1	Compressed Gas (flammable)	100 L*
2.2	Compressed Gas	100 L*
2.3	Compressed Gas (toxic)	All
2.4	Compressed Gas (corrosive)	All
3	Flammable Liquids	100 L
4	Flammable Solids	1 kg
5.1 PG** I & II	Oxidizer	1 kg or 1 L
PG III	Oxidizer	50 kg or 50 L
5.2	Organic Peroxide	1 kg or 1 L
6.1 PG I	Acute Toxic	1 kg or 1 L
PG II & III	Acute Toxic	5 kg or 5 L
6.2	Infectious	All
7	Radioactive	Any discharge or radiation level exceeding 10 mSv/h at the package surface and 200 uSv/h at 1 m from the package surface
8	Corrosive	5 kg or 5 L
9.1	Miscellaneous (except PCB mixtures)	50 kg
9.1	PCB Mixtures	500 g
9.2	Aquatic Toxic	1 kg or 1 L
9.3	Wastes (chronic toxic)	5 kg or 5 L
*Container capacity (refers to container water capacity)		
**PG = Packing Group(s)		

- Noise
 - (xli) Noise-generating activities shall be limited to the hours indicated in the City of Winnipeg Noise Bylaw, and the Province of Manitoba Environment Act Licence, unless otherwise accepted in writing, in advance by the Contract Administrator.
 - (xlii) The Contractor shall be responsible for scheduling Work to avoid potential noise problems and/or employ noise reduction measures to reduce noise to acceptable limits. The Contractor shall also demonstrate to the Contract Administrator that Works to be performed during the night-time period, on Sundays, and Holidays as stated in the Licence shall not exceed the approved limit.
- Dust
 - (xliii) Dust control practices implemented by the Contractor during construction shall include regular street cleaning and dampening of construction access roads and Work areas with water or approved chemicals at an adequate frequency to prevent the creation of dust.
 - (xliv) Only water or chemicals approved by the Contract Administrator shall be used for dust control. The use of waste petroleum or petroleum by-products is not permitted.
 - (xlv) The Contractor shall ensure that trucks which are used to haul excavated material and backfill material to and from the Site utilize tarpaulin covers during transport to prevent material from falling onto the street and creating dust.
 - (xlvi) Stockpiled soils shall be covered with tarpaulin covers to prevent the creation of dust.
- Erosion Control
 - (xlvii) The Contractor shall develop a sediment control plan prior to beginning construction to the satisfaction of the Contract Administrator.
 - (xlviii) Sediment control fencing, or other such erosion control structures, shall be employed wherever construction activity increases the potential for runoff to carry sediment into a drainage channel or other watercourse. The Contractor shall inspect all such structures daily during heavy construction activity in the areas of the structures and after a heavy rainfall to ensure their continued integrity.
- Runoff Control
 - (xlix) Measures shall be undertaken to ensure that runoff containing suspended soil particles is minimized from entering the land drainage system to the extent possible to the satisfaction of the Contract Administrator.
 - (I) Areas that are heavily disturbed and vulnerable to erosion or gulying shall be dyked to redirect surface runoff around the area prior to spring run-off.
 - (II) Construction activities on erodible slopes shall be avoided during spring run-off and heavy rainfall events.
- Vegetation
 - (lii) Right-of-way clearing shall be restricted to areas identified on the Construction Drawings.
 - (liii) Rare, endangered, or threatened plant species shall be protected as specified in the Environmental Screening Report, if encountered.
 - (liv) Vegetation shall not be disturbed without written permission from the Contract Administrator.
 - (lv) The Contractor shall protect plants or trees, which may be at risk of accidental damage as specified in the Environment Screening Report. Such measures may include protective fencing or signage and shall be approved in advance by the Contract Administrator.
 - (lvi) Herbicides and pesticides shall not be used adjacent to any surface watercourses.
 - (lvii) Trees or shrubs shall not be felled into watercourses.

- (lviii) Areas where vegetation is removed during clearing, construction, and decommissioning activities, shall be revegetated as soon as possible in accordance with the landscaping plans forming part of the Contract, or as directed by the Contract Administrator.
- (lix) Trees damaged during construction activities shall be examined by bonded tree care professionals. Viable trees damaged during construction activities shall be pruned according to good practice by bonded tree care professionals.
- (lx) Damaged trees which are not viable shall be replaced at the expense of the Contractor.
- Landscaping
 - (lxi) Construction waste (excluding common construction gravel, sand etc.) shall be removed to a minimum depth of 600 mm below final grade in all areas that are to be backfilled with suitable material and revegetated in accordance with Standard City Practice.
 - (lxii) The Contractor shall adhere to the landscaping plan for maintenance of initial stages and development stages of the plant community.
- Heritage Resources
 - (lxiii) If heritage material is located during the construction and soil removal process, all Work shall cease and the Contractor shall immediately contact the Contract Administrator. The Historic Resources Branch, Manitoba Culture, Heritage and Tourism, or the Project Archaeologist, shall be contacted by the Contract Administrator to determine the nature and extent of the archaeological material and to arrange for its recovery. The archaeological remains shall be recovered by salvage excavation upon authorization by the Contract Administrator, having consulted with the Historic Resources Branch, Manitoba Department of Culture, Heritage and Tourism.
 - (lxiv) The Contractor shall be prepared to continue his Work elsewhere on the project while the Archaeologist investigates the finding and determines its heritage value.
 - (lxv) The Contractor is advised that he may be denied access to such areas of the project until such time as a thorough archaeological investigation is conducted or the find is deemed to have no heritage value.
 - (lxvi) Construction and excavation Work shall not resume until the Contract Administrator, having consulted with the Historic Resources Branch, Manitoba Culture, Heritage and Tourism, or the project archaeologist, authorizes a resumption of Work.
 - (lxvii) If human remains are uncovered during the construction and soil removal process, all Work shall cease and the Historic Resources Branch, Manitoba Culture, Heritage and Tourism shall be contacted by the Contract Administrator. The Historic Resources Branch shall contact The City of Winnipeg Police.
 - (lxviii) If the human remains are not considered forensic, i.e., no foul play suspected, they shall be removed by the Historic Resources Branch, Manitoba Culture, Heritage and Tourism or the project archaeologist and turned over to the Province.
 - (lxix) If the human remains are considered forensic, The City of Winnipeg Police shall be responsible for their removal.
 - (lxx) Additional information may be obtained by contacting: Archaeological Assessment Services, Historic Resources Branch
- Construction Traffic
 - (lxxi) Workforce parking shall be limited to the areas designated for such as detailed in the Contract Documents, or as otherwise may be directed by the Contract Administrator.
 - (lxxii) The Contractor shall adhere to the Standard Provisions of the Standard Construction Specifications, and of the Manual of Temporary Traffic Control in Work Areas on City Streets of The City of Winnipeg, Works & Operations Division.

- (lxxiii) The Contractor's lay down area, construction Site and access road shall be fenced and gated to secure the Site and materials and to discourage pedestrian entrance to construction areas and to control any potential hazard to the public, particularly children.
- (lxxiv) For circumstances where the Contract Administrator has accepted Site access of special equipment or material, the Contractor shall provide adequate flagmen for traffic control in the vicinity of any public buildings.
- Access
 - (lxxv) The Contractor shall maintain access to affected residential properties.
 - (lxxvi) The Contractor shall provide or maintain general and off-street access to any affected business during construction.

WARRANTY

D25. WARRANTY

- D25.1 Notwithstanding GC:13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) years thereafter unless extended pursuant to GC:13.2.1 or GC:13.2.2, in which case it shall expire when provided for there under.
- D25.2 Notwithstanding GC:13.2 [D23] the Contract Administrator may permit the warranty period for a portion or portions of the Work to begin prior to the date of Total Performance if:
 - (a) A portion of the Work cannot be completed because of unseasonable weather or other conditions reasonably beyond the control of the Contractor but that portion does not prevent the balance of the Work from being put to its intended use.

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. 601-2005

KENASTON UNDERPASS PROJECT

KENASTON BLVD. / CN RIVERS SUBDIVISION MILE 5.18
RAILWAY BRIDGE CONSTRUCTION

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. 601-2005

KENASTON UNDERPASS BRIDGE CONSTRUCTION

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

(Name of Contractor)

(Address of Contractor)

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

Canadian dollars.

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

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

Partial drawings are permitted.

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

(Address)

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

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

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

(Date)

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

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

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

(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM K: EQUIPMENT
(See D13)
KENASTON UNDERPASS PROJECT

KENASTON BLVD. / CN RIVERS SUBDIVISION MILE 5.18

RAILWAY BRIDGE CONSTRUCTION

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

FORM K: EQUIPMENT
(See D13)
KENASTON UNDERPASS PROJECT

KENASTON BLVD. / CN RIVERS SUBDIVISION MILE 5.18

RAILWAY BRIDGE CONSTRUCTION

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

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

- E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.
- E1.1.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet Site at <http://www.winnipeg.ca/matmgt>.
- E1.1.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.
- E1.1.3 Further to GC:2.4(d), Specifications included herein the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.2 The following Drawings are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
P-3258-125	Cover Sheet & Drawing Index
P-3258-126	General Notes & Key Plan
P-3258-127	Site Plan – Phase I – Existing Conditions
P-3258-128	Site Plan – Phase II – Bridge Construction
P-3258-129	Site Plan – Phase III – Bridge & Road Final Construction
P-3258-130	General Arrangement – Phase II – Bridge Construction
P-3258-131	General Arrangement – Phase III – Bridge & Road Final Construction
P-3258-132	Foundation Layout & Pile Details
P-3258-133	Abutment Concrete Details – SU.1 & SU.5
P-3258-134	Abutment Reinforcing Details – SU.1 & SU.5
P-3258-135	Abutment Reinforcing Details – SU.1 & SU.5
P-3258-136	Pier Concrete Details – SU.2, SU.3 & SU.4
P-3258-137	Pier Reinforcing Details – SU.2, SU.3 & SU.4
P-3258-138	Bearing Layout & Details
P-3258-139	Precast Concrete Box Girder – Girder Layout
P-3258-140	Precast Concrete Box Girder – Concrete & Stressing Details
P-3258-141	Precast Concrete Box Girder – Girder Reinforcing
P-3258-142	Concrete Joint Details
P-3258-143	Trainman's Walkway – Concrete & Reinforcing Details
P-3258-144	Bridge Rail Elevation & Details
P-3258-145	Electrical – Light Fixture Details

E2. OFFICE FACILITIES

- E2.1 The Contractor shall supply office facilities meeting the following requirements:
- The field office shall be for the exclusive use of the Contract Administrator.
 - The building shall be conveniently located near the Site of the Work.
 - The building shall have a minimum floor area of 25 square metres, a height of 2.4m with two windows for cross ventilation and a door entrance with a suitable lock. .
 - The building shall be suitable for all weather use. It shall be equipped with an electric heater and air conditioner so that the room temperature can be maintained between either 20-25 °C.

- (e) The building shall be adequately lighted with fluorescent fixtures, and have a minimum of three wall outlets.
- (f) The building shall be furnished with two desks, one drafting table, table 3mx1.2m, one stool one four drawer legal size filing cabinet, and minimum 12 chairs.
- (g) A portable toilet shall be located near the field office building. The toilet shall have a locking door and be for the exclusive use of the Contract Administrator and other personnel from the City.
- (h) The field office building and the portable toilet shall be cleaned on a weekly basis immediately prior to each Site meeting. The Contract Administrator may request additional cleaning when he deems it necessary.

E2.2 The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the office facilities.

The office facilities will be provided from the date of the commencement of the Work to the date of Total Performance.

E3. SOILS INVESTIGATION REPORT

E3.1 The Geotechnical Reports are included in Appendix A and Appendix B of this Specification:

- (a) Geotechnical Investigation for Kenaston Underpass Project

Prepared by: UMA Professional Engineering and Consulting Services
March 2005 (Appendix A)

- (b) Additional Geotechnical Investigation "Bedrock Investigation and Test Caisson"

Prepared by: UMA Professional Engineering and Consulting Services
October 2005 (Appendix B)

E3.2 The soils information presented in the Geotechnical Reports and shown on the Drawings is primarily for design purposes and the City does not Guarantee the information is free from errors or discrepancies.

E3.3 No test hole shall be drilled without the approval of the Contract Administrator.

E3.4 Further to GC:3.1, the Contractor shall make his own investigation as to the soil conditions, which will be encountered in the Work. The City assumes no responsibility for failure or neglect on the part of the Contractor to determine the working conditions at the Site.

E4. SITE WORK

E4.1 Description

Site work shall include the Contractor's costs of mobilization at the beginning of the Work and the costs of demobilization at the end of the Work.

Included in Site Work are such items as permits, moving personnel, materials and equipment to and from the Site, setting up temporary facilities, temporary utilities and all Site preparation for performing the Work.

All costs associates with Site clean up and general grading the work Site shall be included herein this pay item.

All regulatory body required costs (material, labour) shall be included herein this pay item.

Costs for pick-up and installation of precast concrete traffic barriers shall be included herein this pay item.

All costs for CN Flagpersons for Site Work shall be included herein this pay items.

Supply and installation of temporary shoring as indicated on the drawings shall be included herein this pay item. All costs for design and preparation of shop drawings for the shoring shall be included herein this pay item. Dimensions are shown on the drawings for proposed shoring length, the Contractor may, at his/her discretion, change the location, size and limits of shoring or excavation. Approval of these changes must be obtained from the Contract Administrator prior to installation of shoring.

Design and implementation of a temporary drainage system for dewatering the excavated areas shall be the responsibility of the Contractor. All costs associated with a temporary drainage system shall be included herein this pay item.

The contractor shall respect on going work in the area and future work to commence within the bridge construction phase. The Contractor shall coordinate work with CN, the Pump Station contractor, Road contractor, Feedermain contractor, Manitoba Hydro and the utilities as required as not to interfere with their proposed work. CN and Group Telecom will require access to the project site for relocation of live Fibre Optic cables as detailed in section E18. Other contractors or utility companies may require access to the bridge project site. Provided the other party's construction work does not interfere with the bridge construction, and the visiting work groups have adequate safety equipment, they shall be granted access to the site at all times.

E4.2 Precast Concrete Traffic Barriers

Six (6) precast concrete barriers and pins, as shown on the Drawings, will be supplied by the City of Winnipeg. The Contractor can arrange to pick them up, load and deliver them to the Site from the City of Winnipeg Bridge Yard at 849 Ravelstone Avenue West by contacting Mike Terleski at 794-8510.

The Contractor shall be responsible for loading the precast units from the City Yard, hauling and unloading and returning them to the City, placing, as well as storing of the precast concrete barriers once they have been received. The Contractor shall supply all necessary equipment for loading, hauling, unloading and storing of the barriers.

Precast concrete barriers shall be installed at locations shown on the Drawings. The barriers shall be properly aligned, pinned together and seated firmly to the subsurface to the satisfaction of the Contract Administrator.

A City standard drawing (CW-315) of the precast concrete unit is included in the appendix.

E4.3 Infrastructure Project Signs

The Contractor shall be responsible to maintain the existing Infrastructure Project Signs. There are total of six (6) signs and they are located as follows:

- (a) Southeast and southwest corners of Sterling Lyon Parkway and Kenaston Blvd.
- (b) West side of Kenaston Blvd. at the abandoned Wilkes Ave.
- (c) Northwest corner of Kenaston Blvd. and Taylor Ave.
- (d) West corner of the intersection of Sterling Lyon Parkway, Victor Lewis Drive and Wilkes Ave.

E4.4 Measurement and Payment

E4.4.1 Method of Measurement

E4.4.1.1 Site Work

Site work, as defined in this Specification, is a lump sum pay item. No measurement will be made for this work.

E4.4.1.2 Work Site Construction Fence

Work site construction fence, as defined in this Specification, is a lump sum pay item. No measurement will be made for this work.

E4.4.2 Basis of Payment

E4.4.2.1 Site Work

Site work shall be paid for at the Contract Lump Sum Price for "Site Work", which price shall be payment in full for performing all operations herein described including the cost of furnishing all necessary labour, materials and all other items incidental to the work included in this Specification.

The Contract Administrator may at his discretion recommend partial payment if Site Work is not complete.

E4.4.2.2 Work Site Construction Fence

Work site construction fence shall be paid for at the Contract Lump Sum Price for "Work Site Construction Fence", which price shall be payment in full for performing all operations herein described including the cost of furnishing all necessary labour, materials and all other items incidental to the work included in this Specification.

E5. STRUCTURAL CONCRETE

E5.1 Description

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.

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

E5.2 Materials

E5.2.1 General

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

E5.2.2 Handling and Storage

All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA A23.1-2000.

E5.2.3 Testing

All materials supplied under this Specification shall be subject to inspection and testing by the Contract Administrator by the Testing Laboratory designated by the Contract

Administrator. All costs for material testing shall be covered by the Contractor. Testing shall be undertaken by a CSA certified laboratory designated by the Contract Administrator. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.

All materials shall conform to CSA Standard CAN/CSA A23.1-2000.

All testing of materials shall conform to CSA Standard CAN/CSA A23.2-2000.

All materials shall be approved by the Contract Administrator at least seven (7) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the specification detailed herein or are found to be defective in manufacture or have become damaged in transit, storage or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

Frequency of tests shall be in accordance with CSA A23.2-2000. A minimum of one slump and air test shall be conducted for each pour complete with one set of cylinders (3) for concrete strength compressive tests.

E5.2.4 Aggregates

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

(a) Fine Aggregate

Fine aggregate shall consist of sand having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, soft or flaking particles, shale, alkali, organic matter or other deleterious substances. Fine aggregate shall be well graded throughout and shall conform to the following grading requirements.

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

The fineness modulus of fine aggregate shall not be less than 2.2 or more than 3.1 unless otherwise approved by the Contract Administrator.

(b) Course Aggregate Standard

Standard course aggregate shall be used for all the concrete described and required in this Specification.

Standard course aggregate shall consist of natural gravel, crushed stone, or other approved materials of similar characteristics, having clean, hard, strong, durable, uncoated particles, free from injurious amounts of soft, friable, thin, elongated, or

laminated pieces, alkali, organic, or other deleterious matter. Course aggregate shall be well graded throughout and shall conform to the grading requirements in the following table.

Sieve Size	Percent Passing
20 mm	100%
14 mm	90% - 100%
10 mm	45% - 75%
5 mm	0% - 15%
2.5 mm	0% - 5%

E5.2.5 Cement

All cement unless hereinafter specifically stated, shall be Type 50 Normal Portland Cement, conforming to requirements of CSA Standard CAN/CSA-A5.

The Contractor shall obtain and furnish to the Contract Administrator a statement signed by an officer or chemist of the cement manufacturer, certifying that the cement furnished does not exceed 0.6 percent alkali equivalent, as measured by the percent of sodium oxide plus 0.658 times the percent of potassium oxide. If requested by the Contract Administrator.

Tests for determining alkali content shall be carried out in accordance with ASTM Standard C114-83A paragraph 17.1 Standard Method of Chemical Analysis of Hydraulic Cement.

E5.2.6 Supplementary Cementing Materials

Use of pozzolans, fly ash or silica fume will be permitted for use in Structural Concrete supplied under this Specification up to a maximum of 15% of cement content.

E5.2.7 Water

Water used for mixing concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances. It shall be equal to potable water in physical and chemical properties.

E5.2.8 Admixtures

No admixtures, other than Air-Entraining Agent and Water Reducing Agent, as specified below, shall be used without the written authorization of the Contract Administrator, unless otherwise specified in these Specifications. It shall be the Contractor's responsibility that each admixture is compatible with all other constituent materials, with respect to the proper performance of the admixture as well as with respect to the proper performance of the other constituents in the presence of the admixture.

(a) Air-Entraining Agent

The air-entraining agent shall conform to the requirements of ASTM Standard C260 and shall produce a satisfactory air-void system and an air content within the ranges specified in CSA Standard CAN/CSA-A23.1-2000 for each class of concrete.

(b) Water-Reducing Agent

The water reducing agent shall be Type WN and shall conform to the requirements of ASTM Standard C494.

(c) Other Admixtures

No other admixtures will be authorized for use in Portland Cement Concrete, unless authorized in writing by the Contract Administrator.

E5.2.9 Styrofoam

Styrofoam shall be high-density expanded polystyrene with a minimum compressive strength of 207 kPa at 10% deformation.

E5.2.10 Patching Mortar

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 1 part cement to 2 parts sand by damp loose volume. White Portland Cement shall be substituted for a part of the grey Portland Cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch unless patch is located in a painted area. The quantity of mixing water shall be no more than necessary for handling or placing.

E5.2.11 Formwork

Unless otherwise indicated on the Drawings, all formwork shall comply as follows:

Formwork materials shall conform to CSA Standard CAN/CSA-A23.1-2000 and American Concrete Publication SP-4 "Formwork for Concrete".

Form sheeting plywood shall be exterior Douglas Fir, concrete form grade, conforming to CSA 0121, a minimum of 20 mm thick.

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

No formwork accessories will normally be allowed to be left in place within 50 mm of the surface following form removal. However, if the Contract Administrator does permit these items to be left in place, they 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.

Forms for exposed surfaces may be either new plywood or steel as authorized by the Contract Administrator.

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.

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.

E5.2.12 Waterstop

The Waterstop, as indicated on the Drawings shall be incidental to the supply and placement of concrete.

E5.2.13 Plain Formliner

Plain formliner shall be Hydroform, or equal as accepted by the Contract Administrator. This formliner shall be used on all exterior exposed formed surfaces.

E5.2.14 Non-Shrink Grout

Where non-shrink grout is used, it shall be Sika 212 Non-Shrink Grout, or equal as accepted by the Contract Administrator. The minimum compressive strength of the grout at 28 days shall be 56 MPa.

E5.2.15 Epoxy Grout

Where epoxy grout is used, it shall be Sika Talygrout 100, or equal as accepted by the Contract Administrator.

E5.3 Concrete Design Requirements

E5.3.1 Mix Design Statement

For each type of concrete used, the Contractor shall provide the Contract Administrator with a Mix Design Statement, certifying the constituent materials and mix proportions that will be used in the Portland Cement Concrete. The Contractor shall include, in the certification, the following information:

- (a) List the product name and source of all proposed constituent materials of the concrete including cement, coarse aggregate, fine aggregate, water, water reducing agent, and air entraining admixture. A statement is required indicating that the constituent materials proposed for each mix design are compatible with each other, thereby providing concrete with good long-term durability capabilities.
- (b) Supply recent records of each mix design for concrete quality control tests including slump, total air content, and 7 and 28-day compressive strengths. The Contractor shall supply reasonable evidence that the mix designs submitted will produce concrete with the specified strength, workability and yield.

When previously satisfactory strength data on the proposed mix is not available, the Contract Administrator may request the preparation of field trial batches in order that the concrete be tested prior to construction. Such field trial batches shall be carried out in similar conditions and using similar equipment, batching, and mixing procedures as will be used in the actual construction. The number of trial batches required shall be determined by the Contract Administrator and shall depend on the class of concrete materials.

- (c) Supply recent test information, on coarse aggregates of water absorption and abrasion.
- (d) Supply recent information, if available on coarse aggregate alkali-silica reactivity.
- (e) Supply recent information on tests performed on Portland Cement, fly ash and silica fume.
- (f) Supply any other information deemed applicable.

E5.3.2 The Contractor shall perform the following tests and submit the results to the Contract Administrator prior to the start of construction.

- (a) Determine the gradation of fine and coarse aggregates in accordance with CSA Test Method A23.2-2A. Results shall be within acceptable limits specified herein.
- (b) The Contractor shall submit test data showing that the Contractor's proportioning and mixing equipment, procedures and concrete mix constituent materials are capable of producing a satisfactory air-void system in the hardened concrete. Prior to Site mobilization, the Contractor shall prepare and cast representative test specimens of each type of concrete using the same proportioning and mixing equipment and procedures, and the same concrete admixtures as will be employed for the supply and placement of each type of structural concrete.
- (c) The air-void system testing program to be carried out by the Contractor prior to Site mobilization must include the following if requested by the Contract Administrator:
 - (i) Date test specimen cast.
 - (ii) Air temperature during casting.
 - (iii) Concrete temperature during placement.

- (iv) Air content of the plastic concrete as determined in accordance with CSA Standard Test Method A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method".
- (v) Slump of the plastic concrete as determined in accordance with CSA Standard Test Method A23.2-5C, "Slump of Concrete".
- (vi) Total air-void content, specific surface, spacing factor, and air-paste ratio of the air-void system in the hardened concrete, as determined in accordance with CSA Standard Test Method A23.2-17C, "Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete".
- (vii) Density of the hardened concrete.
- (viii) Brand and dosage rate of air-entraining and water-reducing admixtures and any other admixtures used in the test specimens.

The test specimen concrete will be considered to have a satisfactory air-void system when the average of all tests shows a spacing factor not exceeding 230 microns with no single test greater than 260 microns.

- (d) Determine the water soluble chloride ion content of the hardened concrete in accordance with CSA Test Method A23.2-4B prior to the start of construction.
- (e) All testing shall be carried out by a CSA certified concrete testing laboratory.
- (f) The cost for batching, casting, and testing trial batch specimens shall be incidental to the Supply and Placement of Structural Concrete. No measurement or separate payment will be made for this Work.

E5.3.3 Concrete Strength and Workability

The Mix Design Statement shall be submitted to the Contract Administrator at least seven (7) days prior to the delivery of any concrete to the job Site. Once accepted by the Contract Administrator, all concrete shall be supplied in accordance with this Statement, which shall be called the Job Mix Formula.

No changes in the Job Mix Formula will be permitted without following the above procedure.

Proportioning of fine aggregate, coarse aggregate, cement, water and air-entraining agent shall be such as to yield concrete having the required properties as follows:

The minimum compressive strength of the cast-in-place concrete shall be 20 MPa before it may be subjected to freezing temperatures.

E5.3.4 Concrete Supply

Unless otherwise specified in these Specifications of the Contract, only the use of a certified ready-mixed concrete plant will be permitted in accordance with Standard Specification CW 3310-R9. Concrete shall be proportioned, mixed and delivered in accordance with the requirements of CSA Standard CAN/CSA-A23.1-2000, "Production of Concrete", except that the transporting of ready-mixed concrete in non-agitating equipment is not permitted without the written permission of the Contract Administrator.

Unless otherwise directed by the Contract Administrator, the discharge of ready-mixed concrete shall be completed within 1½ hours after the introduction of the mixing water to the cement and aggregates.

The Contractor shall maintain all equipment used for handling and transporting the concrete in a clean condition and proper working order.

E5.3.5 Equipment

- (a) General

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.

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

(b) Vibrators

The Contractor shall have sufficient numbers of 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.

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

(c) Miscellaneous Equipment

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.

E5.3.6 Concrete Mix Requirements

Unless indicated otherwise, mix design shall conform to the following:

Structural Component	Agg. Size (mm)	Minimum Concrete Strength MPa (28 days)	Slump (mm)	Cement Type	%Air Entrainment
Abutments	20	35	80 ± 20	50	5 – 8
Wingwalls	20	35	80 ± 20	50	5 – 8
Pier Pile Caps	20	35	80 ± 20	10	5 – 8
Caissons	20	40	100 ± 30	50	4 – 6
Trainman's Walkway	20	35	80 ± 20	10	5 – 8

E5.4 Construction Methods

E5.4.1 Scope of Work

It is intended that this Specification covers the construction of cast-in-place concrete items, as indicated on the Drawings:

E5.4.2 Formliner

Plain formliner shall be used on all exposed formed surfaces. The installation of the formliner shall be in strict accordance with the manufacturer's recommendations. The supply and use of the plain formliner finish shall be considered incidental to the works of this Specification and no separate payment will be made.

E5.4.3 Formwork and Shoring

Formwork shall be designed, erected, braced and maintained to safely support all vertical and lateral loads until such loads can be supported by the concrete all in accordance with CSA Standard CAN/CSA S269.3.

Shoring shall be designed, erected, braced and maintained to safely support all vertical and lateral loads in accordance with AREMA 2004, until such time that the existing or newly constructed structure has sufficient capacity to support the intended loads. Any temporary shoring proposed to support vehicular traffic shall be designed in accordance to CHBDC.

Forms shall be clean before use. Plywood and other wood surfaces shall be sealed against absorption of moisture from the concrete by a factory-applied liner.

Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be commercially manufactured types. The portion remaining within the concrete shall leave no metal within 50 mm of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed 25 mm in diameter.

All exposed edges shall be chamfered 25 mm unless otherwise noted on the Drawings.

Brace shores horizontally in two directions and diagonally in the same two vertical planes so that they can safely withstand all dead and moving loads to which they will be subjected.

The loads and lateral pressures outlined in Part 3, Section 102 of "Recommended Practice for Concrete Formwork", (ACI 347) and wind loads as specified by the National Building Code shall be used for design. Additional design considerations concerning factors of safety for formwork elements and allowable settlements outlined in Section 103 of the above reference shall apply.

Formwork shall be constructed to permit easy dismantling and stripping and such that removal will not damage the concrete. Provision shall be made in the formwork for shores to remain undisturbed during stripping where required.

Forms shall be constructed and maintained so that the completed work is within minus 3 mm or plus 6 mm of the dimensions shown on the Drawings.

Formwork shall be cambered, where necessary to maintain the specified tolerances, to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads.

Forms shall be sufficiently tight to prevent leakage of grout or cement paste.

Form panels shall be constructed so that the contact edges are kept flush and aligned.

Where required by the Contract Administrator, the Contractor shall cast test panels not using less than two panels of representative samples of the forms he proposes for reuse and shall strip them after 48 hours for the Contract Administrator to judge the type of surface produced.

All form lumber, studding, etc., becomes the property of the Contractor when the Work is finished, and it shall be removed from the concrete and the Site by the Contractor after the concrete is set, free of extra charge, and the entire Site left in a neat and clean condition.

It shall be permissible to use the forms over again where possible to a maximum of 3 uses, provided they are thoroughly cleaned and in good condition after being removed from the former portions of the Work. The Contract Administrator shall be the sole judge of their condition and his decision shall be final regarding the use of them again.

E5.4.4 Placing Concrete

The Contract Administrator must be notified at least 48 hours prior to concrete placing so that an adequate inspection may be made of formwork, shoring, reinforcement, and related Works. Concrete placed without required prior notification will be rejected.

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 only on permission from the Contract Administrator and all equipment and processes are subject to acceptance.

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.

Runways for concrete buggies shall be supported directly by the formwork and not on reinforcement.

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.

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 of "cold joints" within the section. If placing must be interrupted, construction joints shall be located where shown on the Drawing or as accepted by the Contract Administrator, failure to do so will result in rejection and removal of concrete.

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

The maximum drop of free concrete into the forms shall not be greater than 1.5 m otherwise rubber tubes or pouring ports spaced not more than 1.5 m vertically and 2.5 m horizontally shall be used. The Contractor shall obtain the Contract Administrator's acceptance prior to pouring concrete of all placing operations.

All concrete, during and immediately after depositing, shall be consolidated by mechanical vibrators so (if recommended by producer) 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.

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

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

E5.4.5 Finishing of Concrete Surfaces

(a) Type 1 Finish – Exterior Exposed Surfaces

All exterior exposed formed surfaces shall be finished by applying a formliner, as outlined within this Specification, to the concrete formwork.

(b) Type 2 Finish - Unformed Surfaces

All unformed concrete surfaces shall be finished as outlined hereinafter.

Screeding of all unformed concrete surfaces shall be performed by the sawing movement of a straightedge along wood or metal strips or from edges that have been accurately set at required elevations.

Screeding shall be done on all concrete surfaces as a first step in other finishing operations. Screeding shall be done immediately after the concrete has been vibrated.

After screeding, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared. The surface shall then

be consolidated with hand floats. Concrete surfaces after floating shall have a uniform, smooth, granular texture.

(c) Type 3 Finish – Unformed Bearing Surfaces

All unformed bearing surfaces and walkways shall be finished as outline hereinafter.

Broom finish of all unformed bearing surfaces to a minimum amplitude of 2 mm and a maximum amplitude of 5 mm.

(d) Type 4 Finish – Remaining Concrete Surfaces

All remaining concrete surfaces, not exposed to view in the completed structure shall be finished as outlined hereinafter.

All remaining concrete surfaces shall have the fins and irregular projections chipped off. Patch honeycomb and fill tie holes with mortar containing approved bonding agent. Mix according to manufacturer's directions.

(e) Type 5 Finish – Rubbed Finish

Use on formed concrete surfaces. Remove fins and projections, patch honeycomb and fill tie holes as required. Saturate with water and rub with medium coarse carborundum stone using a small amount of cement-sand mortar. Continue rubbing until a uniform surface with no irregularities is obtained. Do not remove the paste produced by this rubbing. Carry out final rubbing with a fine stone and water. After the surface is dry, remove loose powder by rubbing with burlap. Leave final surface free from unsound patches, paste, powder and objectionable marks.

E5.4.6 General Curing

Refer to E5.4.9 for cold weather curing requirements and E5.4.10 for hot weather curing requirements.

The use of curing compound will not be allowed.

Concrete shall be protected during the curing period 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 five (5) days after casting or concrete strength has reached 20 MPa.

Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3°C in one hour or 20°C in 24 hours.

Surfaces of concrete which are protected by formwork that is left in place for seven (7) days shall not require any additional curing. Forms will not be permitted to be removed prior to three full days from the time of completion of casting

E5.4.7 Form Removal

The Contract Administrator must be notified at least 24 hours prior to form removal and give approval prior to beginning work.

The concrete forms shall remain in place a minimum of three (3) days, unless otherwise accepted by the Contract Administrator.,

The minimum strength of concrete in place for safe removal of soffit forms for horizontal or inclined members shall be 25 MPa, with the added provision that the member shall be of sufficient strength to safely carry its own weight, together with super-imposed construction loads, and that the forms shall stay in place a minimum of five days unless otherwise accepted by the Contract Administrator.

Field-cured test specimens representative of the cast-in-place concrete being stripped, will be tested as specified in this Specification to verify the concrete strength.

E5.4.8 Patching of Formed Surfaces

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.

All formed concrete surfaces shall have bolts, ties, struts, and all other timber or metal parts not specifically required for construction purposes cut back seventy-five (75) mm from the surface before patching.

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 acceptable to the Contract Administrator, dampening the area to be patched and then applying patching mortar. A slurry grout consisting of water and cement, shall be well 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 surface and left for one hour before final finishing to permit initial shrinkage of the patching mortar, it shall be touched up until it is satisfactory to the Contract Administrator. The patch shall be cured as specified in this Specification. The final colour shall match the surrounding concrete.

All objectionable fins, projections, offsets, streaks, or other surface imperfections shall be removed by means acceptable to the Contract Administrator. Cement washes of any kind shall not be used.

Concrete surfaces shall have a normal finish. Concrete shall be cast against forms, which 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, which will impair the texture of concrete surfaces, shall not be used.

E5.4.9 Cold Weather Concreting

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

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

Supplementary equipment as required below shall be at the Site if concrete is likely to be placed in cold weather.

Formwork and reinforcing steel shall be heated to at least 10°C before concrete is placed.

The temperature of the concrete shall be maintained at not less than 10°C for 7 days or 15°C for 5 days or 20°C for 3 days after placing. The concrete shall be kept above freezing temperature for at least a period of 5 days or until the concrete reaches a strength of 20 MPa. 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 as determined from compressive strength tests on specimens cured under the same conditions as the concrete Works in question.

The temperature of the concrete at the time of placing in the forms shall be within the range specified in CSA Standard CAN/CSA A23.1-2000 for the thickness of the section being placed.

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

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.

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

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

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 housing to the specified 20°C at least 12 hours prior to the start of the concrete placing.

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.

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.

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, temperatures above and below the concrete within the enclosure, temperatures of 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 all times, and shall be turned over to the Contract Administrator at the end of concreting operations.

E5.4.10 Hot Weather Concreting

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

Concrete shall be placed at as low a temperature as possible, preferably below 15°C but not above 27°C . Aggregate stockpiles may be cooled by water sprays and sun shades.

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

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.

Sun shades and wind breaks shall be used as required during placing and finishing.

Work shall be planned so that concrete can be placed as quickly as possible to eliminate the possibility of "cold joints" from occurring at any location.

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

Curing shall follow immediately after the finishing operation.

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

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	27
0.3 - 1	10	27
1.2	5	25

Moderate Drying Conditions:

When surface moisture evaporation exceeds 0.75 kg/m²/h, windbreaks shall be erected around the sides of the structural element.

Severe Drying Conditions:

When surface moisture evaporation exceeds 1.0 kg/m²/h, additional measures shall be taken to prevent rapid loss of moisture from the surface of the concrete. Such additional measures shall consist of the following:

- (a) Erecting sunshades over the concrete during finishing and placing operations.
- (b) Lowering the concrete temperature.
- (c) Applying fog spray immediately after placement and before finishing. Care shall be taken to prevent accumulation of water that may reduce the quality of the cement paste.
- (d) Beginning the concrete curing immediately after trowelling.

The nomograph, Figure D1, Appendix D of CSA Standard CAN/CSA A23.1-2000 shall be used to estimate surface moisture evaporation rates.

E5.4.11 Construction Joints

Construction joints shall be located only where shown on the Drawings or as otherwise accepted in writing by the Contract Administrator. Construction joints shall be at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints.

The face of joints shall be cleaned of all laitance and dirt, after which an epoxy adhesive bonding agent shall be applied. Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.

E5.5 Quality Control

E5.5.1 Inspection

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.

E5.5.2 Access

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.

E5.5.3 Materials

All materials supplied under this Specification shall be subject to testing and acceptance by the Contract Administrator in accordance with E5.2.3.

E5.5.4 Concrete Quality

Quality control tests will be used to determine the acceptability of the concrete supplied by the Contractor, at the sole expense of the Contractor.

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.

The frequency and number of concrete quality control tests shall be in accordance with the requirements of CSA Standard CAN/CSA-A23.1-2000.

An outline of the quality tests is as follows:

- (a) 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 E5.3.6, a second test shall be made.

In the event of a second failure, the concrete will be rejected. If the first test fails Contract Administrator reserves the right to refuse the use of the batch of concrete represented.

- (b) Air content determinations shall be made in accordance with CSA Standard test method 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 E5.3.6, 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 concrete will be rejected. After the first failure, the Contract Administrator reserves the right to reject the batch of concrete represented.

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

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

- (e) 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".

- (f) 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.

- (g) 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 compressive strength as specified in E5.3.6 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.

E5.5.5 Corrective Action

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 approved manner to the satisfaction of the Contract Administrator.

E5.6 Measurement and Payment

E5.6.1 Method Of Measurement

Structural Concrete

The supply and placement of structural concrete shall be measured on a volume basis for each category of concrete. The volume to be paid for shall be the total number of cubic metres of structural concrete 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.

E5.6.2 Basis Of Payment

Structural Concrete

The supply and placement of structural concrete will be paid for at the Contract Unit Price per cubic metre for "Structural Concrete" of the various bridge components listed 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 this item of Work.

All formwork materials, accessories, heating and hoarding are incidental to the supply and placement of structural concrete and no payment shall be made for this Work unless indicated otherwise.

Items of Work

- (i) Abutment Working Slab
- (ii) Abutment Pile Caps
- (iii) Abutment Backwalls
- (iv) Abutment Wingwalls
- (v) Pier Pile Caps
- (vi) Trainman's Walkway

E6. REINFORCING STEEL

E6.1 Description

This Specification shall cover the supply, fabrication, and placement of reinforcing steel.

The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things

necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E6.2 Materials

E6.2.1 General

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

E6.2.2 Handling and Storage of Materials

All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the requirements of CSA Standard CAN/CSA G30.18, except as otherwise specified herein.

E6.2.3 Reinforcing Steel

Reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.

All reinforcing steel shall be supplied in accordance with the reinforcing schedules as shown on the Drawings.

All reinforcing steel shall conform to the requirements of the latest edition of the CSA Standard CAN/CSA G30.18, Grade 400 MPa, Billet-Steel Bars for Concrete Reinforcement. If, in the opinion of the Contract Administrator, any reinforcing steel provided for the concrete works exhibit flaws in the manufacture or fabrication, such material shall be immediately removed from the Site and replaced with acceptable reinforcing steel.

All reinforcing steel shall be straight and free from paint, oil, millscale, and injurious defects. Rust, surface seams, or surface irregularities will not be cause of rejection, provided that the minimum dimensions, cross-sectional area, and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA Standard CAN/CSA G30.18.

E6.2.4 Bar Accessories

Bar accessories shall be of a type acceptable to the Contract Administrator. They shall be made from a non-rusting material or galvanized steel, and they shall not stain, blemish, or spall the concreted surface for the life of the concrete. Bar chairs are to be PVC; galvanized bar chairs are not acceptable.

Bar accessories are not included in the Drawings and shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices and are to be acceptable to the Contract Administrator. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

E6.3 Construction Methods

E6.3.1 Fabrication of Reinforcing Steel

Reinforcing steel shall be fabricated in accordance with CSA Standard CAN/CSA G30.18, latest edition, to the lengths and shapes as shown on the Drawings.

E6.3.2 Placing of Reinforcing Steel

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

Reinforcing steel shall be free from all foreign material in order to ensure a positive bond between the concrete and steel. The Contractor shall also remove any dry concrete, which

has been deposited on the steel from previous pouring operations before additional concrete may be placed. Intersecting bars shall be tied positively at each intersection.

Splices in reinforcing steel shall be made only where indicated on the Drawings. Prior approval of the Contract Administrator shall be obtained where other splices must be made. Welded splices will not be permitted.

Replacement Reinforcing shall be placed accurately in-line with existing reinforcing. Laps, when required shall be typical Class B splices for reinforcing steel. Drilled and epoxy grouted reinforcing shall be embedded as specified on the drawings, or as indicated by the Contract Administrator and installed as required.

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 prior approval of the Contract Administrator. A minimum of twenty-four (24) hours advance notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for inspection of the reinforcement.

E6.4 Quality Control

E6.4.1 Inspection

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.

E6.4.2 Access

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

E6.4.3 Quality Testing

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

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.

E6.5 Measurement and Payment

E6.5.1 Method of Measurement

The supplying and placing of 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, accepted by the Contract Administrator, as computed from the approved reinforcing layout shown on the Drawings, excluding the mass of bar accessories.

E6.5.2 Basis Of Payment

The supplying and placing of Reinforcing Steel shall be paid for at the Contract Unit Price per kilogram for "Supply Reinforcing Steel" and "Place Reinforcing Steel" for the various bridge components listed 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

- (i) Abutments
- (ii) Pier Pile Caps
- (iii) Trainman's Walkway

E7. PRECAST CONCRETE GIRDERS

E7.1 Description

This Specification shall cover the supply of all material, labour, plant and equipment required to complete the work as hereinafter specified and as shown on the Drawings including but not necessarily confined to the following:

- (a) Supply of all materials and the fabrication of prestressed precast concrete box girders as shown on the drawings, including delivery and erection.
- (b) Design and implementation of temporary bracing for lateral stressing.

E7.2 Materials

Manufacturers specification for the concrete for the precast concrete girder shall be strictly followed and shall supersede this Specification should any discrepancies exist.

E7.2.1 Concrete

The concrete shall be 'Agilia', trademark of LaFarge, or approved HPC equivalent.

The concrete shall have minimum compressive strengths of 45 MPa at release of the prestressing strands and 70 MPa minimum 28 day strength, as required by design.

The maximum nominal size of coarse aggregate shall be 14 mm.

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.

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.

When aggregates are subjected to five cycles of the sulphate soundness test, ASTM Designation C88 (latest edition), the mass percentage of loss shall not be more than 10% when sodium sulphate is used, or 15% by mass when magnesium sulphate is used.

Concrete shall contain 5% ± 1% entrained air. Admixtures to be used must be approved by the Contract Administrator.

Cement shall be in accordance with CSA Standard CAN/CSA A23.1-2000.

The use of High Performance cementing compounds is acceptable, provided the supplier can provide documentation verifying the 28 day strength and that the supplier certifies the design mix.

A testing procedure for HPC must be submitted to the Contract Administrator for approval. Use of HPC cannot commence until approval from the Contract Administrator has been received.

The Contractor shall submit shop drawings of the girders one week prior to fabrication of the girder. The Contractor shall produce evidence satisfactory to the Contract Administrator that the concrete mix proportions selected will produce concrete of the quality specified. When previous satisfactory strength data on the proposed concrete mix is not available, the Contract Administrator may require the preparation of trial mixes in order that the concrete be tested prior to fabrications of the girders.

Notwithstanding the Contract Administrator's approval of the design mix, it remains the Contractor's responsibility that the concrete meets all the requirements of this Specification.

E7.2.2 Grout

Grout shall have a compressive strength of 70 MPa @ 28 days and shall be non-shrink, non-metallic. Admixtures to be used in grout must be approved by the Contract Administrator. Grout specified within this Specification section shall be used for the grouting the post-tensioning ducts as well as the precast girder shear keys.

Shear key preparation shall include light sand blasting prior to grout installation as deemed acceptable to the Contract Administrator.

E7.2.3 Prestressing Steel

Prestressing steel shall be Grade 1860 MPa and shall conform to the requirements of CSA Standard G279 and this Specification.

E7.2.4 Reinforcing Steel

Reinforcing steel shall be Grade 400 MPa and shall conform to the requirements of CSA Standard G30.18 and section E4 of this Specification.

E7.2.5 Other Materials

Miscellaneous metal, anchor inserts and lifting devices and all other incidental materials shall be supplied as shown on the Drawings and shall be subject to the approval of the Contract Administrator.

E7.3 Manufacture

E7.3.1 General

All precast concrete components shall be plant manufactured by a manufacturer currently engaged in the special process of precast and prestressed concrete work. This manufacturer shall be a registered member of the Canadian Prestressed Concrete Institute

All plant casting operations for the production of prestressed and precast concrete shall be under the direct supervision of a Registered Professional Engineer in the Province of Manitoba.

The casting operations of the manufacturer shall be continuously open to inspection by representatives of the Contract Administrator. Complete and up-to-date copies of all shop drawings together with a complete set of the Contract Drawings and Specifications shall be kept available for their use.

During production of the precast members, weight checks shall be carried out on completed units when requested by the Contract Administrator.

Mark each member with identifying number and date of casting.

E7.3.2 Tolerances

The distance centreline to centreline of bearings shall not vary by more than 6.5 mm from the lengths shown on the plans, when measured 12 hours after the completion of the stress transfer.

Cross-sectional dimensions including the locations of the prestressing steel, shall not vary from those shown on the plans by more than 3.5 mm.

The bottom surface of members at the bearing areas shall be in a true level plan, which does not vary by more than 1.5 mm from a true straight edge placed in any direction across the area or plate.

E7.3.3 Formwork

The faces of the forms shall be smooth to impart a good finish to the concrete and particular care shall be taken to ensure the verticality and rigidity of the side forms of deck units forming surfaces which will be in contact with each other after erection. The faces of the forms shall be treated with a release agent to ensure that stripping may be carried out without damage to the concrete. Care shall be taken to maintain all embedded material free of the release agent.

Forms shall be constructed as to allow for the redistribution of loading and the movement of the member, which will take place upon application of the prestressing force.

E7.3.4 Stressing

The Contractor shall submit to the Contract Administrator the following at least 7 days prior to the start of stressing operations.

- (a) Copies of the stressing sequence and of the strand elongation calculations as well as all data required for checking these calculations. Separate elongation calculations will be required for each significant variation in the modulus of elasticity of the strand.
- (b) A calibration graph for each jack to be used in the stressing operation.
- (c) The proposed method of tensioning the strands.
- (d) The proposed method of distressing and the distressing sequence.
- (e) The anchorage losses experienced by the Contractor under similar loading applications, and the proposed method of measuring the anchorage losses during the stressing operation.
- (f) A copy of the proposed "Record of Concrete Strength" form, and the "Record of Pre-Tensioning" to be used by the Contractor.
- (g) Camber calculations of girder at release.

The elongation calculations, distressing sequence and all other items having an effect upon the design and performance of the members shall be prepared by a Professional Engineer Registered in Manitoba and the required submissions shall be stamped by the Professional Engineer.

The submission of the stressing calculations to the Contract Administrator shall in no way relieve the Contractor of the Full responsibility for the success or failure of the stressing operations.

The initial force in each strand shall be as shown on the plans or as specified by the Contract Administrator. Prior to the stressing of the strands to the initial force, a 2.2 kN load shall be applied to each strand to eliminate slack and equalize stresses. For the first member

stressed, the 2.2 kN load shall be applied to all strands and then rechecked before stressing any of the strands to the initial force.

A pre-calibrated pressure gauge, tensionmeter or load cell shall be used as a check on the elongation, the accuracy of which shall be verified by the Contractor whenever the Contract Administrator considers it necessary.

Before the stressing operation begins, the Contractor shall have filled out on the approved "Record of Pre-tensioning" form the calculated jack gauge reading, the required gross elongation (based on estimated anchorage losses), and the required net elongation of the each strand. During the stressing operation, the Contractor shall record the actual jack gauge reading, the measure gross elongation, the measured anchorage losses, and then calculate the actual net elongation for each strand.

The actual net elongation of a strand shall not vary from the required net elongation by more than 3.5 mm. The actual anchorage losses encountered shall be used to modify the gross elongation required, if the actual net elongations are consistently greater or less than the required net elongation.

At no time shall the actual jack pressure exceed the pressure corresponding the calculated gross elongation by the 5 percent. If the required gross elongation is not obtained by stressing to this maximum allowable jack pressure at one end of the member, it will be necessary to complete the stressing from the other end of the member.

A copy of the "Record of Pre-Tensioning" form shall be submitted to the Contract Administrator upon completion of the pre-tensioning of each member.

Tensioning shall be carried out in a manner such that the jack is coaxial with the tendon or strand. If the strands are tensioned individually, care shall be taken to ensure the unravelling of the strand does not take place.

For pre-tensioned members, the Contract Administrator has allowed for a stress loss due to an increase in temperature of the prestressing strands from the time of tensioning to the time of initial set of the concrete. In order to verify the design value used for this stress loss, the Contractor shall keep an accurate record of the temperature of the concrete in each member from the time of placing of the concrete until the completion of the steam curing of the first three (3) members fabricated and every third member thereafter. The results shall be plotted on the graph with the ambient air temperature of the same member.

Transfer of the pre-tensioning force shall be carried out by a method approved by the Contract Administrator. If the strands are to be cut, the distressing sequence shall be approved by the Contract Administrator.

All pre-tensioning strands shall be cut off flush with the end of the member and the exposed ends of the pre-tensioning strands and a 50 mm strip of adjacent concrete shall be cleaned and painted. Cleaning shall be by abrasive blast to remove all dirt and residue that is not firmly bonded to the metal or concrete surfaces. The surfaces shall be immediately coated with 25 mm coat of zinc-rich paint approved the Contract Administrator. The paint shall be thoroughly mixed at the time of application and shall be worked into any voids in the pre-tensioning strands.

E7.3.5 Reinforcing Steel

Reinforcing steel shall be placed accurately in the positions shown on the plans, and shall be retained in such positions by means of bar accessories and wires so that the bars shall not be moved out of alignment, during or after the deposition of concrete. Bar accessories shall be galvanized or shall be made from non-rusting material.

Reinforcing steel shall be kept free of all foreign materials in order to ensure a positive bond between the concrete and steel. The Contractor shall remove any material, which has been deposited on the steel before concrete is placed.

Intersection bars shall be tied positively at each intersection.

E7.3.6 Depositing of Concrete

Concrete shall be deposited carefully and well worked by vibrating so that it shall fill the forms completely and make complete contact with all reinforcing bars, prestressing strands, and anchorages.

The concrete shall be deposited in such frequent locations in the forms that there shall be no necessity for moving large quantities of concrete from place to place in the forms. The concrete shall be placed in layers not exceeding 600 mm in depth and each layer shall be vibrated into place by methods, which will not permit the ingredients to separate. The Contractor shall provide and use different personnel on the depositing equipment and on the vibrating equipment to ensure that each batch of concrete shall be properly worked into place as deposited.

The buckets, chutes or any other equipment used to deposit concrete in the members shall be positioned as close to the top of the forms as possible to keep the free fall of the concrete to a minimum.

The depositing of concrete in each unit shall be a single continuous complete operation so that each unit shall be monolithic without joints.

Before any concrete shall be deposited, the interior of the forms shall be made free of all chips, earth, shavings, sawdust, rubbish or other foreign substances.

E7.3.7 Testing of Concrete

Concrete compressive strength requirements will consist of a minimum strength, which must be attained before various loads, or stresses are applied to the concrete. With the exception of the concrete strengths required for:

- (a) Transfer of the pre-tensioning forces.
- (b) Subjecting a member to freezing temperatures.
- (c) Hauling and erecting a member.

All concrete shall attain the minimum strength as shown the Drawings and indicated in this Specification at the age of 28 days. The compressive strength of the concrete is to be determined in accordance with CSA Standard A23.2-2000.

The minimum number of test cylinders that a Contractor shall mold from each separately mixed batch of concrete to be placed in a member is as follows:

- (d) Two (2) cylinder to be tested prior to the transfer of the pre-tensioning forces where applicable.
- (e) Three (3) cylinders for the 28 day strength.
- (f) Two (2) cylinder to be tested prior to the member being hauled to the site and erected, where applicable.

In the event that the strength of the concrete cylinder(s) tested prior to the transfer of the pre-tensioning forces is less than the strength required for transferring the pre-tensioning forces, the Contractor shall mould and test additional cylinders from each subsequent batch of concrete. The number of additional cylinders to be moulded and tested for the purpose of establishing the required concrete strength for the transfer of the pre-tensioning forces will be determined by the Contract Administrator.

All test cylinders shall be cured under the same conditions as the member until such time as the steam curing or moist curing of the member has been completed.

In addition to the moulding of the specified number of test cylinders the Contractor will be required to perform the following tests on every separate batch of concrete to be placed in a member:

- (g) slump
- (h) air
- (i) temperature

and to record the results of such tests. The Contractor shall be responsible for maintaining an up-to-date record of all test results on a "Record of Concrete Strength" form approved by the Contract Administrator. A separate "Record of Concrete Strength" form is to be prepared for each member and the strengths of the test cylinders as well as the pertinent data are to be listed in the same order as the batches of concrete were placed in the forms. A complete set of test results is to be submitted to the Contract Administrator within seven (7) days after the date that the 28 day cylinders from the last member were tested. All costs involved in performing and recording the previously mentioned tests will be the responsibility of the Contractor.

The Contract Administrator at his own discretion and at the Owner's expense may make any other tests deemed necessary on the concrete, on the components of the concrete as well as on any finished or partially finished member. The Contractor must allow the Contract Administrator unhindered access to the concrete, concrete components and members and to also assist the Contract Administrator in carrying out any test.

E7.3.8 Vibrating Concrete

Vibrators shall only be used when acceptable to the concrete supplier.

External vibration shall be used when sections are too small or inaccessible for the internal type.

Internal vibrators shall be used in all sections, which are sufficiently large, and they shall be supplemented by platform or screed-type vibrators in the event that satisfactory top surfaces cannot be obtained with the internal type alone; internal vibrators shall be supplemented with vibrators operated against outside of the forms to improve vertical surfaces.

Vibrators shall be of sturdy construction, adequately powered and capable of transmitting to the concrete not less than 3,600 impulses per minute when operating under load. The vibration shall be sufficiently intense to cause the concrete to flow or settle readily into place and to visibly affect the concrete over a radius of at least 450 mm from the vibrator when used in concrete having 25 mm slump.

A sufficient number of vibrators shall be employed so that at the required rate of placement, vibration and complete compaction are obtained throughout the entire volume of each layer of the concrete. At least one extra vibrator shall be on hand for emergency use. Form vibrators shall be attached to the forms in such a manner as to transmit the vibration to the concrete effectively and the vibrators shall be raised in lifts as filling of the forms proceeds; the dimension of each lift being not more than the height of concrete visibly affected by the vibration. The form vibrators shall be spaced horizontally apart at distances not greater than the radius through which the concrete is visibly affected.

Internal vibrators shall be kept constantly moving vertically in the concrete and they shall be applied at points uniformly spaced that are not farther apart than the radius over which the vibrator is visibly effective. The vibrator shall not be held in one location long enough to draw a pool of grout from the surrounding concrete. Internal vibrators shall be applied

close enough to the forms to vibrate the surface concrete effectively but care shall be taken to avoid hitting the forms with sufficient force to damage them.

With form or internal vibrators, the vibration shall be such that the concrete becomes uniformly plastic and there shall be at least 20 seconds of vibration per square foot of surface of each layer of the concrete, computed on the basis of the visibly affected radius and taking overlapping into consideration.

Surface vibrators shall be applied only long enough to embed the coarse aggregate and to bring enough mortar to the surface for satisfactory screeding.

Care will have to be exercised so as not to damage the prestressing steel in any way, and so that the vibration is not transferred through the steel to concrete already poured and which is at the stage between the initial and final set.

The tops of all members shall receive a screeded, untrowelled surface.

Immediately after the removal of the forms, any defects in the concrete shall be brought to the Contract Administrator's attention and they shall be repaired as directed by the Contract Administrator, provided the defects are not extensive enough to cause rejection of the member.

Honeycomb, if any, shall be repaired as soon as the forms are taken off, subject to the approval of the Contract Administrator. When approved by the Contract Administrator, repairs shall be accomplished by removing any aggregate that is loose or that is not thoroughly bonded to the surrounding concrete, washing the sound concrete with clean water, using a wire brush to remove any loose particles and by applying an approved epoxy resin to the dried areas to be patched immediately prior to the applying of cement mortar. Patched areas shall be rubbed flush with the surrounding surface after the cement mortar has hardened.

Holes made by hold-up or hold-down devices or other fabrication equipment, shall be cleaned of all oil or grease, washed with clean water and then, without delay, patched flush with the surface of the member with the cement mortar.

All objectionable fins, projections, offsets, steaks, or other surface imperfections shall be totally removed to the Contract Administrator's satisfaction by approved means.

E7.3.9 Concrete Finish

Finally, the concrete surface shall be thoroughly wetted down and all air pockets and other surface cavities shall be carefully filled with the approved cement mortar. When sufficiently dry, the surface shall be rubbed down to leave a smooth and uniform finish. Cement washes of any kind will not be allowed.

If, in the Contract Administrator's opinion, the concrete does not adequately fulfill the requirements for sound concrete, the Contractor shall, at his own expense, and as directed by the Contract Administrator, either:

- (a) Completely remove honeycomb areas and replace with the cement mortar, as described above, or
- (b) Give the entire surface or certain designated portions thereof, a rubbed finish as directed by the Contract Administrator, or
- (c) Coat the entire surface or certain designated portions thereof, with a cement base heavy duty, waterproof coating such as Thoroseal or equivalent, or
- (d) Replace the member if, in the Contract Administrator's opinion (a), (b) or (c) as stated above, will not be satisfactory or will be detrimental to the strength of the member.

E7.3.10 Curing

Concrete shall be either moist cured for a minimum of three days from the time of casting or steam cured until the concrete has reached a strength (fci) as shown on the plans or as specified by the Contract Administrator.

If steam curing is used, it shall not be applied until after the initial set has taken place. Initial set shall be considered to have taken place four (4) hours after the completion of concrete placing. The cylinders used to determine the concrete strength shall be cured under the same conditions as the member in question.

From the time of pre-tensioning to the time of initial set, the ambient air temperature of the member shall not vary by more than $\pm 3^{\circ}$ C. During steam curing the ambient air temperature shall rise at a rate not to exceed 4.4° C per hour to a maximum temperature of 60° C.

An air temperature recording thermometer approved by the Contractor Administrator shall be laced on the top of the member after placing of concrete is completed and the thermometer shall not be removed until after steam curing has been completed. A graph showing the ambient air temperature plotted against the time of day shall be submitted to the Contract Administrator by the Contractor upon completion of the steam curing for each member. The graph shall be properly identified as to the hour, day, month and year, as well as to the times of the completion of placing concrete, and of the start and completion of steam curing.

Once curing has been completed, the temperature of the concrete shall not be allowed to fall at a rate exceeding 15° C per hour.

The members shall not be subjected to freezing temperatures until reaching the design strength (fci) as shown on the plans.

E7.3.11 Grouting

Grout shall be mixed preferably in a colloidal grout mixer of the roller type or a high speed stirring mixer capable of operating from 1,800 to 2,000 r.p.m. The mixing shall be done at high speeds for 2 or 3 minutes, followed by slow agitation until the grout is used up.

From the mixer, the grout shall pass through a strainer into positive displacement grouting pumps equipped with a re-circulating device for use when the grout is not being injected.

The member shall be kept from freezing for at least 72 hours beyond the completion of grouting or mortaring operations, providing that the preceding temperatures have not been below 15.6° C. In the event that the preceding temperatures are below 15.6° C, the 72 hours may be extended by the Contractor Administrator.

The Contractor shall take not less than six (6) standard cubes at his own cost during each day of grouting operations for 7 and 28 day strength determinations. The results of these tests as well as the slump, air tests and grout temperature shall be supplied to the Contractor Administrator.

The Contractor must take steps as to ensure the ducts will not have air pockets upon completion of grouting. Grout admixtures to increase flowability are acceptable. Admixtures must be reviewed by the Contract Administrator.

E7.4 Handling and Erection

Lifting devices shall be cast into the concrete at the locations as shown on the Shop Drawings. The devices shall be of such a nature as to avoid twisting, racking, or other distortions while handling, storing, moving, and erecting the members. The devices shall be fully anchored to the main body of concrete. The Contractor shall be responsible for the adequacy and location of the lifting device.

The members shall not be hauled to the site or erected until the concrete design strength (f'c) has been reached.

The Contractor shall be responsible for the sequence and all incidental Works for the installation of the precast prestressed concrete box girders and shall submit, to the Contract Administrator, an erection plan, sealed by a Professional Engineer Registered in the Province of Manitoba, including the proposed equipment to be used, positioning of the equipment, the sequence of erection, the design and installation details of the temporary lateral support beam for use during post tensioning, the time frame in which the post tensioning shall occur, the sequence of post tensioning, and the manner in which the grout is to be placed, at least three (3) business days before any precast prestressed concrete box girders are to be placed on Site.

Written proof of the concrete strength of the precast prestressed concrete box girders shall be submitted to the Contract Administrator at least three (3) business days prior to the erection of the precast prestressed concrete box girders.

Records showing details of members installed, temporary bracing installed or removed and weather conditions shall be kept daily and be available to the Contractor Administrator upon request.

The contractor is responsible for installation procedure and stressing sequence. However, the centre girder must be placed accurately, anchor pintels install and grouted prior to lateral post-tensioning. Grout must have sufficient strength as to resist lateral stressing.

The Contractor is responsible for obtaining CN Rail Protection for installation of the precast concrete girders. All costs associated with CN Flagpersons shall be included herein this pay item for installation and delivery of the precast concrete girders.

E7.4.1 Temporary Bracing

The Contractor shall be responsible for the design, supply, installation and removal of:

- (a) Erection bracing
- (b) Transportation bracing
- (c) Lateral stability bracing during lateral stressing

The Contractor shall submit his proposed methods for the bracing to the Contract Administrator for approval, but an approval shall not in any way relieve the Contractor of his responsibility to design and safe installation of and satisfactory bracing.

E7.4.2 Temporary Works

A Registered Professional Engineer shall design erection bracing, transportation bracing, and lateral stability bracing if required for erection of prestressed precast concrete members. The Contractor shall be responsible for the design of such works.

If specifically requested by the Contract Administrator the Contractor will submit the detailed drawings and design calculations bearing the Professional Engineer's stamp to the Contractor Administrator for information only.

- (a) The submission of such detailed working drawings and design calculations to the Contract Administrator shall in no way relieve the Contractor of the full responsibility for the success or failure of these temporary works detailed on these drawings.

E7.5 Shop drawings, sealed by a Professional Engineer Registered in the Province of Manitoba shall be submitted to the Contract Administrator a minimum of fourteen (14) days prior to the box girder fabrication.

E7.6 Installation of Precast Box Girder shall include transportation to Site, placement of the box girders, lateral post-tensioning, pressure grouting of the post-tensioning ducts, lateral connections, steel bearing plates. Installation procedures sealed by a Professional Engineer Registered in the Province of Manitoba shall be submitted to the Contract Administrator a minimum of seven (7) days prior to transportation of the box girders to the Site.

E7.7 Measurement and Payment

E7.7.1 Method of Measurement

(a) Supply Precast Concrete Girders

Supply precast concrete girders shall be measured on a per girder basis.

(b) Install Precast Concrete Girders

Install precast concrete girders shall be measured on a per girder basis.

E7.7.2 Basis of Payment

(a) Supply Precast Concrete Girders

Supply of precast concrete girders shall include structural design of bracing and fabrication of pre-stressed precast concrete box girders. All costs for fabrication of projected reinforcing shall be incidental to this pay item. This pay item shall also include submission of concrete mix design. Payment shall be made as per the unit price per girder for "Supply Precast Concrete Girders" as listed below based on satisfaction of concrete testing and approval of product from the Contract Administrator for:

- (i) Exterior Girders G1
- (ii) Exterior Girders G2
- (iii) Interior Girders G3
- (iv) Refuge Bay Girders G4

(b) Install Precast Concrete Girders

Install Precast Concrete Box Girders shall be paid for at the unit price for "Install Precast Concrete Girders" as herein specified and accepted by the Contract Administrator.

E8. EXPANSION AND FIXED JOINTS

E8.1 Description

This Specification shall cover the supply and installation of the expansion and fixed joints for the proposed bridge.

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

E8.2 Material

E8.2.1 General

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

E8.2.2 Grout

Grout shall be non-metallic, non-shrink grout of a type approved by the Contract Administrator.

E8.2.3 Expansion Joints

All expansion joints on bridge deck shall be Goodco Goodflex Type C or approved equal. The expansion joint extending over the trainman's walkway shall be O.S. Brown K-5000 Compression Seal.

E8.2.4 Fixed Joints

Fixed joints shall be the same products specified for expansion joint.

E8.3 Equipment

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

E8.4 Fabrication

Shop drawings showing fabrication details of expansion and fixed joints, complete with galvanized steel armouring plates and anchors, as required by the Drawings and the specific manufacturer specification for the expansion and fixed joints indicated herein this Specification, shall be provided to the Contract Administrator for approval. Submission of shop drawings to the Contract Administrator in no way relieves the Contractor of his responsibility for the fabrication quality and accuracy and proper installation of the expansion and fixed joints as indicated herein this Specification and on the Drawings.

E8.5 Construction Methods

E8.5.1 Expansion Joints

The Contractor shall install expansion joints at the locations shown on the Drawings in accordance with the Manufacturer's recommendations. Field measurements shall be taken prior to fabrication of expansion joints.

E8.5.2 Fixed Joints

The Contractor shall install fixed joints at the locations shown on the Drawings in accordance with the Manufacturer's recommendations. Field measurements shall be taken prior to fabrication of expansion joints.

E8.6 Quality Control

All workmanship and all materials furnished and supplied under this Specification are subject to the close and systematic inspection by the Contract Administrator. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Contract Administrator reserves the right to reject any materials or works, which are not in accordance with the requirements of this Specification or manufacturer's recommendations.

E8.7 Measurement and Payment

E8.7.1 Method of Measurement

(a) Supply and Install Expansion Joints

Supply and install expansion joints shall be measured on a per linear metre basis.

(b) Supply and Install Fixed Joints

Supply and install fixed joints shall be measured on a per linear metre basis.

E8.7.2 Basis of Payment

(a) Supply and Install Expansion Joints

Supply and install of expansion joints shall include the supply and installation of the expansion seals at SU2, SU3 and SU4. Payment shall be made as per the unit price for "Supply and Install Expansion Joints" and shall include material supply, fabrication, transportation and installation as shown on the Drawings. The submission of shop drawings detailing the expansion joint and installation procedure shall be included herein this pay item.

The linear metres to be paid shall be the total length of supply and install expansion joints supplied and placed in accordance with this Specification and accepted by the Contract Administrator, as computed from Drawing dimensions.

(b) Fixed Joints

The supply and placement of fixed joints shall include the supply and installation of the expansion seals at SU1 and SU5. Payment shall be made as per the unit price for "Supply and Install Fixed Joints" and shall include material supply, fabrication, transportation and installation as shown on the contract drawings. The submission of shop drawings detailing the expansion joint and installation procedure shall be included herein this pay item.

The linear metres to be paid shall be the total length of supply and install fixed joints supplied and placed in accordance with this Specification and accepted by the Contract Administrator, as computed from Drawing dimensions.

E9. BEARINGS

E9.1 Description

This Specification shall cover the supply and installation of the bearings, steel plates and angles and steel pintels for the proposed bridge.

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

E9.2 Material

E9.2.1 General

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

E9.2.2 Material

(a) Bearing Pads

The bridge bearing pads shall be supplied and installed by the Contractor as shown on the Drawings.

(i) Expansion Joints

Bearing pads shall be Goodco Laminated Elastomeric pads as shown on the Drawings or approved equivalent. Bearing pads shall have Shore A hardness of 55 Durometer.

(ii) Fixed Joints

Bearing pads shall be Goodco Laminated Elastomeric pads as shown on the Drawings or approved equivalent. Bearing pads shall have Shore A hardness of 60 Durometer.

(b) Pintels, Steel Plates and Steel Angles

Steel pintels, embedded plates and angles shall be supplied and installed as shown on the drawings. Steel pintels shall be ANSI 316 stainless steel.

(c) Grout

Grout shall be non-metallic, non-shrink grout of a type approved by the Contract Administrator.

E9.3 Equipment

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

E9.4 Fabrication

Shop drawings showing details of bearings, completed with laminated and non-laminated bearing pads and steel bearing plates shall be provided to the Contract Administrator for approval. Submission of shop drawings to the Contract Administrator in no way relieves the Contractor of his responsibility for the fabrication quality and accuracy and proper installation of the bearing pads as indicated herein this Specification and on the Drawings.

E9.5 Guarantee

E9.5.1 Fabrication Guarantee

The bearing supplier shall provide a written guarantee stating that they will perform satisfactorily within the design range of movement and under the design loads for a period of five (5) years from the issuance of the Final Certificate, provided that the bearings have been properly installed. The supplier shall state that they have reviewed the installation procedures and find it in accordance with their recommendations. The supplier shall guarantee the replacement of the bearings at no cost to the City in the event that the bearings does not perform satisfactorily within the design range of movement and under the design loads.

E9.5.2 Installation Guarantee

The Contractor shall ensure that the bearings are installed in such a manner that will not void the fabrication guarantee.

The Contractor shall guarantee in writing, the performance of the bearings for a period of five (5) years from the date of issuance of the Final Certificate. Provided in the guarantee for the replacement of the bearings at no cost to the City in the event that the bearings do not perform satisfactorily in the range of design movement and under the design loads.

E9.6 Construction Methods

E9.6.1 Bearings

The bearings, complete with steel pintels, embedded plates and angles shall be installed by the Contractor prior to placing the girders.

Before erection of the bearings, the Contractor shall satisfy himself that the location of substructure units and elevations of bridge seats are in accordance with the plans and specifications. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.

Workmanship and finish shall be in accordance with plans and specifications and shall conform to the best practices of bridge construction. The parts shall be assembled as shown on the plans and all match marks shall be observed. The material shall be handled carefully so that no parts will be bent, broken or otherwise damaged.

E9.7 Quality Control

All workmanship and all materials furnished and supplied under this Specification are subject to the close and systematic inspection by the Contract Administrator. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Contract Administrator reserves the right to reject any materials or works, which are not in accordance with the requirements of the specification.

E9.8 Measurement and Payment

E9.8.1 Method of Measurement

(a) Supply and Install Girder Expansion Bearing Pads

Supply and install girder expansion bearing pads, shall be measured on a per unit basis. Each unit shall include the individual bearing pad supplied and placed in accordance with this Specification, the Drawings and as accepted by the Contract Administrator.

(b) Supply and Install Girder Fixed Bearing Pads

Supply and install girder fixed bearing pads shall be measured on a per unit basis. Each unit shall include the individual bearing pad and pintel supplied and placed in accordance with this Specification, the Drawings and as accepted by the Contract Administrator.

E9.8.2 Basis of Payment

(a) Supply and Install Girder Expansion Bearing Pad

Supply and install girder expansion bearing pads shall include material supply, fabrication, transportation and installation as shown on the contract drawings. Payment shall be made at the Contract Unit Price for "Supply and Install Girder Expansion Bearing Pads" on a per unit basis supplied and placed in accordance with this Specification and accepted by the Contract Administrator, as computed from the Drawings. The submission of shop drawings detailing shall be included herein this pay item.

(b) Girder Fixed Bearing Pad

Supply and install girder fixed bearing pads shall include material supply, fabrication, transportation and installation as shown on the contract drawings. Payment shall be made at the Contract Unit Price for "Supply and Install Girder Expansion Bearing Pads" on a per unit basis supplied and placed in accordance with this Specification and accepted by the Contract Administrator, as computed from the Drawings. The submission of shop drawings detailing shall be included herein this pay item. The submission of shop drawings detailing shall be included herein this pay item.

E10. PRECAST CONCRETE PILES

E10.1 Description

This Specification shall cover the supply and driving of 400 A/F precast prestressed hexagonal concrete piles.

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.

The Contractor is responsible for obtaining CN Rail Protection for installation of the precast concrete piles. All costs associated with CN Flagpersons shall be included herein this pay item for installation and delivery of the precast concrete piles.

E10.2 Material

E10.2.1 General

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

E10.2.2 Handling and Storage

The method of handling and storing pre-cast concrete piles shall be such as to eliminate the danger of fracture, impact or undue bending stresses and shall be in accordance with the recommendations of the pile manufacturer. The Contractor, in handling or lifting the piles, will not be permitted to drag them along the ground. Any piles excessively damaged or broken through negligence or improper handling operations shall be immediately removed from the site and replaced with sound piles by the Contractor at his own expense.

E10.2.3 Precast, Prestressed Hexagonal Concrete Piles

- (a) The pre-cast concrete piles shall be pre-cast, pre-stressed hexagonal concrete piles conforming to the requirements of CSA Standard CAN/CSA-A23.4 Precast concrete and as details on the drawings. Pre-cast concrete piles shall be supplied in the sizes, lengths and quantities as shown on the drawings.
- (b) Pile alignment shall not vary by more than 2 mm per metre of length with a maximum variation of twenty-five (25) mm from end to end of pile. Pile cross-sections shall in no case vary suddenly by more than 5 mm or gradually by more than 10 mm.
- (c) The concrete for the pre-cast concrete piles shall conform to the requirements of CSA Standard CAN/CSA-A23.1-2000 Concrete Materials and methods of concrete construction. The cement shall be sulphate resisting Portland cement, and the maximum size aggregate shall be 20 mm nominal.
- (d) The concrete compressive strength of the pre-cast concrete piles shall be 25 MPa minimum at time of stress transfer (distress), and shall be 35 MPa minimum at time of driving.
- (e) The prestressing steel for the pre-cast concrete piles shall be seven wire strand, conforming to the requirements of CSA standard G279, Grade 1860, uncoated, high tensile, low relaxation.
- (f) The reinforcing steel for the pre-cast concrete piles shall be deformed steel bars conforming to the requirements of CSA Standard G30.18 of Grade 400. The minimum cover on reinforcing and / or prestressing steel shall be 50 mm.
- (g) Piles shall be so proportioned, pretensioned, cast and cured to be able to resist all loads from handling and driving as well as maximum design load of 800 kN for 400 mm hexagonal piles.
- (h) Each pile shall be stamped or marked with the date of manufacture. Lifting loops shall be cast into each pile.

E10.3 Equipment

- (a) All pile driving equipment shall be of such a capacity that the required bearing penetration will be obtained without undue damage being done to the pile. Piles shall be driven by a hammer with a rated energy of 40,000 N-m.
- (b) Only fixed lead pile drivers shall be used, unless the Contract Administrator gives approval for other types of equipment, hanging or swinging leads will only be approved if they are so constructed that they can be held in a fixed position during the

driving operations. All leads shall be of such construction as to drive the piles to their true and correct alignment, as indicated on the drawing. The Contractor shall furnish the Contract Administrator with the manufacturer's specifications and catalogue for all steam, diesel or air hammers used, showing all the data necessary for computing the bearing value of piles driven. Gravity or drop hammers shall be weighted in the presence of the Contract Administrator, or a certificate of weight shall be furnished to the Contract Administrator. Hammers so weighted shall have the exact weight stamped on them. A gravity hammer shall have a minimum weight of 1,350 kg., exclusive of pile cap. Water jets shall not be used, unless the Contract Administrator agrees that such use is necessary or desirable. The heads of concrete piles shall be protected by a cap of a design approved by the Contract Administrator. The bottom of the cap shall have a recess with a cushion of rope or other material next to the pile head and the top of the cap shall have a timber shock block.

E10.4 Construction Methods

E10.4.1 Location and Alignment of Piles

The piles shall be driven in the positions shown on the drawings or as directed by the Contract Administrator. Piles shall be driven vertically unless shown otherwise on the drawings. Batter piles shall be driven to the batter specified and shall not be jacked or pulled into their final positions.

E10.4.2 Driving of Piles

- (a) The piles shall be driven in the positions shown on the drawings or as directed by the Contract Administrator. All piles shall be driven vertically unless shown otherwise on the drawings. Piles shall be placed not more than 2 percent out of plumb (for vertical piles) and not more than 75 mm off centre, measured as time of cut-off. Rather than reject misaligned piles, the Contract Administrator may decide to increase the size of the pile caps to accommodate the misaligned. In this case, the total cost of such a change, including engineering and construction costs shall be deducted from the monies owing the Contractor.
- (b) The Contractor shall drive the piles in augured holes, which may be augured as deep as 4 m, or to the bottom elevation of the pile caps. The method, size and depth of hole must first be approved by the Contract Administrator. The method of driving shall be such as not to impair the strength of the pile and shall meet the approval of the Contract Administrator. All piles shall be driven to refusal as end bearing piles, as determined by the Contract Administrator. The final set for the piles shall be three (3) consecutive sets of 12 blows per 25 mm for 400 mm piles. The Contractor will be required to remove any surface and / or shallow depth obstruction(s) to obtain the required penetration of the pile.
- (c) Piles covering a large area or in groups, shall be driven working out from the centre of the area or group to ensure that the piles at the boundaries are in their correct final positions.
- (d) If, during the piling operations, upheaval of piles occurs, the Contractor will be required to re-drive the lifted piles down to their original elevations. The Contractor will also be required to excavate material, which has boiled up during pile driving operations. The elevation of all piles previously driven or re-driven shall be observed to detect uplift. If uplift of 3 mm or more occurs in any pile, that pile shall be re-driven to its original elevation and thereafter to the required final driving resistance.
- (e) Driving of all piles shall be continuous without intermission until the pile has been driven to final elevation. The tops of the piles shall be maintained at or above a point located a minimum of 600 mm above cut-off elevation.
- (f) Where boulders or other obstructions make it difficult to drive certain piles in the location shown and to the proper bearing strata or depth, the Contractor shall resort to

all usual methods to install piles as required, including spudding, pre-drilling, jetting or other feasible means. If, in the judgment of the Contract Administrator, the Contractor is unable to complete properly any pile or piles driven to replace the original pile in the contract they shall be abandoned. Piles abandoned because of obstructions encountered before reaching the accepted bearing strata shall be cut off at the cut-off elevation and paid for as outlined hereinafter.

- (g) Any piles which are excessively spalled, crushed or broken through negligence of the Contractor shall be removed or otherwise replaced as directed by the Contract Administrator, unless, in the opinion of the Contract Administrator, the damage is so slight that the pile can be repaired properly, which repairs shall be done by the Contractor at his own expense.
- (h) Holes for the piles may be pre-drilled to a maximum depth of 4 metres. The minimum pile penetration below the bottom elevation, at the start of driving of the pile shall be 3 metres. The Contractor shall excavate or otherwise remove obstructions to ensure piles are driven to site below this elevation.

E10.4.3 Cut Off of Piles

After piles have been driven to the required penetration (and if required re-driven), the Contractor shall mark the required cut-off elevation on each pile. The top of all piles shall be neatly cut off (true to level) at the cut-off elevation to expose a minimum of 600 mm of pile prestressing strands, ready for bending into the cast-in-place concrete as dowels.

E10.5 Quality Assurance

E10.5.1 Inspection

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection 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 approval that may have been previously given.

E10.5.2 Access

The Contract Administrator shall be afforded full access for the inspection and control testing of the pre-cast piles both at the site of work and at any plant used for the fabrication of the pre-cast piles, to determine whether the pre-cast piles are being supplied in accordance with this specification.

E10.5.3 Pile Driving Records

The Contractor shall mark 300 mm increments on each pile, with spray paint, over the entire length of each pile, prior to placement of the pile.

The Contract Administrator will keep a record of each and every pile driven. The records shall give the date, time, the diameter, length, location, type, total depth of penetration, rate of penetration, number of blows per 300 mm, refusal counts, steam, air or diesel pressure and kind and size of hammer used in driving, any unusual phenomena shall be noted and recorded, especially if they indicate possible damage to the pile.

Energy output of driving equipment at the time of final set shall be carefully recorded, along with the final penetration readings and reported immediately to the Contract Administrator. The required set per blow will be subject to approval by the Contract Administrator, showing regard to the specific driving equipment and piles permitted.

E10.6 Measurement and Payment

E10.6.1 Method of Measurement

Supply Precast Concrete Piles shall be measured on a linear metre basis. The number of linear metres to be paid for shall be the total number of linear metres acceptably supplied in accordance with this Specification and accepted by the Contract Administrator.

Drive Precast Concrete Piles shall be measured on a linear metre basis. The total number of linear metres supplied less fifty (50) percent of the number of linear metres of piling cut-off after driving, except where piles are driven to their final elevation without the requirement for a cut-off.

E10.6.2 Basis of Payment

Supply and drive precast concrete piles shall be paid for at the Contract Unit Price per linear metre for "Supply" and "Drive" Precast Concrete Piles measured as specified herein, which price shall be payment in full for the supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification

E11. ROCK-SOCKETED CAISSONS

E11.1 Description

This Specification shall cover all operations relating to the supply and installation of rock-socketed caissons for piers, including the supply and placement of concrete and reinforcing steel for the rock-socketed caissons.

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

The Contractor is responsible for obtaining CN Rail Protection for installation of the rock socket caissons. All costs associated with CN Flagpersons shall be included herein this pay item for installation and delivery of materials for the rock socket caissons.

E11.2 Elevations on Drawings

The elevations indicated on the rock socketed caisson Drawings are approximate only. The geotechnical report shall be referred for accurate soil conditions and elevations. The soil profile elevations stated on the drawings are only a guide.

E11.3 Materials

E11.3.1 General

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

E11.3.2 Handling and Storage

All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA A23.1 (2000). Materials damaged by careless or negligent handling or storage by the Contractor shall be replaced at the Contractor's expense.

E11.3.3 Testing

All materials supplied under this Specification shall be subject to inspection by the Contract Administrator and testing by the Testing Laboratory designated by the Contract

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

All materials shall be approved 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 specification detailed herein or are found to be defective in manufacture or have become damaged in transit, storage or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

E11.3.4 Steel Casings

Steel casings shall be as follows:

- (a) 914 mm diameter x 20 mm thick permanent casing as indicated on the Drawings, conforming to CSA G 40.21, Grade 300W.
- (b) 1067 mm diameter x 20 mm thick permanent casing as indicated on the Drawings, conforming to CSA G 40.21, Grade 300W. 1067 mm dia. steel casing shall be hot dip galvanized the top 6.5 metres of pile.

The lengths of the piles shall be as shown on the Drawings. The length may be increased, based on the rock quality determined at the time of construction.

Galvanizing shall be in accordance with CSA G164.

E11.3.5 Concrete

The concrete shall conform to Section E5 of this Specification.

The concrete shall be placed by the tremie method if dewatering is not successful.

E11.3.6 Reinforcing Steel

The reinforcing steel shall conform to Section E6 of this Specification.

E11.4 Equipment

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

E11.4.1 Tremie Equipment

The tremie pipe shall consist of a tube, having a diameter of not less than 250mm, constructed with sections having flange couplings fitted with gaskets. The discharge end shall have a proper seal so that water will not enter the tube at any time. Tremie concrete may also be deposited by means of a bottom dump tremie bucket equipped with a closing top. The tremie bucket shall be of a type approved by the Contract Administrator.

E11.5 Construction Methods

E11.5.1 Location and Alignment of Caissons

The Caissons shall be installed in the positions shown on the Drawings or as directed by the Contract Administrator. The Contractor will be required to remove obstructions in order to achieve the proper pile alignments.

E11.5.2 Cut-off of Steel Casings

The casings shall be set to the elevations shown on the Contract Drawings.

All costs associated with the casing cut-offs shall be incidental to the appropriate Contract Unit Price for "Supply Steel Casings".

E11.5.3 Dewatering

Any water present within the caisson holes shall be pumped out and removed from site.

The caisson hole safe and dewatered to facilitate inspection by the Contract Administrator.

All costs associated with the dewatering shall be incidental to the appropriate Contract Unit Price for "Supply and Install Rock-Socketed Caissons".

E11.5.4 Rock-Socketed Caisson Installation

The Contractor shall drill holes, or use a down hole hammer, at each caisson location down to bedrock. Temporary steel casings shall be advanced into the bedrock.

The Contract Administrator may determine one or more of the temporary steel casings may be required to be changed to a permanent casing should the quality or condition of the earth and or rock indicate such a requirement at the time of construction.

The Contractor shall construct sockets into bedrock using a down-hole hammer powered by compressed air, or by coring. The sockets shall be advanced a minimum of 3500 mm into sound bedrock as determined by the Contract Administrator. The Contract Administrator may require extension of the rock sockets if, in the opinion of the Contract Administrator, it is necessary in order to reach a suitable layer of bedrock.

Sockets shall be de-watered, and loose and broken rock removed using compressed air.

After de-watering, the caisson hole shall be inspected by the Contract Administrator. Upon approval of the caisson hole by the Contract Administrator the Contractor shall place the reinforcing steel as indicated on the Drawings and fill the entire length of the caissons with concrete to the top elevation of the permanent 914 mm diameter steel casing as indicated on the Drawings. The 1067 mm diameter steel casing shall then be placed to the elevation and positions indicated on the Drawings. Install reinforcing steel and place concrete as indicated on the Drawings.

E11.5.5 Tremie Concrete Procedure

Where tremie concrete is to be used, sufficient additional cement shall be added to the mix to compensate for dilution due to the depositing of concrete in the water.

Tremie concrete shall be deposited in a manner approved by the Contract Administrator. Tremie concrete shall not be placed without the Contract Administrator's approval.

To prevent segregation, concrete deposited underwater shall be carefully deposited in a compact mass in its final position by means of a tremie pipe, or other approved method, and shall not be disturbed after being deposited. Still water shall be maintained at the point of deposit. The water level shall be regulated so that there is no fluctuation of water pressure that may be injurious to the concrete.

The minimum rate of depositing tremie concrete shall be 15 m³/hr. Continuous soundings shall be taken during the concrete pour and all irregularities in the concrete profile shall be corrected. If a tremie pipe is used, it shall be supported so as to permit

- (a) free movement of the discharge end over the entire top surface of the work, and
- (b) rapid lowering when necessary to retard or stop the flow of concrete.

The discharge end shall be closed at the start of the work in order to prevent water from entering the tube and it shall be sealed at all times when not within the deposited concrete.

The tremie tube shall be kept full up to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it within the deposited concrete.

If a bottom dump tremie bucket is used, the rate of lowering and raising shall be such that the bucket does not create undue turbulence in the rock socket. The bucket shall always be within the deposited concrete when the bottom is opened.

Where tremie concrete is used, in addition to the heating and hoarding requirements in E5.4.9, the Contractor shall heat the water inside the temporary sleeves and rock sockets to a minimum temperature of 5 °C, and after the concrete has been deposited and shall maintain the water above the rock socket at this temperature for a period of at least 7 days.

If tremie concrete methods are used, the associated cost shall be incidental to the Contract Unit Price for "Supply and Install Rock-Socketed Caissons".

E11.5.6 Heating and Hoarding

The Contractor shall make provisions for heating the concrete, the permanent and casings to a minimum of 5 °C prior to placing any concrete. The deposited concrete shall be heated and protected against freezing in accordance with E5.4.9. All costs associated with heating and hoarding shall be incidental to the Contract Unit Price for "Supply and Install Rock-Socketed Caissons".

E11.6 Measurement and Payment

E11.6.1 Method of Measurement

E11.6.1.1 Supply and Install Rock-Socketed Caissons

Supply and install rock-Socketed caissons shall be a Lump Sum item for the work stated in this Specification and on the Drawings. No measurement will be made for this item.

E11.6.1.2 Provisional Items

E11.6.1.2.1 Temporary Casings Converted to Permanent Casings (914 dia.)

Supply of temporary steel casings converted to permanent casings is a provisional item and shall be measured on a per metre basis of 914 mm diameter temporary steel casings converted to permanent steel casings as approved and deemed required, in writing, by the Contract Administrator.

Measurement for installation shall be per linear metre.

E11.6.1.2.2 Increase Caisson Length

(i) 1067 dia. Caisson Length Increase (including steel casing)

1067 dia. caisson length increase (including steel casing) is a provisional item and shall be measured on a linear metre basis for each additional metre of length of 1067 dia. caisson length increase as approved and deemed required, in writing, by the Contract Administrator.

(ii) 914 dia. Caisson Length Increase

914 dia. caisson length Increase is a provisional item and shall be measured on a linear metre basis for each additional metre of length of 914 dia. caisson length Increase as approved and deemed required, in writing, by the Contract Administrator.

(iii) 760 dia. Rock-Socket Length Increase

760 dia. rock-socket length increase is a provisional item and shall be measured on a per metre basis for each additional metre of length of the 760 dia. rock-socket length increase as approved and deemed required, in writing, by the Contract Administrator.

E11.6.2 Basis of Payment

E11.6.2.1 Supply and Install Rock-Socketed Caissons

Supply and install rock-socketed caissons shall be paid at the Contract Lump Sum Price for "Supply and Install Rock-Socketed Caissons", measured as specified herein, 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 and on the Drawings.

E11.6.2.2 Provisional Items

E11.6.2.2.1 Temporary Casings Converted to Permanent Casings

Temporary casings converted to permanent casings shall be paid at the Contract Unit Price for the provisional item "Temporary Casings Converted to Permanent Casings (914 dia.)", measured as specified herein, 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 and the Drawings.

E11.6.2.2.2 Increase Caisson Length

(i) 1067 dia. Caisson Length Increase (including casing)

1067 dia. Caisson Length Increase (including casing) shall be paid at the Contract Unit Price for the provisional item "1067 dia. Caisson Length Increase (including casing)", measured as specified herein, 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.

The 1067 dia. Caisson Length Increase (including steel casing) provisional item shall be activated when the minimum specified caisson length, as indicated on the Drawings, is exceeded by 1000 mm or more as directed, in writing, by the Contract Administrator.

(ii) 914 dia. Caisson Length Increase

914 dia. caisson length increase shall be paid at the Contract Unit Price for the provisional item "914 dia. Caisson Length Increase" measured as specified herein, 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.

The 914 dia. caisson length increase provisional item shall be activated when the minimum specified caisson length, as indicated on the Drawings, is exceeded by 1000 mm or more as directed, in writing, by the Contract Administrator.

(iii) 760 dia. Rock-Socket Length Increase

760 dia. rock-socket length increase shall be paid at the Contract Unit Price for the provisional item "760 dia. Rock-Socket Length Increase", measured as specified herein, 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.

The Length of Rock Socket provisional item shall be activated when the minimum specified socket length, as indicated on the Drawings, is exceeded, as directed, in writing, by the Contract Administrator.

E12. DRAINAGE SYSTEM

E12.1 Description

This Specification shall cover the supply and installation of the drain pipe system on the superstructure deck, behind the abutments including the wingwalls.

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

E12.2 Materials

E12.2.1 General

The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.

E12.2.2 Drain Pipes, Fittings, and Accessories

Drain pipes, fittings, and other accessories and appurtenances for the deck and abutment drain pipe system, shall conform to the requirement of the City of Winnipeg Standard Construction Specification CW 3610-R3 and requirements of the latest revision of CSA G401-93, for Corrugated Steel Pipe (CSP). Corrugated steel pipe shall be perforated and non-perforated aluminized Type 2 150 mm, 200 mm, and 300 mm diameters by 1.6 mm gauge.

All other drain pipes, fittings, manholes, and other accessories and appurtenances shall conform to the requirement of Standard Construction Specifications CW 2130-R5 and CW 2131-R3.

E12.2.3 Filter Fabric

Filter fabric shall be either Mirafi P600X Woven by Dominion Textile Inc. or Typar Style 3607 by Dupont Company or as accepted by the Contract Administrator, and shall conform to the requirements of Standard Construction Specification CW 3616-R1.

E12.2.4 Prefabricated Drainage Composites

Prefabricated drainage composites shall be Miradrain 6000 complete with filter fabric by Mirafi or equal as accepted by the Contract Administrator. Mastic adhesive shall be as recommended by the prefabricated drainage composite manufacturer.

E12.3 Equipment

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

E12.4 Construction Methods

For the purpose of this contract three types of drain pipe systems and one type of vertical surface drain system are to be constructed:

- (a) Drain pipes located on the superstructure precast prestressed concrete girders. The price for supply and installation of this drain pipe system shall include the drain pipe, all required fittings, drain pipe fill material, and filter fabric (Deck Drain Pipe System)

The Contractor is to coordinate this work with installation of Deck Waterproofing as described in Specification E13 to meet time restrictions for the installation of ballast by Canadian National Railway.

- (b) Drain pipe located in excavations for other works. This includes the perforated drain pipe behind the bridge abutments and wingwalls. The price for supply and installation of this drain pipe system shall include the drain pipe, all required fittings, drain pipe fill materials, and the filter fabric (Drain Pipe System Without Excavation and Backfill)
- (c) Vertical surface to be drained are the concrete abutments. This includes installation of the prefabricated drainage composite to the vertical surfaces and tie-in to the drain pipe system as and where shown on the Drawings.

The drain pipe shall be laid to the line and grade shown on the Drawings or as directed by the Contract Administrator with the separate sections securely jointed together by means of tightly drawn coupling bands. Drain pipe of the round or elongated type shall have the outside laps of circumferential joints in each pipe section of the upstream end and longitudinal lap seams at the sides of the pipe.

E12.5 Measurement and Payment

E12.5.1 Method of Measurement

E12.5.1.1 CSP Drain Pipe

CSP drain pipe system shall be measured per linear metre. The length to be measured shall be the total number of metres of CSP drain pipe installed in accordance with this Specification, the Drawings and accepted by the Contract Administrator.

E12.5.1.2 PVC Drain Pipe

PVC drain pipe system shall be measured on a per linear metre. The length to be measured shall be the total number of metres of PVC drain pipe installed in accordance with this Specification, the Drawings and accepted by the Contract Administrator.

E12.5.2 Basis of Payment

E12.5.2.1 CSP Drain Pipe

CSP drain pipe system shall be paid at the Contract Unit Price for "CSP Drain Pipe", measured as specified herein, 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 and the Drawings.

E12.5.2.2 PVC Drain Pipe

PVC drain pipe shall be paid at the Contract Unit Price for "PVC Drain Pipe", measured as specified herein, 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 and the Drawings.

E13. WATERPROOFING MEMBRANE

E13.1 Description

This Specification shall cover the supply and installation of bridge waterproofing membrane.

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

E13.2 Materials

E13.2.1 General

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

E13.2.2 Handling and Storage of Materials

All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the requirements of the manufacturer.

E13.2.3 Waterproofing Membrane System

E13.2.3.1 Waterproofing Membrane Material

The waterproofing membrane material shall be one of the following types listed herein. Waterproofing membrane material selected shall be installed in accordance with the manufacturer's specifications and to the satisfaction of the Contract Administrator.

Bemalastic membrane 1213 BDM manufactured by McAsphalt or approved equal.

Prime Coat: Apply an asphalt primer, approved by the manufacturer and the Contract Administrator with a spray rate of 0.1 to 0.21/m². Prior to the application of asphalt primer, the deck shall be dry and frost free.

E13.2.3.2 Membrane Protection

Membrane protection shall consist of one 13mm thick layer of "Bridgemate" as manufactured by Elsro Asphalt Ltd., or two 10 mm thick layers of "Viraflex" Type 270 asphaltic panels manufactured by W.R. Meadows or approved equal. All edges shall be staggered and sealed.

E13.2.4 Equipment

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

E13.3 Construction Methods

E13.3.1 General

All work shall be carried out by mechanics skilled in this type of operation and all work shall be subject to acceptance by the Contract Administrator.

All concrete surfaces to be treated shall be smooth, free of voids, moisture and contaminants, including curing compound/sealer and form release agents, and cleared of dust and all loose material.

After the concrete has been prepared, the prime coat shall be applied in such a manner that the surface to receive treatment shall be uniformly and completely covered.

E13.3.2 Waterproofing Membrane System

The waterproofing membrane system shall consist of one concrete priming coat, an impervious membrane bonded to the top surface of the concrete and inner surfaces of the trainman's walkways to the height as shown on the Drawings and a membrane protection placed on all the exposed surfaces of the membrane.

E13.3.3 Installation of Waterproofing Membrane Material

Installation of waterproofing membrane shall in accordance with the manufacturers recommendations. A written installation procedure shall be submitted to the Contract Administrator 21 days prior to installation. The proposed installation procedure will be reviewed and discussed with the manufacturer. Installation procedure approval must be received prior to proceeding with installation. If an alternate waterproofing membrane system is proposed, the same procedure must be followed.

E13.3.4 Installation of Waterproofing Membrane Protection

When using "Bridgemate" panels they shall be installed with ship-lapped edges in the long direction and butt joint edges in the short direction.

When using "Vibraflex" panels they shall be installed with butt joints. The joint in second layer shall be staggered to avoid coincidence with the joint in the first later.

Joints shall be filled with hot-poured elastic type joint sealer.

Edges of membranes and vertical or steeply sloped portions of the joint shall be sealed with cold applied plastic cement.

The Contractor shall arrange for the CN to place the ballast over the waterproofing membrane protection with 48 hours of installation of the membrane protection.

E13.4 Quality Control

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection a by the Contract Administrator. The Contractor shall be wholly responsible of 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

E13.5 Measurement and Payment

E13.5.1 Method of Measurement

Waterproofing membrane shall be measured on an area basis. The area to be measured shall be the total number of square metres of waterproofing membrane installed in accordance with this Specification and accepted by the Contract Administrator, as computed from the Drawings.

E13.5.2 Basis of Payment

Waterproofing membrane shall be paid for at the Contract Unit Price per square metre for "Waterproofing Membrane", measured as specified herein, which price shall be payment in full for supplying all material and performing all operations herein described and all other items incidental to the work included in this Specification.

E14. EXCAVATION

E14.1 Description

This Specification shall cover all operations related to excavation for abutments, pier pile cap beam, prestressed precast concrete box girders, as herein specified.

The work to be done by the Contractor under this Specification shall include the furnishings 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.

E14.2 Materials

E14.2.1 General

The Contractor shall be responsible for the excavation, stockpiling and removal of all materials as set forth in this Specification. Materials to be stockpiled shall be handled in careful and workmanlike manner, to the satisfaction of the Contract Administrator.

E14.2.2 Excavation

Excavated material shall include the excavation and satisfactory disposal of all surplus concrete pavement, asphalt pavement, ballast, earth, gravel, sand, clay, silt and all other material of whatever character which may be encountered.

E14.3 Equipment

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

E14.4 Construction Methods

E14.4.1 Scope of Work

- (a) Excavation: The excavation of material to a depth as shown on the Drawings for piers, abutments and prestressed precast concrete box girders.
- (b) Off-site disposal of all excavated materials.
- (c) Dewatering and or precipitation removal of the excavations as may be required for construction of the structure in the dry.

E14.5 Survey Monuments

The Contractor shall avoid damaging survey monument and shall take all necessary precautions to protect the same. The Contract Administrator at the sole expense of the Contractor will rectify any damage to the survey monuments.

E14.6 Measurement and Payment

E14.6.1 Method of Measurement

Excavation, as defined in this Specification, is a lump sum pay item. No measurement will be made for this work.

E14.6.2 Basis of Payment

Excavation will be paid for at the Contract Lump Sum Price for "Excavation", which price shall be payment in full for performing all operations herein described including the cost of furnishing all necessary labour, materials, and equipment for the protective works necessary for safe excavation, disposal, preparation of slopes and channels, and all other items incidental to the work included in this Specification.

E15. BACKFILL

E15.1 Description

This Specification shall cover backfill for abutments

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

E15.2 Materials

E15.2.1 General

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

E15.2.2 Handling and Storage of Materials

All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator.

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

All material shall be accepted by the Contract Administrator at least seven (7) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials in whole or in part, so not conform to the Specification detailed herein, or are found to be defective in manufacture, or have become damaged in transit, storage or handling operation, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

E15.2.3 Granular Backfill Material

Granular backfill material shall be clean and free from organic material, meeting the following gradation requirements:

CANADIAN METRIC SIEVE SIZE	PERCENT PASSING BY WEIGHT
50 000	100
20 000	75 – 100
5 000	45 – 85
2 500	35 – 55
315	15 – 35
160	5 – 20
80	0 – 7

E15.3 Equipment

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

E15.4 Construction Methods

E15.4.1 Scope of work

The work shall comprise of the supply, placement, and compaction of backfill material for the abutments.

E15.4.2 Backfill Operations

E15.4.2.1 General

The Contract Administrator shall be notified at one (1) working day in advance of any backfilling operation. No backfill shall be placed against any concrete until approved by the Contract Administrator and in no case before cylinders show the concrete strength

to be at least 20 MPa. All damp proofing and drain installations must also be completed prior to backfilling.

The abutments shall be backfilled with backfill materials described below to the grade line as shown on the Drawings. Backfill materials shall be free of frozen lumps and shall be placed and compacted in an unfrozen state. Backfill shall not be placed on frozen subsoil.

The Contractor shall be required to provide necessary water or equipment during compaction of backfill material to achieve the required densities.

The Contractor shall place backfill material in 150 mm lifts and shall compact each lift. The backfill shall be compacted to 100% Standard Proctor.

E15.5 Quality Control

E15.5.1 Inspection

All workmanship and materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operation 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 previously been given. The Contract Administrator reserves the right to reject any materials or works, which are not in accordance with requirements of this Specification.

E15.5.2 Materials

All material supplied and placed under this Specification shall be subject to testing and acceptance by the Contract Administrator in accordance with E15.2 and E15.4 of this Specification.

E15.5.3 Quality of Backfill Material

The Standard Proctor Density for granular backfill material shall be determined at the optimum moisture content in accordance with standard laboratory Proctor Compaction Test Procedure. The field density of each backfill layer shall be 100% percentage of the applicable Proctor Density, as specified in E15.4.2.1 of this Specification.

Quality control test will be used to determine the acceptability of each backfill layer, as place and compacted by the Contractor before any succeeding layer may be applied.

The filed density of the compacted layers shall be verified by Field Density Tests in accordance with ASTM Standard D155560-64, Test for Density of Solid in Place by the Sand-Cone Method, or equivalent as accepted by the Contract Administrator.

The frequency and number of tests to be made shall be as determined by the Contract Administrator. The Contractor is responsible for all testing costs. The Contract Administrator will select the Testing Agency.

Holes made by removal of samples from the layer shall be promptly filled by the Contractor with appropriate material and thoroughly compacted so as to conform in every way with the adjoining compacted material.

E15.5.4 Corrective Action

Any backfill material that does not meet the gradation and/or compaction requirements of the Specification shall be removed and replaced by the Contractor at his own expense, to the satisfaction of the Contract Administrator.

E15.6 Method of Measurement

Backfill, as defined in this Specification, is a lump sum pay item. No measurement will be made for this work.

E15.7 Basis of Payment

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 including the cost of furnishing all necessary labour, materials, and equipment for the protective works necessary for safe placement of backfill material in accordance with the contract specification and accepted by the Contract Administrator.

E16. BRIDGE LIGHTING

E16.1 Description

E16.2 The Specification shall cover the supply and installation of the pier and deck mounted lighting fixtures, conduits, pull boxes, and junction boxes and all required appurtenances and incidental components.

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 and incidental to the satisfactory performance and completion of the work as hereinafter specified.

E16.3 Materials

E16.3.1 General

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

E16.3.2 Handling and Storage of Materials

All materials shall be handled and stored in a careful and workmanship like manner, to the satisfaction of the Contract Administrator.

E16.3.3 Inspection

All materials supplied under this Specification shall be subject to inspection by the Contract Administrator or by the Testing Laboratory designated by the Contract Administrator. Furthermore all material supplied and installed shall be CSA approved.

E16.3.4 Pier Mounted Lighting Fixtures

Pier mounted lighting fixture shall be outdoor, surface mounted as indicated on the Drawings, 100W clear HPS, 347V, energy-efficient ballast, photocell control, tamper-resistant screws, vandal-resistant polycarbonate lens, lamp included.

Holophane Wallpack II No. WL2C100HP00XX

E16.3.5 Bridge Deck Mounted Lighting Fixture

Bridge deck mounted lighting fixture shall be outdoor, surface mounted as indicated on the Drawings, 100W HPS, horizontal position, 347V, energy-efficient ballast, photocell control, specular metal reflector, clear flat prismatic glass lens with clear flat polycarbonate protective cover in metal trim frame as indicated on the Drawings, lamp included.

Kirlin No. RS51290-24

E16.3.6 Vandal-Proof Covers

Vandal-proof covers around lighting fixtures supplied and installed by the Contractor as indicated on the Drawings.

E16.3.7 Steel Frames

Steel frames are supplied under Specification E17 "Miscellaneous Metal"

E16.3.8 Steel Cage Lighting Covers

Supply and install steel cage lighting covers as indicated.

E16.3.9 Conductors for Pier and Bridge Deck Mounted Lighting

All conductors and terminations required for the lighting to be supplied and installed under future contract.

E16.3.10 Conduits and Related Materials

All conduit shall be sized as shown on the drawings or otherwise accepted by the Contract Administrator in accordance with the Canadian Electrical Code, unless otherwise specified.

All conduits, pull boxes and junction boxes for the lighting electrical embedded work shall be Rigid PVC (polyvinyl chloride) conforming to the requirement of CSA C22.2 No. 136.

All covers for boxes shall be stainless steel and fastened with stainless steel vandal-proof screws.

Flexible couplings shall be such as Crouse-Hinds Type EC or equal accepted by Contract Administrator.

E16.4 Equipment

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

E16.5 Construction Methods

E16.5.1 General

The works involved with lighting fixtures and conduit shall include:

- (a) The supply and installation of conduit and related materials.
- (b) The supply and installation of lighting fixtures, ballasts and brackets.
- (c) The supply and installation of vandal-proof covers for pier and bridge deck mounted lighting.

E16.5.2 Permits, Codes, and Regulations

The Contractor shall be responsible to obtain and pay for all electrical permits, inspections, etc., required by the authorities having jurisdiction over this work, and shall provide a copy of each permit to the Contract Administrator before commencing any work on the site.

The work shall be carried out in accordance with the latest regulations of the Canadian Electrical Code and all applicable municipal and Provincial Codes and Regulations. In no instance, however, shall the standard established by the Drawings and Specifications be reduced by any of the Codes referred to above.

E16.5.3 Pier and Bridge Deck Mounted Lighting Fixtures

Pier mounted lighting fixtures shall be mounted on the pier shafts as per the manufacturers recommendations.

The steel frames are supplied and installed in accordance with Specification E17 "Miscellaneous Metals".

E16.5.4 Placing Conduits, Pull Boxes, and Junction Boxes

E16.5.4.1 General

All conduits, pull boxes and junction boxes shall be placed as shown on the Drawings. The conduit to be placed in concrete shall be firmly anchored in place to prevent movement during pouring of the concrete. Extreme care shall be exercised when pouring concrete to prevent damage to any conduit. The open ends of the conduits shall be suitably capped, to protect the conduit from damage. The conduit system shall be watertight.

Fish wire shall be placed in all conduits and shall be firmly anchored at the open ends of the conduits. The Contractor shall drill a small hole in the conduit cap for passage of the fish wire.

Upon completion of the conduit system, the Contractor shall ascertain that no obstructions are blocking any conduit. If any obstruction is encountered, it shall be removed by the Contractor at his own expense.

E16.5.4.2 Direct Buried Conduits Underground

Bedding for direct buried conduit shall consist of a 150 mm layer of well compacted granular material.

Granular material shall be backfilled by hand to a depth of 300 mm above the conduit and shall be completed by hand in 150 mm layers.

The remainder of the trench shall be filled with selected material free from stones larger than 100 mm in any one dimension. Mechanical tamping equipment may be used, but care must be taken to compact backfill at each 300 mm interval. Any subsequent settlement shall be made good.

Except where otherwise specified, buried conduit shall be minimum of 740 mm below final grade.

E16.5.5 Power Supply

The pier and bridge deck mounted lighting will be connected to the street lighting system under future contract.

E16.6 Quality Control

E16.6.1 General

All workmanship and all materials finished 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 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.

E16.7 Method of Measurement

E16.7.1 Supply and Install Bridge Lighting

Supply and install bridge lighting including the lighting fixtures, fasteners, electrical conduit, pull boxes, and junction boxes for pier and bridge deck mounted lighting is a lump sum pay item. No measurement will be made for this work.

E16.8 Basis of Payment

E16.8.1 Supply and Install Bridge Lighting

The supply and install of bridge lighting will be paid for at the Contract Lump Sum Price for "Supply and Install Bridge Lighting", 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.

E17. MISCELLANEOUS METAL

E17.1 Description

This Specification shall cover supply, fabrication, galvanizing, transportation, handling, and delivery of miscellaneous metal. This Specification shall include, but is not limited to, the supply and installation of the items of work listed herein:

- (a) Bridge Railing
- (b) Deck and Pier Mounted Lighting Frames
- (c) Miscellaneous metal items not covered specifically within this Specification

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.

E17.2 Materials

E17.2.1 General

The Contractor shall be responsible for the supply, safe storage and handling of all miscellaneous metal materials as set forth in this Specification.

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

E17.2.2 Steel

Unless otherwise specified, all steel shall conform to the requirements of CSA Standard CAN/CSA-G40.21, Grade 350W.

E17.2.3 Hot-Dip Galvanizing

All items supplied under this Specification shall be hot-dip galvanized in accordance with CSA Standard G164 to retention of 600 gm/m². All metal surfaces to be galvanized shall be thoroughly cleaned of rust, rust scale, mill scale, dirt and other contaminants by commercial sand, grit or shot blasting and/or pickling prior to galvanizing. Heavy deposits of oil and grease shall be removed with solvents prior to blasting or pickling.

E17.2.4 Galvanizing Touch-up

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 A780-80 for "Repair of Damaged Hot Dip Galvanizing Coating". Accepted 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, Manitoba.

E17.2.5 Anchor Studs

Anchor studs shall conform to the requirements of ASTM Specification A108, Grade Designation 1020 and shall be galvanized.

E17.2.6 Welding

Welding shall conform to CSA-W59. All work is to be performed by a firm certified by the Canadian Welding Bureau to the requirements of CSA W47.1.

Welding operators employed on the work are to be currently qualified by the C.W.B. Qualification is to have been issued within two years of the commencement of fabrication.

Trim and bevel ends and other items to enable satisfactory welding.

Keep all paint back from areas requiring welding after fabrication.

E17.2.7 Hardware

All bolts, nuts, washers, inserts, pintels, etc., as required shall be ASTM A325, galvanized, unless noted otherwise.

E17.2.8 Non-Shrink Grout

Non-shrink grout shall be supplied as specified in Specification E5, "Structural Concrete".

E17.3 Equipment

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

E17.4 Construction Methods

E17.4.1 Scope of Work

It is intended that this Specification cover the following miscellaneous metal elements, including all components and related fasteners as shown on the Drawings:

- (a) Supply an installation of steel bridge railing and metal work on trainman's walkway,
- (b) Supply and installation of steel frames for lighting fixtures, incidental to "Bridge Lighting" pay item.
- (c) Steel plates and studs as shown on the Drawings for the bearings, precast prestressed concrete girders and other items shall be incidental to the appropriate pay items.

E17.4.2 Fabrication

E17.5 Quality Control

E17.5.1 Inspection

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.

E17.5.2 Access

The Contractor shall allow the Contract Administrator free access to all parts of the work at all times.

E17.5.3 Qualifications of Contractor

The Contractor shall produce evidence that his plant is recently fully approved by the C.W.B. to the requirement of CSA Standard 47.1, Division 2.

E17.5.4 Qualifications of Operators

The Contractor shall produce evidence that all welding operators to be employed on the work are currently qualified by the C.W.B. at the time of fabrication and in the processes in which they are to be employed on the work. Such qualification shall have been issued within two years of the commencement of fabrication.

The Contractor shall also produce evidence relative to each operator, that he has been executing satisfactory welding in the required processes within the six-month period previous to the award of this contract.

E17.5.5 Welding Procedures

The Contractor shall submit copies of the welding procedures, which he intends to use, for examination and acceptance by the Contract Administrator.

Such procedures shall be accompanied by documentary proof that they have been qualified previously by the C.W.B. at the plant where the work is to be carried out.

E17.6 Quality Control

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operation 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.

E17.6.1 Submissions

At least twenty-one (21) days prior to the scheduled commencement of any fabrication, the qualifications of Contractor, the qualifications of operator, the shop drawings, mill certificates, welding procedures, and welding consumable certificates shall be submitted to the Contract Administrator for his acceptance.

The shop drawings shall consist of three (3) sets of full size prints and one (1) reproducible sepia set.

The shop drawings shall clearly show shapes, weights, dimensions, detail, connection (including proper CSA welding identification), bolt holes, and accessories.

Calculated mass of miscellaneous metal for each shop drawing following shop drawing final acceptance shall be submitted.

E17.6.2 Preparation of Material

(a) Bending Material

(b) Steel items to be bent shall be bent by methods that will not injure the metal. The steel shall not be heated unless permission is given by the Contract Administrator.

Any damage to the galvanizing surface shall be repaired in accordance with Clause E17.2.4 of this Specification.

- (c) Edge Preparation of Welding
- (d) The edges of plates or sections which are to be welded together shall be prepared by sawing, shearing, flame-cutting, machining, chipping or arc air gouging to the details shown on the shop drawings. Surfaces and edges to be welded shall be smooth, uniform and free from thins, tears, cracks, and other defects, which would adversely affect the quality or strength of the weld. Surfaces to be welded shall also be free from loose scale, slag, rust, grease, moisture or other material that will prevent proper welding. Mill scale that withstands vigorous wire brushing, a light film of drying oil or a thin rust inhibitive coating may remain.
- (e) Surfaces within 50 mm of any weld location shall be free from any paint or other material that would prevent proper welding or produce objectionable fumes while welding.
- (f) Edges of material thicker than specified in the following list shall be trimmed if and as required to produce a satisfactory welding edge wherever a weld along the edge is to carry calculated stress:
 - (i) Sheared edges of material thicker than 12 mm
 - (ii) Rolled edges of plates (other than Universal Mill Plates) thicker than 9 mm
 - (iii) Toes of angles thicker than 16 mm
 - (iv) Universal Mill Plates or edges of flanges of wide section thicker than 25 mm.

Edges may be prepared by oxygen cutting, providing that a smooth and regular surface free from cracks and notches is secured, and providing that an accurate profile is secured by the use of mechanical guide. Freehand cutting shall be done only where accepted by the Contract Administrator.

E17.6.3 Edge Preparation (Non-welded Edges)

Steel may be cut to size by sawing, shearing, flame-cutting or machining.

Any flame cutting of steel shall be in accordance with Clause 445669.

Edges of flame cut flange plates shall be ground to a radius of 2 mm. Re-entrant cuts shall be filleted to a radius of not less than 19 mm.

E17.6.4 Butt Joints

Minimize the number of butt joints by maximizing the length of plates. Details of all butt joints shall be submitted to the Contract Administrator for his review. The fabricator may submit an alternative butt joint design provided that such design has been pre-qualified by A.W.S.

E17.6.5 Anchor Studs

Welding of anchor studs shall conform to the requirements of CSA Standard W59, Section 3.1.2.2 and 5.5.6.5.

E17.6.6 Assembly

The shop assembly of the various components of the weldments shall be executed in accordance with CSA.

Tack welding shall be done by qualified operators, using the smallest size weld required to hold the components of the assembly together. Tack welds shall not be less than 50 mm in length and shall be incorporated in the final weld.

Tack welds shall be made with 4 mm maximum size electrodes and shall be subject to the preheat requirement of CSA-W59.

E17.6.7 Preheat and Interpass Temperatures

No welding shall be done when the temperatures of the base metal is lower than -20°C. At temperatures below 0°C, the steel shall be preheated to a temperature of at least 10°C in excess of that stated in Table 1.

Preheat shall be applied to all steel to welded so that the steel within 75 mm of the weld is heated to the temperature shown in Table 1.

Preheat shall be applied in such a manner that moisture from the heating equipment does not penetrate the joint.

For all welding processes, preheat and interpass temperatures shall be maintained during welding at temperature not less that stated in Table.1.

Table 1

Minimum Preheat and Interpass Temperatures	
Thickness of Thickest Part at Point of Welding	CSA Standard CAN/CSA Grade 350 W G40.21
Less than 19 mm	21°C
19 mm to 38 mm	66°C
38 mm to 64 mm	107°C
Over 64 mm	150°C

Preheat requirements of tack welds shall be as in the above table except where single pass tack welds are used and are to be incorporated and consumed in a weld made by the submerged arc and the gas metal arc processes, preheat is unnecessary.

E17.6.8 Bent Plates

When bending plates, the plates shall be so taken from the stock plates that the bend line will be at right angles to the direction of rolling. The radius of the bend measured inside, shall be not less than the thickness of the plate.

E17.6.9 Weld Profiles

Weld profiles shall meet the requirements of CSA Standard W59, Clause 5.9.

E17.6.10 Shipping

Structural members shall be loaded in such a manner that they can be transported and unloaded at their destination without being excessively stressed, deformed or otherwise damaged.

E17.6.11 Handling and Storing Materials

Material to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. Long members shall be supported on skids placed near enough to prevent injury from deflection.

E17.6.12 Straightening Bent Material

The straightening of plates and angles or other shapes shall be done by methods that will not produce a fracture or other injury. The metal shall not be heated unless permitted by

the Contract Administrator, in which case the heating shall not be to a higher temperature than that producing a “dark cherry red” colour. After heating, the metal shall be cooled as slowly as possible.

Following the straightening of a bend or buckle, the surface of the metal shall be carefully inspected for evidence of fracture, and if necessary, replaced or repaired to the satisfaction of the Contract Administrator.

E17.6.13 Welding of Galvanized Metal

All field welding to galvanized metal shall be touched up by the Galvalloy Process in accordance with Clause E17.2.4 of these Specifications. All Galvalloy repairs shall be made flush with adjacent metal.

E17.7 Measurement and Payment

E17.8 Method of Measurement

Supply and install bridge railing shall be measured per linear metre. The length to be measured shall be the total number of metres of bridge railing installed in accordance with this Specification, the Drawings and accepted by the Contract Administrator.

E17.9 Basis of Payment

Supply and install bridge railing shall be paid at the Contract Unit Price for “Supply and Install Bridge Railing”, measured as specified herein, 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 and the Drawing.

E18. SIGNALS AND COMMUNICATION CONDUIT

E18.1 Description

This Specification shall cover the supply and installation of signal and communication conduits in the trainman’s walkways.

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

One conduit in the North and South trainman’s walkway shall be split to allow for live fibre optic wire installation as shown on the Drawings. The split conduit can either be purchased or fabricated. Either option is acceptable provided a watertight conduit is provided after live wire installation and conduit is closed. The trainman’s walkway reinforcing, joints, Styrofoam, etc. must be constructed/placed in stages to allow live wire installation in the split conduit as shown on the drawings. Group Telecom and CN have live wires that are to be transferred to the open conduits prior to casting the trainman’s walkway. Group Telecom and CN will use their own forces to relocate the live wires, however the Contractor must coordinate all required works to facilitate this task. The wires to be relocated are shown on the Site Plans.

E18.2 Materials

E 18.2.1 General

The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and approval by the Contract Administrator.

E 18.2.2 Conduits

Rigid conduit shall be unplasticized PVC in accordance with CSA C22.2 No. 136 c/w appropriate approved fittings, couplings and expansion joints. Conduit sizes required for the utilities shall be as follows:

- i) 100 mm diameter PVC conduit
- ii) 100 mm diameter split PVC conduit for live wire installation. Open split pipe shall be water tight and complete with all fittings and clamps.

E 18.2.3 Fish Wire

Fish wire in duct shall be galvanized steel line type and shall not be less than 12 BWG Grade 130.

E18.3 Equipment

All equipment shall be of a type approved by the Contract Administrator.

E18.4 Construction Methods

E 18.4.1 Installation of Conduit

E 18.4.2 Placing of Conduit

All conduit shall be installed as shown on the Drawings. The conduit to be placed in concrete shall be firmly anchored in place to prevent movement during pouring of the concrete. Extreme care shall be exercised when pouring concrete to prevent damage to any conduit especially the split conduit with live utilities. The open ends of the conduits shall be suitably capped, to protect the conduit from damage. The conduits shall extend a minimum of one (1) metre past the edge of the bridge for future extension.

E 18.4.3 Placing of Fish Wire

The fish wire shall be placed in all conduits and shall be firmly anchored at the open ends of the conduits. Drill a small hole in the conduit cap for passage of the fish wire.

E 18.4.4 Obstructions

Upon completion of the conduit system, the Contractor shall ascertain that no obstructions are blocking any conduit. If any obstruction is encountered, it shall be removed by the Contractor at his own expense.

E18.4.1 Miscellaneous Works

All other items necessary for the complete installation of the conduits shall be done as directed by the Contract Administrator.

E18.4.2 Quality Control

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 work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.

The Contract Administrator reserves the right to reject materials or works, which are not in accordance with the requirements of this Specification.

E18.5 Measurement and Payment

E18.5.1 Method of Measurement

Supply and installation of utility conduits will be measured per linear metre for each type of conduit. The total linear metres of conduit measured shall be the total number of linear metres supplied and installed, complete with fish wire, in accordance with this Specification and the Drawings, and accepted by the Contract Administrator, as computed from measurements made by the Contract Administrator.

E18.5.2 Basis of Payment

Supply and installation of conduits will be paid for at the Contract Unit Price per linear metre for "Supply and Install Utility Conduit", for the conduits listed below, measured as specified herein, 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.

Items of Work

- (i) Split Conduit
- (ii) Standard Conduit

E19. PAINT

E19.1 Description

This Specification shall cover the supply and application of paint to all exposed surfaces of the piers, abutment, wingwalls and superstructure excluding the underside of the deck and the top surface of the trainman's walkway.

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

E19.2 Materials

E19.2.1 General

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

E19.2.2 Handling and Storage of Materials

All materials shall be handled in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the requirements of the manufacturer.

E19.2.3 Paint Type

The paint shall be Flat Exterior Latex and shall be approved by the Contract Administrator in writing prior to being applied. Colour to be specified by the Contract Administrator.

E19.3 Construction Methods

E19.3.1 General

All work shall be carried out by personnel skilled in this type of operation and all work shall be subject to acceptance by the Contract Administrator.

All concrete surfaces to be painted shall be smooth, free of voids, moisture and contaminants, including curing compound/sealer and form release agents, and cleared of dust and all loose material.

All concrete surfaces to be painted shall receive a light brush sandblast to clean the surface and expose voids. Voids shall be filled using an approved patching material.

After the concrete surfaces have been prepared, a prime coat shall be applied in such a manner that the surfaces to receive painting shall be uniformly and completely covered.

Paint shall be applied with a roller or sprayed on with a gun.

Scope of Work:

All exposed surfaces of the following components shall receive one coat of primer and two coats of paint :

- (a) Piers, excluding tops of piers and caissons
- (b) Abutments, excluding top bearing area of abutment.
- (c) Superstructure, excluding complete underside of deck and walking surfaces of trainman's walkway.

E19.4 Quality Control

All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the work. The Contractor shall be wholly responsible for the control of all operation incidental thereto notwithstanding any inspection or acceptance that may have been previously given.

The Contract Administrator reserves the right reject any materials or works, which are not in accordance with the requirements of this Specification.

E19.5 Measurement and Payment

E19.5.1 Method of Measurement

The painting of structure is a lump sum pay item. No measurement will be made for this work.

E19.5.2 Basis of Payment

Painting of structure will be paid for at the Contract Lump Sum Unit Price for "Painting of Structure", as specified herein, which price shall be payment in full for supplying all materials and performing all operation herein described and all other items incidental to the work included in this Specification.