THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 303-2010

SOUTHWEST RAPID TRANSIT CORRIDOR – STAGE 1: OSBORNE STATION & ASSOCIATED WORKS

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B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, June 10, 2010.

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

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

B3. SITE INVESTIGATION

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

B3.2 The Bidder is required to complete CN's Contractor Orientation Training as outlined in Appendix 'C' prior to entering CN property for the Site investigation, if necessary.

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.

B4. BIDDER'S CONFERENCE

B4.1 Further to C3.1, the Contract Administrator will hold a non-mandatory Bidders' conference at Masonic Memorial Temple Ltd., 420 Corydon Avenue, Winnipeg, MB, R3L 0N8 at 2:00 p.m. on Thursday, May 27th, 2010.

B4.2 The Bidder is advised that, at the Bidders' Conference:

(a) A presentation related to the Osborne Station Design (an overpass, transit station building and associated works, underground and landscaping works) will be given at the non-mandatory pre-bid information meeting.

(b) Notes of presentations made at this meeting will be available at least two (2) Business Days prior to the Submission Deadline on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/bidopp.asp.

(c) No information provided at this meeting or in the meeting notes is intended to change any provision of the Bid Opportunity. Any required changes arising from the meeting will be explicitly changed through addenda. Notify the Contract Administrator if anything at the meeting of in the notes from the meeting appears to warrant an addendum.

B4.3 The Bidder shall not be entitled to rely on any information or interpretation received at the Bidders' Conference unless that information or interpretation is provided by the Contract Administrator in writing.

B5. ENQUIRIES

B5.1 All enquiries shall be directed to the Contract Administrator identified in D4.1.

B5.2 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.

B5.3 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.

B5.4 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.

B5.5 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.

B6. ADDENDA

B6.1 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.

B6.2 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.

B6.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/bidopp.asp

B6.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

B6.3 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.

B7. SUBSTITUTES

B7.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

B7.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B7.3 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.

B7.4 The Bidder shall ensure that any and all requests for approval of a substitute:

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

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

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

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

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

B7.5 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.

B7.6 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.

B7.6.1 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.

B7.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.

B7.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B16.

B7.9 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.

B7.10 Notwithstanding B7.2 to B7.9, and in accordance with B8.6 deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B16.1(a).

B8. BID COMPONENTS

B8.1 The Bid shall consist of the following components:

(a) Form A: Bid;

(b) Form B: Prices;

(c) Bid Security

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

B8.2 Further to B8.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B7.

B8.3 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Bid.

B8.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B8.4.1 Samples or other components of the Bid which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder’s Bid.

B8.5 Bidders are advised not to include any information/literature except as requested in accordance with B8.1.

B8.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, will be evaluated in accordance with B16.1(a).

B8.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B8.8 Bids shall be submitted to:

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

B9. BID

B9.1 The Bidder shall complete Form A: Bid, making all required entries.

B9.2 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.

B9.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B9.2.

B9.3 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.

B9.4 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.

B9.4.1 The name and official capacity of all individuals signing Form A: Bid should be printed below such signatures.

B9.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid and the Contract, when awarded, shall be both joint and several.

B10. PRICES

B10.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

B10.1.1 Notwithstanding C.12.2.3(c), prices on Form B: Prices shall not include the Manitoba Retail Sales Tax (MRST, also known as PST), which shall be extra where applicable.

B10.2 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.

B10.3 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.

B10.4 Prices from Non-Resident Bidders are subject to a Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).

B11. QUALIFICATION

B11.1 The Bidder shall:

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

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

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

B11.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

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

B11.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

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

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

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

B11.4 Further to B11.3(c), the Bidder shall, within five (5) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder/Subcontractor has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

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

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

B11.5 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B11.6 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B12. BID SECURITY

B12.1 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.

B12.1.1 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.

B12.1.2 All signatures on bid securities shall be original.

B12.1.3 The Bidder shall sign the Bid Bond.

B12.1.4 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.

B12.2 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.

B12.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B12.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B12.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B12.3 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.

B13. OPENING OF BIDS AND RELEASE OF INFORMATION

B13.1 Bids will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Division, or in such other office as may be designated by the Manager of Materials.

B13.1.1 Bidders or their representatives may attend.

B13.1.2 Bids determined by the Manager of Materials, or his designate, to not include the bid security specified in B12 will not be read out.

B13.2 Following the submission deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt

B13.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract Amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page

at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt

B13.4 The Bidder is advised that any information contained in any Bid may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B14. IRREVOCABLE BID

B14.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.

B14.2 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.

B15. WITHDRAWAL OF BIDS

B15.1 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.

B15.1.1 Notwithstanding C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B15.1.2 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.

B15.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:

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

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

(c) if the notice has been given by any one of the persons specified in B15.1.3(b), declare the Bid withdrawn.

B15.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B14.2 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.

B16. EVALUATION OF BIDS

B16.1 Award of the Contract shall be based on the following bid evaluation criteria:

(a) compliance by the Bidder with the requirements of the Bid Opportunity, or acceptable deviation there from (pass/fail);

(b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B11 (pass/fail);

(c) Total Bid Price;

(d) economic analysis of any approved alternative pursuant to B7.

B16.2 Further to B16.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, or contains additions, deletions, alterations or other

irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.

B16.3 Further to B16.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid or in other information required to be submitted, that he is responsible and qualified.

B16.4 Further to B16.1(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.

B16.4.1 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.

B16.4.2 Further to B16.1(a), in the event that a unit price is not provided on Form B: Prices, the City will determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

B17. AWARD OF CONTRACT

B17.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B17.2 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.

B17.2.1 Without limiting the generality of B17.2, 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.

B17.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid, in accordance with B16.

B17.3.1 Following the award of Contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

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

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

C0.2 A reference in the Bid Opportunity to a section, clause or subclause with the prefix "**C**" designates a section, clause or subclause in the *General Conditions for Construction*.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of a bridge structure and associated works.

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

(a) Supply and Installation of Fences

(b) Temporary and Permanent Shorings

(c) Excavation and Backfill

(d) Demolition and Removals

(e) Dewatering

(f) Site Work

(g) Bridge Works (Substructures, Superstructures, Retaining Walls and Other Minor Works)

(h) Transit Station Building (Architectural, Electrical, Mechanical, Structural and Other Minor Works)

(i) Control Building

(j) West Side Pedestrian Ramp and Reconstruct Concrete Sidewalk

(k) East Side Pedestrian Plaza and Reconstruct Concrete Sidewalk

(l) Landscaping Works

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

(a) "**Contract #1**" means the Southwest Rapid Transit Corridor – Stage 1: Land Drainage Construction & Associated Works;

(b) "**Contract #2**" means the Southwest Rapid Transit Corridor – Stage 1: Land Drainage Pumping Station & Associated Works;

(c) "**Contract #3**" means the Southwest Rapid Transit Corridor – Stage 1: Transitway Construction, Donald/Harkness Reconstruction & Associated Works;

(d) "**Contract #4**" means the Southwest Rapid Transit Corridor – Stage 1: Transitway Tunnel at CN Rivers Subdivision Mileage 1.38 & Associated Works;

(e) "**Contract #5**" means the Southwest Rapid Transit Corridor – Stage 1: Osborne Station & Associated Works;

(f) "**Contract #6**" means the Southwest Rapid Transit Corridor – Stage 1: Transitway Construction, Landscaping & Associated Works;

(g) "**Southwest Rapid Transit Corridor – Stage 1**" means the overall project of the Southwest Rapid Transitway Corridor from Queen Elizabeth Way to Jubilee Avenue;

(h) "**Stage 1**" in this Contract means the first half of construction for the north side of the Transitway Tunnel at CN Rivers Subdivision Mileage 1.38;

(i) "**Stage 2**" in this Contract means the second half of construction for the south side of the Transitway Tunnel at CN Rivers Subdivision Mileage 1.38;

(j) "**Stage 1 Track Detours**" means the first half of the track detour construction for the north side of the Transitway Tunnel at CN Rivers Subdivision;

(k) "**Stage 2 Track Detours**" means the second half of the track detour construction for the south side Transitway Tunnel at CN Rivers Subdivision;

(l) "**Stage 3 CN Track Relocation**" means the final track construction for the Transitway Tunnel at CN Rivers Subdivision.

(m) **"Osborne Station Bridge Structure"** in this Contract means the construction of the bridge structure, pedestrian ramps, retaining walls and associated works.

(n) **"Osborne Station Building Structure"** in this Contract means the construction of the building structure and associated works.

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is Dillon Consulting Limited, represented by:

Dave Krahn, P.Eng.
Project Manager
200-895 Waverley Street
Winnipeg, Manitoba R3T 5P4

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

D4.2 At the pre-construction meeting, Dave Krahn, 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.

D6. NOTICES

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

D6.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.3, D6.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D4.1.

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

The City of Winnipeg
Chief Financial Officer
Administration Building, 3rd Floor
510 Main Street
Winnipeg MB R3B 1B9

Facsimile No.: (204) 949-1174

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
Internal Services Department
Legal Services Division
Attn: City Solicitor
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. AUTHORITY TO CARRY ON BUSINESS

D8.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D9. SAFE WORK PLAN

D9.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D9.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/Safety/default.stm

D9.3 Notwithstanding Appendix C "CN Safety Requirements", the Contractor shall conform and operate in accordance with the Canadian National Railway Company (CN) "Safety Guidelines for Contractors".

D10. INSURANCE

D10.1 The City shall provide and maintain the following Project Insurance Coverages:

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

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

D10.1.1 Further to D10.1(a) and D10.1(b), the following shall apply;

(a) The Contractor shall be responsible for deductibles up to $50,000.00 maximum of any one loss.

(b) 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.

(c) Wrap-Up Liability insurance shall be maintained from the date of commencement of the Work until one year from the date of Substantial Performance of the Work, after which, if Total Performance has not been met, the responsibility for payment of further insurance premiums shall transfer to the Contractor. The City may reduce any payment to the Contractor by the amount of such further insurance premiums.

(d) Liability coverage shall be provided for completed operations hazards from the date of Substantial Performance of the Work, as set out in the certificate of Substantial Performance of the Work, on an ongoing basis for a period of six (6) years following Substantial Performance of the Work

D10.2 Responsibilities of the Contractor:

(a) The Contractor shall provide and maintain 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).

(b) The Contractor is responsible for insuring equipment and tools used on the Project that may be owned, rented, leased or borrowed.

D10.2.1 Further to D10.2(a) and D10.2(b), the following shall apply;

(a) Premiums and deductibles shall be borne by the Contractor;

(b) Policies shall be taken out with insurers licensed to and carrying on business in the Province of Manitoba;

(c) The Contractor shall not cancel, or cause any such policy or policies to lapse without a minimum thirty (30) days prior written notice to the City;

(d) The Contractor shall provide written notice to the City of Winnipeg of any material changes to their policies within thirty (30) days of the change taking effect;

(e) The Contractor shall provide the Contract Administrator with evidence of insurance 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 and said insurance shall be in the form of a Certificate of Insurance and shall be in a form satisfactory to the City Solicitor.

D10.3 Responsibilities of Others, including payment of premiums and deductibles:

(a) All Subcontractors, Consultants and Subconsultants engaged for the Project are responsible to provide and maintain 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);

(b) All Subcontractors, Consultants and Subconsultants engaged for the Project are responsible for insuring equipment and tools used on the Project that may be owned, rented, leased or borrowed.

D11. PERFORMANCE SECURITY

D11.1 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.

D11.1.1 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.

D11.2 If the bid security provided in his Bid was not a certified cheque or draft pursuant to B12.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D12. SUBCONTRACTOR LIST

D12.1 Provide the Contract Administrator with a complete list of the Subcontractors proposed for engagement (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 the General Conditions for the return of the executed Contract.

D13. REQUIRED SAFETY COURSE COMPLETION

D13.1 Each individual proposed to be on the Site for any reason shall be required to complete the Contractor Orientation Course, CN Safety.

D13.2 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.

D13.3 The requirements are extended to any person visiting the Site.

D13.4 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(s) 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.

D13.5 Information about the safety-training course is available at www.contractororientation.com or contact CN directly at (719) 647-0337.

D14. ENVIRONMENTAL PROTECTION PLAN

D14.1 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.

D14.2 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 offices of the Contract Administrator.

D14.3 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

D14.4 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) Polychlorined 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)
(u) And any other applicable Acts, Regulations and By-laws.

D14.5 City of Winnipeg

(a) Alarms By-Law
(b) Anti-Litter By-Law
(c) Development Fees By-Law
(d) Electrical Inspections By-Law
(e) Fire Prevention By-Law
(f) Noise Control By-Law
(g) Sewer By-Law
(h) Pigeon Control By-Law
(i) Solid Waste By_law
(j) Waterworks By-Law
(k) Traffic By-Law
(l) City of Winnipeg Noise Policy and Guidelines

D14.6 Prior to commencing construction activities or delivery of materials to Site, submit an Environmental Protection Plan for review and approval by Contract Administrator. The Environmental Protection Plan shall present a comprehensive plan to address known or potential environmental issues which may be present during construction. Where applicable, the Environmental Protection Plan shall include Subcontractor activities. The submission of the Environmental Protection Plan to the Contract Administrator shall in no way relieve the Contractor of full responsibility for the success or failure of all environmental management practices and procedures.

D14.7 The Environmental Protection Plan shall address the following:

(a) Name[s] of person[s] responsible for ensuring adherence to Environmental Protection Plan.

(b) Name[s] and qualifications of person[s] responsible for manifesting hazardous waste to be removed from Site.

(c) Name[s] and qualifications of person[s] responsible for training Site personnel.

(d) Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

(e) Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features including vegetation to be preserved within authorized Work areas.

(f) Environmental Emergency Response: including procedures, instructions, and reporting in the event of unforeseen spill of regulated substance.

(g) Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

(h) Hazardous materials and waste management plan outlining storage, transportation and disposal.

(i) Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project Site.

(j) Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

(k) Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete wash or curing water, clean-up water, dewatering of ground water, hydrostatic test water, and water used in flushing of lines.

(l) Monitor and report to ensure implementation of environmental protection measures.

D14.8 Fires

(a) Fires and burning rubbish or waste materials on Site is not permitted.

D14.9 Disposal of Waste

(a) Dispose all waste at licensed facilities or with licensed haulers.

(b) The top 1.0 m of Site overburden is not to be removed from Site and is to be stockpiled along the Transitway roadway, East Boulevard, South of Brandon Avenue.

(c) All waste disposal grounds receiving debris and construction waste from this project must be operated under the authority of a valid permit issued pursuant to MR 150 (latest edition) Waste Disposal Grounds Regulation under the Environment Act.

(d) Dispose of all sewage and seepage from the on-site sanitary facilities in accordance with the Onsite Wastewater Management Systems Regulation MR 83/2003.

(e) Do not bury waste materials on Site.

(f) Do not dispose of solid or liquid wastes in drains or waterways.

D14.10 Hazardous Waste

D14.10.1 Definitions

(a) Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in the Dangerous Goods Handling and Transportation Act or regulations including hazardous materials and wastes.

(b) Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

(c) Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

(d) Workplace Hazardous Materials Information System (WHMIS): a Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

D14.10.2 Materials Management

(a) Only bring on Site quantity of hazardous materials required to perform Work.

(b) Maintain MSDSs in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

(c) Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

D14.10.3 Storage and Handling

(a) Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

(i) Sign storage areas.

(ii) Store and handle flammable and combustible materials in accordance with current Manitoba and National Fire Code of Canada requirements.

(iii) Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.

(iv) Do not use flammable liquids having flash point below 38 degrees C, such as naptha or gasoline as solvents or cleaning agents.

(v) Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

(vi) Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

(b) Keep no more than 100 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

(i) Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

(ii) Storage of quantities of flammable and combustible liquids exceeding 100 litres for Work purposes requires the written approval of the Contract Administrator

(iii) Fuel storage exceeding 100L shall be a minimum distance of 100 metres from any water body and in compliance with the requirements of the Storage and Handling of Petroleum Products and Allied Products Manitoba Regulation 188/2001 of the Dangerous Goods Handling and Transportation Act.

(c) Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

(i) Store hazardous materials and wastes in closed and sealed containers.

(ii) Label containers of hazardous materials and wastes in accordance with WHMIS.

(iii) Store hazardous materials and wastes in containers compatible with that material or waste.

(iv) Segregate incompatible materials and wastes. Ensure that different hazardous materials or hazardous wastes are not mixed.

(v) Store hazardous materials and wastes in secure storage area with controlled access.

(vi) Maintain clear egress from storage area.

(vii) Store hazardous materials and wastes in location that will prevent them from spilling into environment.

(viii) Store products on spill trays or berms with 110% capacity.

(ix) Do not store within 30 meters of a waterway or drain

(x) Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

(xi) Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began and disposal occurred. Maintain tipping and other disposal receipts.

(d) Report spills or accidents immediately:

(i) to the Contract Administrator.

(ii) to Manitoba Conservations Accident Reporting Line at 204-944-4888 in accordance with Manitoba Regulation 439/87 of the Dangerous Goods and Transportation Act.

(iii) Submit a written spill report to the Contract Administrator outlining cause and proposed corrective action and Manitoba Conservation as required. Provide copies of reports submitted to Manitoba Conservation to the Contract Administrator.

D14.10.4 Transportation

(a) Transport hazardous materials and wastes in accordance with the Manitoba Dangerous Goods Handling and Transportation Act.

(i) Ensure that trained personnel handle, offer for transport, or transport dangerous goods.

(ii) Use licensed carrier authorized by provincial authorities to accept subject material.

(iii) Label container[s] with legible, visible safety marks as prescribed by federal and provincial regulations.

(iv) Provide photocopy of shipping documents and waste manifests to the Contract Administrator.

(v) Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to the Contract Administrator.

(vi) Report discharge, emission, or escape of hazardous materials immediately to the Contract Administrator and appropriate provincial authority. Take measures to control release.

D14.10.5 Disposal

(a) Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

(i) Recycle hazardous wastes for which there is approved, cost effective recycling process available.

(ii) Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

(iii) Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

(iv) Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

D14.10.6 Noise

(a) Noise-generating activities shall be limited to the hours indicated in the City of Winnipeg Noise By-Law, unless otherwise accepted in advance by the Contract Administrator.

(b) The Contractor shall be responsible for scheduling Work to avoid potential noise problems and/or employ noise reduction measures to reduce noise t 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 shall not exceed the approved limit.

D14.10.7 Dust

(a) 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.

(b) 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.

(c) The Contractor shall ensure that trucks which are used to haul excavated material and backfill material to and from the Work Site utilize tarpaulin covers during transport to prevent material from falling onto the street and creating dust.

(d) Stockpiled soils shall be covered with tarpaulin covers to prevent the creation of dust.

D14.10.8 Erosion and Sediment Control

(a) Develop an erosion control plan to control negative impacts on water and air quality; plan should meet these objectives:

(i) Prevent loss of soil during construction by storm water run-off and wind erosion.

(ii) Protect against erosion from stockpiled topsoil aggregates.

(iii) Prevent sedimentation of the land drainage system and receiving streams with dust, particulate matter or eroded sediment.

(b) Supply, install, maintain and remove (as applicable and when no longer required) effective sediment control barriers and erosion control before starting Work that may result in the deposit of sediment into a ditch or water body to avoid potential impacts to fish and fish habitat.

(i) Erosion and sediment control measures and installations include, as required, silt socks around storm drains, silt fence barriers, erosion control blanket, straw wattles, and geotextile fabric as appropriate.

(ii) Routinely inspect all erosion and sediment control measures and installations and immediately repair any deficiencies.

D14.10.9 Work to Adjacent Waterways

(a) Do not operate construction equipment in waterways and, where possible, avoid operating equipment within 30 meters of the waterway.

(b) Do not use waterway beds for borrow material.

(c) Do not dump excavated fill, waste material or debris in ditches or waterway.

(d) Design and construct temporary crossings to minimize erosion to waterways.

(e) Dispose of excavated materials above the high water mark and 30 meters way from a watercourse.

D14.10.10 Drainage

(a) Provide temporary drainage and pumping as necessary to keep excavations and Site free from water.

(b) Do not pump water containing suspended materials into waterways, sewer or drainage systems.

(c) Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

D14.10.11 Reducing Site Disturbances

(a) Do not disturb, in any way, the embankment slopes, roadway shoulders, and adjacent ground surfaces areas outside the limits of the construction areas including the approved lay down, staging and access unless written permission has been obtained from the Contract Administrator. Such written permission will be granted only if it can be shown that there is no alternative.

(b) Minimize disturbance of any undeveloped areas on Site and maintain existing Site grading where indicated and where possible.

(i) Minimize stripping of topsoil and vegetation

(ii) Re-grade and plant vegetation on construction Site as soon as possible.

(iii) Avoid soil compaction where possible.

D14.10.12 Pollution Control

(a) Maintain temporary erosion and pollution control features installed under this Contract.

(b) Maintain construction equipment in good working order. Control emissions from equipment.

(c) Cover or wet down dry materials and stockpiled soils to prevent blowing dust and debris. Provide dust control for the construction Site, temporary and access roads.

(d) Bring only clean fill, granular, rip rap and other similar construction materials to the project Site.

D15. WATER MANAGEMENT PLAN

D15.1 Provide the Contract Administrator with a water management plan at least five (5) Business Days prior to commencement of any Work on the Site but in no event later than the date specified in the General Conditions for the return of the executed Contract.

D15.2 The Water Management Plan shall be prepared and submitted in a format that clearly identifies how the Contractor will undertake dewatering activities at the Site during construction.

D15.3 The Water Management Plan shall include provisions for drawing down the water table sufficient to dewater the excavation to maintain dry conditions for construction of the tunnel. This will require the use of wells. The Water Management Plan shall be further updated or altered as dictated by Site conditions. The Water Management Plan shall remain in effect until all construction and backfill activities are completed.

(a) Subject to the approval of the Contract Administrator, water with negligible suspended solids may be pumped into the LDS sewer.

(b) For water containing suspended solids, provide alternative means to remove the water from the Site.

(c) Formal approval for pumping water into the LDS sewer system must be obtained from the Contract Administrator in writing seven (7) days prior to commencement of pumping.

D16. TEMPERATURE MANAGEMENT PLAN

D16.1 Provide the Contract Administrator with a Temperature Management Plan for all mass concrete at least five (5) Business Days prior to commencement of any Work on the Site but in no event later than the date specified in the General Conditions for the return of the executed Contract.

D16.2 Mass concrete is defined as all structural concrete with a minimum thickness or dimension of 1.0 metres or more.

D16.3 The Temperature Management Plan shall be prepared and submitted in a format that clearly identifies how the Contractor will undertake temperature management for the mass concrete pours at the Site during construction.

D16.4 The Temperature Management Plan shall be prepared in accordance with the requirements of CSA A23.1 and shall include provisions for monitoring the temperature of the mass concrete pours and ambient temperature from time of placement until such time as management measures are no longer required.

SCHEDULE OF WORK

D17. DETAILED WORK SCHEDULE

D17.1 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 C4.1 for the return of the executed Contract.

D17.2 The detailed work schedule shall consist of the following:

(a) a critical path method (C.P.M.) schedule for the Work;

(b) a Gantt chart for the Work based on the C.P.M. schedule;

(c) a daily manpower schedule for the Work;

all acceptable to the Contract Administrator.

D17.3 Further to D17.2(a), the C.P.M. schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:

(a) Construct temporary asphalt pavement widening;

(b) Install construction fencing;

(c) Relocate chain link fence (by MB Hydro), Contractor to install non-conductive fence;

(d) Install 150 water service;

(e) Relocate Masonic Temple's 150 water service;

(f) Abandon 150 watermain;

(g) Install hydro duct protection and install concrete piles;

(h) Construct sheet pile retaining wall;

(i) Construct shoring;

(j) Construct bridge substructures;

(k) Construct substructure for elevated pedestrian ramp;

(l) Install west roof drainage system;

(m) Install east roof and surface drainage system;

(n) Construct retaining wall;

(o) Construct control building;

(p) Install electrical service from hydro service point;

(q) Construct station envelope substructure;

(r) Construct bridge superstructure;

(s) Construct bridge approach slabs;

(t) Construct pedestrian ramp superstructure;

(u) Construct under bridge slope paving;

(v) construct building envelope (includes architectural, structural, mechanical, electrical and furnishings);

(w) Construct pedestrian plaza including stairways and ramps;

(x) Landscaping;

(y) Reconstruct concrete sidewalk;

(z) Asphalt mill and fill.

D17.4 Further to D17.2(b), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or Specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

D17.5 Further to D17.2(c), the daily manpower schedule shall list the daily number of individuals on the Site for each trade.

D18. COMMENCEMENT

D18.1 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.

D18.2 The Contractor shall not commence any Work on the Site until:

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

(i) evidence of authority to carry on business specified in D8;

(ii) evidence of the workers compensation coverage specified in C6.15;

(iii) the Safe Work Plan specified in D9;

(iv) evidence of the insurance specified in D10;

(v) the performance security specified in D11;

(vi) the Subcontractor list specified in D12;

(vii) the Environmental Protection Plan specified in D14;

(viii) the Water Management Plan specified in D15;

(ix) the Temperature Management Plan specified in D16; and

(x) the Detailed Work Schedule specified in D17.

(xi) the CN Safety course specified in D13.

(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.

(c) The Contractor has provided proof of CN Contractor Safety Training for each individual proposed to Work on the Site. Contractor to contact Christina Cusson at (204) 231-7805 for CN Right of Entry and Safety Training requirements.

(d) The Contractor has attended a Transit safety meeting to be arranged by Tony Dreolini at (204) 986-5574.

D18.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

D18.4 The City intends to award this Contract the week of July 12, 2010

D18.4.1 If the actual date of award is later than the intended date, the dates specified for Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

D19. RESTRICTION OF WORK HOURS

D19.1 All Work shall be carried out between the hours of 07:00 and 22:00 Monday to Friday and between 09:00 and 21:00 Saturday or Statutory or Civic holidays.

D19.2 No Work shall be performed outside the hours stated in D19.1 or on Sunday or statutory or civic holidays without written permission from the Contract Administrator. Approval will only be granted if it is in the best interests of the City to do so.

D19.3 Further to clause 3.10 of CW 3110, the Contractor shall require written permission 48 hours in advance from the Contract Administrator for any Work to be performed outside the hours stated in D19.1.

D20. COORDINATION OF CONSTRUCTION WITH CN RAIL

D20.1 General Requirements

D20.1.1 The Contractor shall be responsible to meet all Canadian National (CN), constraints, requirements, and safety measures.

D20.1.2 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.

D20.1.3 If any emergency occurs, CN can be contacted through its Emergency CN Police Line 1-800-465-9239.

D20.1.4 The Contractor shall follow the requirements of CN as stipulated in the CN Safety Requirements herein in this Bid Opportunity Appendix C. All employees of the Contractor shall obtain the CN Contractor Orientation Identification card and sticker prior to working on Site.

D20.1.5 The Contractor shall provide CN with a 24 hour phone number through which the Contractor can be contacted for emergency purposes.

D20.2 Contractor's Use of Site

D20.2.1 The Contractor shall confine storage of materials and the operations of equipment, workmen, and erection of trailers to the limits indicated on the Contract drawings.

D20.2.2 No materials shall be stored closer than 5 m of the nearest rail of any operated track. Material shall not be stockpiled higher than 1.5 m.

D20.2.3 All costs, liabilities, cleaning up and restoring of Site after completion of the project will be the Contractor's responsibility.

D20.3 Rail Traffic Protection and Restrictions on Construction Operations

D20.3.1 The Contractor shall give CN 72 hour's notice of the hours within which work requiring Flagman is to be carried out in order that protection may be provided.

D20.3.2 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.

D20.3.3 Further to Appendix C Section 10.3, NC will entertain longer hours of work than indicated depending on the following conditions being met:

(a) The Contractor provide advance notice of work as indicated in D20.1.1 in order to make proper flagging requirements.

(b) A review of Site conditions by CN ensures that there are no adverse affects on train operations, ie. Unobstructed viewing of signals and required infrastructure by CN train, trainman walking, noise permits, etc.

D20.3.4 Further to Appendix C Section 12.2.1, there is not a predetermined long block available. Periods of train inactivity may be coordinated through the flagman. Do not expect CN to mover train schedules around for Work on this project.

D20.3.5 Further to Appendix C Section 18.3.11, CN requirements will not be waived with respect to proximity of cranes. CN must provide authorization and protection. If the Contractor is within 10 m encroachment specified, flagman notification and approval is required.

D20.3.6 It is the City of Winnipeg's intention to proved flagging, through CN. If required by the Contractor, subject to reasonable notice as indicated in D20.3.1.

D20.4 Signals and Communication Cables

D20.4.1 The Contractor shall request CN to locate their cables before commencement of any Work.

D20.4.2 The Contractor shall give CN 72 hour's notice to locate cables.

D20.4.3 The Contractor shall use extreme caution when working in the vicinity of any signal and communication cables.

D20.4.4 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.

D20.5 Barricades and Signage

D20.5.1 The Contractor shall 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.

D20.6 Down Time

D20.6.1 The Contractor shall anticipate down time each day for crane work or any equipment, such as drill rigs, that could fall on CN property. With 40 to 60 trains a day, passing adjacent to the project site, 90 to 200 minutes of down time within a 24-hour period is anticipated.

D21. ENCROACHMENT ON PRIVATE PROPERTY

D21.1 Further to Section 3.11 of CW 3110 of the General Requirements, the Contractor shall confine his Work to the public right-of-ways and construction easements at all times, except if he has received written permission from the property owner. The Contractor shall provide the Contract Administrator with a copy of any written permission he has received to enter onto private property.

D21.2 The Contractor's construction activities shall be confined to the minimum area necessary for undertaking the Work and he shall be responsible for all damage to private property resulting from his Work. Particular care shall be taken to assure no damage is done to buildings, fencing, trees and plants, and provision shall be made to maintain full drainage for private properties during construction.

D22. WORK BY OTHERS

D22.1 Work by others on or near the Site will include but not necessarily limited to:

(a) Tunnel Contractor

(b) Railway Detour Contractor;

(c) Railway Relocation Contractor; and

(d) Roadway Contractor.

(e) Bell Canada Fibre Optics

(f) Rogers Fibre Optics

(g) Manitoba Hydro (relocate and install gas main, and chain link fence)

(h) Manitoba Telecom Services (relocate buried cable)

D23. SUBSTANTIAL PERFORMANCE

D23.1 The Contractor shall achieve Substantial Performance by July 29, 2011.

D23.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D23.3 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.

D24. TOTAL PERFORMANCE

D24.1 The Contractor shall achieve Total Performance by August 31, 2011.

D24.2 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.

D24.3 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.

D25. LIQUIDATED DAMAGES

D25.1 If the Contractor fails to achieve Total Performance in accordance with the Contract by the day fixed herein for Total Performance, the Contractor shall pay the City ten thousand dollars ($10,000) per Calendar Day for each and every Calendar Day following the day fixed herein for Total Performance during which such failure continues.

D25.2 The amount specified for liquidated damages in D25.1 is based on a genuine pre-estimate of the City's damages in the event that the Contractor does not achieve Total Performance by the day fixed herein for same.

D25.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D26. SCHEDULED MAINTENANCE

D26.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

(a) Water management as specified in D15.

D26.2 Determination of Substantial Performance and Total Performance shall be exclusive of scheduled maintenance identified herein. All scheduled maintenance shall be completed prior to the expiration of the warranty period. Where the scheduled maintenance cannot be

completed during the warranty period, the warranty period shall be extended for such period of time as it takes the Contractor to complete the scheduled maintenance.

CONTROL OF WORK

D27. JOB MEETINGS

D27.1 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.

D27.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D28. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D28.1 Further to C6.24, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

D29. LAYOUT OF THE WORK

D29.1 Further to C6, the Contract Administrator will provide the basic centrelines and an elevation of the works as shown on the drawings.

D29.2 The Contractor shall be responsible for the true and proper layout of the Work and for the correctness of the location, levels, dimensions, and alignment of all aspects of the Work. The Contractor shall provide all required instruments and competent personnel for performing all layouts.

D29.3 Should any error appear or arise in location, levels, dimensions, and/or alignments during the course of the Work, the Contractor shall promptly rectify such errors to the satisfaction of the Contract Administrator, at his own expense.

D29.4 The Contract Administrator shall be notified at least one (1) Working Day prior to any Work being commenced in order to have the option to check and review all elevations and layouts at his discretion.

D29.5 The Contractor shall carefully protect and preserve all benchmarks, stakes, and other items used in giving the basic data supplied by the Contract Administrator. Any such benchmarks or stakes removed or destroyed by the Contractor, without the consent of the Contract Administrator, shall be replaced by the Contract Administrator at the expense of the Contractor.

MEASUREMENT AND PAYMENT

D30. PAYMENT

D30.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

D30.2 Further to C12, payment shall be in accordance with the following payment schedule:

(a) All portions of Work including those designated for lump sum payment, will be paid for on a monthly pro-rata basis as determined by the Contract Administrator in consultation with the

Contractor provided the portion of the Work to be paid for has been permanently incorporated into the Works.

WARRANTY

D31. WARRANTY

D31.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) years thereafter, except where longer warranty periods are specified in the respective Specification sections, unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.

D31.1.1 For the purpose of Performance Security, the warranty period shall be one (1) year.

D31.2 Notwithstanding C13.2, 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 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.

D31.3 In such case, the date specified by the Contract Administrator for the warranty period to begin shall be substituted for the date specified in C13.2 for the warranty period to begin.

FORM H1: PERFORMANCE BOND
(See D10)

KNOW ALL MEN BY THESE PRESENTS THAT

_____
(hereinafter called the "Principal"), and

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

_____

_____ dollars ($_____.____)

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

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

BID OPPORTUNITY NO. 303-2010

SOUTHWEST RAPID TRANSIT CORRIDOR – STAGE 1: OSBORNE STATION & ASSOCIATED WORKS

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

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

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

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

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

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

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness as to Principal if no seal)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

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

_____
(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 303-2010

SOUTHWEST RAPID TRANSIT CORRIDOR – STAGE 1: OSBORNE STATION & ASSOCIATED WORKS

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

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

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

_____

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

_____
(Address)

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

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

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

_____ .
(Date)

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

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

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

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM J: SUBCONTRACTOR LIST
(See D12)

SOUTHWEST RAPID TRANSIT CORRIDOR – STAGE 1: OSBORNE STATION & ASSOCIATED WORKS

Name	Address

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

E1.1 These Specifications shall apply to the Work.

E1.2 The City of Winnipeg Standard Construction Specifications in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.

E1.2.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/Spec/Default.stm

E1.2.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.

E1.2.3 Further to C2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.3 The following are applicable to the Work:

Specification No.	Specification Title
DIVISIONS 06, 07, 08, 09 AND 10 – ARCHITECTURAL	
06 10 10	ROUGH CARPENTRY
06 17 53	SHOP - FABRICATED WOOD TRUSSES
07 21 16	MINERAL WOOL BATT INSULATION, BATT AND BLANKET INSULATION
07 26 00	VAPOUR RETARDERS
07 27 10	AIR BARRIERS
07 46 50	PREFORMED METAL SOFFITS AND RAINWEAR
07 62 00	METAL FLASHING AND TRIM
07 92 10	JOINT SEALERS
08 11 14	STEEL DOORS AND FRAMES
08 11 16	ALUMINUM DOORS AND FRAMES
08 31 10	SLIDING GLASS ENTRANCE DOORS – ALUMINUM
08 44 13	GLAZED ALUMINUM CURTAIN WALLS
08 45 00	TRANSLUCENT WALL AND ROOF ASSEMBLIES
08 71 10	DOOR HARDWARE
09 54 23	LINEAR METAL CEILINGS
10 95 00	MISCELLANEOUS SPECIALTIES
DIVISION 05 – STRUCTURAL	
05 12 23	STRUCTURAL STEEL
DIVISIONS 26, 27 AND 28 – ELECTRICAL	
26 00 05	ELECTRICAL SCOPE OF WORK
26 05 01	ELECTRICAL GENERAL PROVISIONS
26 05 20	WIRE AND BOX CONNECTORS - 0-1000 V
26 05 21	BUILDING WIRES
26 05 28	GROUNDING – SECONDARY
26 05 31	SPLITTERS, JUNCTION, PULL BOXES AND CABINETS
26 05 32	OUTLET BOXES, CONDUIT BOXES AND FITTINGS
26 05 34	CONDUITS, CONDUIT FASTENING AND CONDUIT FITTINGS
26 05 41	UNDERGROUND SERVICE
26 09 24	LIGHTING CONTROL EQUIPMENT – LOW VOLTAGE
26 24 17	PANEL BOARDS BREAKER TYPE
26 27 26	WIRING DEVICES
26 28 14	FUSES LOW VOLTAGE
26 28 21	MOULDED CASE CIRCUIT BREAKERS
26 28 23	DISCONNECT SWITCHES – FUSED AND NON-FUSED

26 29 01	CONTACTORS
26 29 10	MOTOR STARTERS TO 600V
26 50 00	LUMINAIRE SCHEDULE
26 52 01	EMERGENCY LIGHTING
26 53 00	EXIT LIGHTING
27 05 13	INCOMING TELEPHONE SERVICE
27 51 15	PANIC ALARM SYSTEM
28 23 00	CCTV SYSTEMS
28 31 01	FIRE ALARM SYSTEMS

DIVISIONS 21, 22 AND 23 – MECHANICAL

21 05 01	COMMON WORK RESULTS FOR MECHANICAL
21 13 16	DRY PIPE SPRINKLER SYSTEM
22 42 01	PLUMBING SPECIALTIES AND ACCESSORIES
23 05 05	INSTALLATION OF PIPEWORK
23 05 29	HANGER AND SUPPORTS FOR HVAC PIPING AND EQUIPMENTS
23 05 53.01	MECHANICAL IDENTIFICATION
23 09 33	ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC
23 31 13.01	METAL DUCTS – LOW PRESSURE TO 5000 PA
23 33 00	AIR DUCT ACCESSORIES
23 34 00	HVAC FANS
23 37 20	LOUVRES, INTAKES AND VENTS
23 83 00	RADIANT HEATING UNITS

Consultant Drawing No.	City Drawing No.	Drawing Name/Title
GENERAL		
C5-G100-T	B237-10-1	COVER SHEET
C5-G101-T	B237-10-2	INDEX SHEET
C5-G102-T	B237-10-3	LEGEND & DESIGN DATA
C5-G103-T	B237-10-4	SITE PLAN & PROPOSED WORKS
C5-G104-T	B237-10-5	GENERAL ARRANGEMENT
C5-G105-T	B237-10-6	BRIDGE SECTIONS – 1 OF 2
C5-G106-T	B237-10-7	BRIDGE SECTIONS – 2 OF 2
C5-G107-T	B237-10-8	SITE FENCING – PLAN AT WEST END
C5-G108-T	B237-10-9	SITE FENCING – PLAN AT EAST END
C5-G109-T	B237-10-10	HYDRO SUBSTATION SECURITY FENCING 1 OF 2
C5-G110-T	B237-10-11	HYDRO SUBSTATION SECURITY FENCING 2 OF 2
C5-S1000-T	B237-10-12	PROTECTION FOR EXISTING UNDERGROUND UTILITIES
C5-S1001-T	B237-10-13	SHORING PLAN AND ELEVATION
C5-S1002-T	B237-10-14	SHORING SECTIONS
OVERPASS – SUBSTRUCTURES		
C5-S1100-T	B237-10-15	BRIDGE FOUNDATION LAYOUT
C5-S1101-T	B237-10-16	BRIDGE FOUNDATION DETAILS
C5-S1102-T	B237-10-17	WEST ABUTMENT SU-1 CONCRETE
C5-S1103-T	B237-10-18	WEST ABUTMENT SU-1 REINFORCING
C5-S1104-T	B237-10-19	PIER SU-2 CONCRETE 1 OF 2
C5-S1105-T	B237-10-20	PIER SU-2 CONCRETE 2 OF 2
C5-S1106-T	B237-10-21	PIER SU-2 REINFORCEMENT 1 OF 2
C5-S1107-T	B237-10-22	PIER SU-2 REINFORCEMENT 2 OF 2
C5-S1108-T	B237-10-23	PIER SU-3 CONCRETE
C5-S1109-T	B237-10-24	PIER SU-3 REINFORCEMENT
C5-S1110-T	B237-10-25	EAST ABUTMENT SU-4 CONCRETE 1 OF 2
C5-S1111-T	B237-10-26	EAST ABUTMENT SU-4 CONCRETE 2 OF 2
C5-S1112-T	B237-10-27	EAST ABUTMENT SU-4 REINFORCEMENT 1 OF 2
C5-S1113-T	B237-10-28	EAST ABUTMENT SU-4 REINFORCEMENT 2 OF 2

OVERPASS – SUPERSTRUCTURE

C5-S1114-T	B237-10-29	BUILDING FOUNDATION LAYOUT
C5-S1115-T	B237-10-30	BEARING LAYOUT AND DETAILS
C5-S1116-T	B237-10-31	STEEL GIRDERS – LAYOUT
C5-S1117-T	B237-10-32	STEEL GIRDERS – ELEVATIONS
C5-S1118-T	B237-10-33	STEEL GIRDERS – DIAPHRAGMS 1 OF 2
C5-S1119-T	B237-10-34	STEEL GIRDERS – DIAPHRAGMS 2 OF 2
C5-S1120-T	B237-10-35	STEEL GIRDERS – DETAILS
C5-S1121-T	B237-10-36	DECK LAYOUT
C5-S1122-T	B237-10-37	DECK DETAILS 1 OF 3
C5-S1123-T	B237-10-38	DECK DETAILS 2 OF 3
C5-S1124-T	B237-10-39	DECK DETAILS 3 OF 3
C5-S1125-T	B237-10-40	EXPANSION JOINT – LAYOUT
C5-S1126-T	B237-10-41	EXPANSION JOINT – DETAILS 1 OF 2

STATION, RAMPS & PLAZA

C5-S1127-T	B237-10-42	EXPANSION JOINT – DETAILS 1 OF 2
C5-S1128-T	B237-10-43	CONCRETE TRAFFIC BARRIER – 1 OF 2
C5-S1129-T	B237-10-44	CONCRETE TRAFFIC BARRIER – 2 OF 2
C5-S1130-T	B237-10-45	APPROACH SLABS
C5-S1130A-T	B237-10-45A	TRANSITION AND ROADWAY SLAB LAYOUTS
C5-S1130B-T	B237-10-45B	TRANSITION AND SLAB REINFORCEMENT
C5-S1130C-T	B237-10-45C	PRECAST CONCRETE MEDIAN
C5-S1131-T	B237-10-46	WEST END RETAINING WALLS – LAYOUT
C5-S1132-T	B237-10-47	WEST END RETAINING WALLS – SECTIONS & DETAILS 1 0F 3
C5-S1133-T	B237-10-48	WEST END RETAINING WALLS – SECTIONS & DETAILS 2 0F 3
C5-S1134-T	B237-10-49	WEST END RETAINING WALLS – SECTIONS & DETAILS 3 0F 3
C5-S1135-T	B237-10-50	WEST END – CONTROL BUILDING & ACCESS HATCH
C5-S1136-T	B237-10-51	WEST SIDE PEDESTRIAN RAMP – PLAN & ELEVATION
C5-S1137-T	B237-10-52	WEST SIDE PEDESTRIAN RAMP – SECTIONS & DETAILS 1 OF 4
C5-S1138-T	B237-10-53	WEST SIDE PEDESTRIAN RAMP – SECTIONS & DETAILS 2 OF 4
C5-S1139-T	B237-10-54	WEST SIDE PEDESTRIAN RAMP – SECTIONS & DETAILS 3 OF 4
C5-S1140-T	B237-10-55	WEST SIDE PEDESTRIAN RAMP – SECTIONS & DETAILS 4 OF 4
C5-S1141-T	B237-10-56	EAST END RETAINING WALLS – LAYOUT
C5-S1142-T	B237-10-57	EAST END RETAINING WALLS – SECTIONS & DETAILS 1 OF 4
C5-S1143-T	B237-10-58	EAST END RETAINING WALLS – SECTIONS & DETAILS 2 OF 4
C5-S1144-T	B237-10-59	EAST END RETAINING WALLS – SECTIONS & DETAILS 3 OF 4
C5-S1145-T	B237-10-60	EAST END RETAINING WALLS – SECTIONS & DETAILS 4 OF 4
C5-S1146-T	B237-10-61	EAST SIDE PEDESTRIAN PLAZA – PLAN
C5-S1147-T	B237-10-62	EAST SIDE PEDESTRIAN PLAZA – SECTIONS
C5-S1148-T	B237-10-63	EAST SIDE PEDESTRIAN PLAZA – FOUNDATION & FRAMING LAYOUT
C5-S1149-T	B237-10-64	EAST SIDE PEDESTRIAN PLAZA – SECTIONS & DETAILS 1 OF 3
C5-S1150-T	B237-10-65	EAST SIDE PEDESTRIAN PLAZA – SECTIONS & DETAILS 2 OF 3

C5-S1151-T	B237-10-66	EAST SIDE PEDESTRIAN PLAZA – SECTIONS & DETAILS 3 OF 3
C5-S1152-T	B237-10-67	WEST END & EAST END SIDEWALK SLAB
C5-S1153-T	B237-10-68	QUADGUARD II DETAILS 1 OF 3
C5-S1154-T	B237-10-69	QUADGUARD II DETAILS 2 OF 3
C5-S1155-T	B237-10-70	QUADGUARD II DETAILS 3 OF 3

ARCHITECTURAL

C5-A2000-T	B237-10-71	FLOOR PLAN
C5-A2001-T	B237-10-72	ROOF PLAN AND DETAILS
C5-A2002-T	B237-10-73	CONTROL BUILDING PLAN, ELEVATIONS & DETAILS
C5-A2003-T	B237-10-74	EXTERIOR BUILDING ELEVATIONS
C5-A2004-T	B237-10-75	EXTERIOR BUILDING ELEVATIONS & SECTIONS
C5-S2005-T	B237-10-76	WALL SECTIONS, DETAILS 1 OF 2
C5-A2006-T	B237-10-77	SECTIONS & MISC. DETAILS
C5-A2007-T	B237-10-78	WALL SECTIONS, DETAILS 2 OF 2
C5-A2008-T	B237-10-79	MISCELLANEOUS ROOF DETAILS
C5-A2009-T	B237-10-80	ROOF DETAILS
C5-A2010-T	B237-10-81	PLAN DETAILS
C5-A2011-T	B237-10-82	INTERIOR ELEVATIONS
C5-A2012-T	B237-10-83	INTERIOR ELEVATIONS & DETAILS

STRUCTURAL

C5-S2100-T	B237-10-84	FOUNDATION PLAN, BASE PLATES & MECHANICAL SHED FRAMING PLAN
C5-S2101-T	B237-10-85	ROOF FRAMING PLANS
C5-S2102-T	B237-10-86	SECTIONS & DETAILS
C5-S2103-T	B237-10-87	SECTIONS
C5-S2104-T	B237-10-88	SECTIONS & GENERAL NOTES
C5-S2105-T	B237-10-89	SECTIONS
C5-S2106-T	B237-10-90	SECTIONS

ELECTRICAL

C5-E2200-T	B237-10-91	ELECTRICAL STATION LAYOUT
C5-E2201-T	B237-10-92	ELECTRICAL SITE LAYOUT
C5-E2202-T	B237-10-93	ELECTRICAL DETAILS AND SCHEDULES

MECHANICAL

C5-M2300-T	B237-10-94	FLOOR PLAN / SECTIONS
C5-M2301-T	B237-10-95	SPRINKLERS / WATER
C5-M2302-T	B237-10-96	EQUIPMENT SCHEDULE

CIVIL WORK

C5-C3000-T	B237-10-97	REMOVALS 1 OF 2
C5-C3001-T	B237-10-98	REMOVALS 2 OF 2
C5-C3002-T	B237-10-99	CONTROL LINE GEOMETRY 1 OF 2
C5-C3003-T	B237-10-100	CONTROL LINE GEOMETRY 2 OF 2
C5-C3004-T	B237-10-101	PAVING AND GRADING 1 OF 2
C5-C3005-T	B237-10-102	PROFILE 1 OF 2
C5-C3006-T	B237-10-103	PAVING AND GRADING 2 OF 2
C5-C3007-T	B237-10-104	PROFILE 2 OF 2
C5-C3008-T	B237-10-105	CROSS SECTIONS 1 OF 3
C5-C3009-T	B237-10-106	CROSS SECTIONS 2 OF 3
C5-C3010-T	B237-10-107	CROSS SECTIONS 3 OF 3
C5-C3011-T	B237-10-108	CATCH BASIN DETAILS

UNDERGROUND UTILITIES

C5-U4000-T	B237-10-109	UNDERGROUND UTILITIES PLAN WEST OF OSBORNE
C5-U4001-T	B237-10-110	UNDERGROUND UTILITIES PLAN EAST OF OSBORNE

LANDSCAPING

C5-L5000-T	B237-10-111	LANDSCAPE WORKS OVERALL PLAN
C5-L5001-T	B237-10-112	LANDSCAPE WORKS EAST SIDE LAYOUT & PLANTING
C5-L5002-T	B237-10-113	LANDSCAPE WORKS WEST SIDE LAYOUT & PLANTING
C5-L5003-T	B237-10-114	LANDSCAPE WORKS EAST SIDE LANDSCAPE GRADING
C5-L5004-T	B237-10-115	LANDSCAPE WORKS WEST SIDE LANDSCAPE GRADING
C5-L5005-T	B237-10-116	LANDSCAPE WORKS ENLARGEMENTS
C5-L5006-T	B237-10-117	SECTIONS
C5-L5007-T	B237-10-118	LANDSCAPE DETAILS
C5-L5008-T	B237-10-119	LANDSCAPE DETAILS
C5-L5009-T	B237-10-120	LANDSCAPE DETAILS
C5-L5010-T	B237-10-121	LANDSCAPE DETAILS

E2. GEOTECHNICAL REPORT

E2.1 Further to C3.1, test hole logs from the 2004 Klohn Crippen geotechnical report and from the 2010 AECOM investigations are provided in Appendix A and B respectively to aid the Contractor's evaluation of the existing soil conditions. The information presented is considered accurate at the locations and time of drilling as outlined in the Appendices. However, variations in soil conditions may exist between test holes and fluctuations in groundwater levels can be expected seasonally and may occur as a result of construction activities. The nature and extent of variations may not become evident until construction commences. The complete Klohn Crippen geotechnical report and AECOM investigation memo may be viewed at the Contract Administrator's Office upon request.

E3. SHOP DRAWINGS

E3.1 Description

E3.1.1 This Specification provides instructions for the preparation and submission of shop drawings.

(a) The term 'shop drawings' means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, including Site erection drawings which are to be provided by the Contractor to illustrate details of a portion of the Work.

(b) Submit specified shop drawings to the Contract Administrator for review. All submissions must be in metric units. Where data is in imperial units, the correct metric equivalent shall also be show on all submissions for Contract Administrator review.

E3.2 Shop Drawings

E3.2.1 Original drawings shall be prepared by Contractor, Subcontractor, supplier, distributor or manufacturer to illustrate appropriate portion of Work including fabrication, layout, setting or erection details as specified in appropriate sections.

E3.2.2 Shop drawings for the following components shall bear the seal of a Professional Engineer registered in the province of Manitoba:

(a) Metal Fabrications, layout, and erection details

(b) Shoring

(c) Form details for deck pouring

(d) Bearings

(e) Expansion Joints

(f) Reinforcing Steel Layout and Details

E3.3 Contractor's Responsibilities

(a) Review shop drawings, product data and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.

(b) Verify:

(i) Field Measurements

(ii) Field Construction Criteria

(iii) Catalogue numbers and similar data

(c) Coordinate each submission with requirements of Work and Contract Documents. Individual shop drawings will not be reviewed until all related drawings are available.

(d) Notify Contract Administrator, in writing at time of submission, of deviations from requirements of Contract Documents.

(e) Responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator's review of submission, unless Contract Administrator gives written acceptance of specified deviations.

(f) Responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.

(g) Make any corrections required by the Contract Administrator and resubmit the required number of corrected copies of shop drawings. Direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.

(h) After Contract Administrator's review and return of copies, distribute copies to Subcontractors and others as appropriate.

(i) Maintain one (1) complete set of reviewed shop drawings, filed by Specification Section Number, at the Site of the Work for use and reference of the Contract Administrator and Subcontractors.

E3.4 Submission Requirements

(a) Schedule submissions at least fourteen (14) Calendar Days before dates reviewed submissions will be needed, and allow for a fourteen (14) Calendar Day period for review by the Contract Administrator of each individual submission and re-submission, unless noted otherwise in the Contract Documents.

(b) Submit two (2) paper prints of shop drawings. The Contract Administrator will retain one (1) copy of all submittals and return one (1) copy to the Contractor.

(c) Accompany submissions with transmittal letter containing:

(i) Date

(ii) Project title and Bid Opportunity number

(iii) Contractor's name and address

(iv) Number of each shop drawing, product data and sample submitted

(v) Specification Section, Title, Number and Clause

(vi) Drawing Number and Detail / Section Number

(vii) Other pertinent data

(d) Submissions shall include:

(i) Date and revision dates.

(ii) Project title and Bid Opportunity number.

(iii) Name of:

(i) Contractor

(ii) Subcontractor

(iii) Supplier

(iv) Manufacturer

(v) Detailer (if applicable)

(iv) Identification of product or material.

(v) Relation to adjacent structure or materials.

(vi) Field dimensions, clearly identified as such.

(vii) Specification section name, number and clause number or drawing number and detail / section number.

(viii) Applicable standards, such as CSA or CGSB numbers.

(ix) Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.

E3.5 Other Considerations

(a) Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.

(b) Material and equipment delivered to the Site of the Works will not be paid for at least until pertinent shop drawings have been submitted and reviewed.

(c) Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.

(d) No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions and review of shop drawings.

E4. VERIFICATION OF WEIGHTS

E4.1 All material which is paid for on a weight basis shall be weighed on a scale certified by Consumer & Corporate Affairs, Canada.

E4.1.1 All weight tickets shall have the gross weight and the time and date of weighing printed by an approved electro/mechanical printer coupled to the scale.

E4.1.2 The tare weight and net weight may either be hand written or machine printed. All weights, scales and procedures shall be subject to inspection and verification by the Contract Administrator. Such inspection and verification may include, but shall not be limited to:

(a) Checking Contractor's scales for Consumer & Corporate Affairs certification seals.

(b) Observing weighing procedures.

(c) Random checking of either gross or tare weights by having such trucks or truck/trailer(s) combinations as the Contract Administrator shall select weighed at the nearest available certified scale.

(ii) Checking tare weights shown on delivery tickets against a current tare.

E4.1.3 No charge shall be made to The City for any delays or loss of production caused by such inspection and verification.

E4.2 The Contractor shall ensure that each truck or truck/trailer(s) combination delivering material which is paid for on a weight basis carries a tare not more than one (1) month old.

E4.2.1 The tare shall be obtained by weighing the truck or truck/trailer(s) combination on a certified scale and shall show:

(a) Upon which scale the truck or truck/trailer(s) combination was weighed.

(b) The mechanically printed tare weight.

(c) The license number(s) of the truck and trailer(s).

(d) The time and date of weighing.

E5. MOBILIZATION AND DEMOBILIZATION

E5.1 Description

E5.1.1 This Specification covers all operations relating to the mobilization and demobilization of the Contractor to the Site, as specified herein.

E5.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E5.2 Scope of Work

E5.2.1 The Work under this Specification shall include but not be limited to:

(a) Mobilizing and demobilizing on-site Work facilities;

(b) Supplying, setting up, laying out, and removing site office facilities as detailed in E6 “Office Facilities”;

(c) Supplying and installing secure fencing around the site (Type 1);

(d) Maintaining and removing any access roadway;

(e) Traffic control (E10) and traffic management (E11); and

(f) Pedestrian protection/accommodation (E12).

E5.3 Materials

E5.3.1 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.

E5.3.2 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.

E5.4 Equipment

E5.4.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E5.5 Construction Methods

E5.5.1 Layout of On-Site Work Facilities

(a) The Contractor shall mobilize all on-site Work and other temporary facilities.

(b) Upon completion of construction activities, the Contractor shall remove all on-site Work and other temporary facilities.

E5.5.2 Cellular Telephone Communication

(a) The Contractor’s site supervisor is required to carry, at all times, a cellular telephone, with voice mail.

E5.5.3 Secure Site Fencing (Type 1)

(a) A minimum 2.4 m high chain-link secure fence around the site lay-down and Work site areas shall be installed prior to commencement of site activities.

(b) The fencing shall remain secure and in place during all construction facilities.

(c) The fencing shall be removed upon demobilization of on-site Work facilities.

E5.5.4 Traffic Gates

(a) The Contractor shall supply, install, maintain, and remove steel gates to keep non-Contract traffic and pedestrians out of the Work site.

(b) The gates shall be removed upon completion of construction activities.

E5.5.5 Access Roadway

(a) The Contractor shall maintain any access roadway they install.

(b) The access road shall be maintained on a regular basis to provide continual unrestricted site access, to the satisfaction of the Contract Administrator.

(c) Upon completion of the Work, the area shall be restored to its original condition.

E5.5.6 Restoration of Existing Facilities

(a) Upon completion of the Work and demobilization, the Contractor shall restore existing facilities.

E5.6 Measurement and Payment

E5.6.1 Mobilization and demobilization will be paid for at the Contract Lump Sum Prices for "Mobilization and Demobilization".

E5.6.2 Mobilization and demobilization will be paid for at a percentage of the Contract Lump Sum Prices, as specified herein. These percentages shall be as follows:

(a)	When Contract Administrator is satisfied that construction has commenced	30%
(b)	During construction	60%
(c)	Upon completion of the project	10%

E6. OFFICE FACILITIES

E6.1 The Contractor shall supply office facilities meeting the following requirements:

(a) The field office shall be for the exclusive use of the Contract Administrator.

(b) The building shall be conveniently located near the site of the Work.

(c) The building shall have a minimum floor area of 25 square metres, a height of 2.4m with a window and a door entrance with a suitable lock.

(d) 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 16-18^{o}C or 24-25^{o}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 one desk, one drafting table, table 3m x 1.2m, one stool, one four drawer legal size filing cabinet, and a minimum of 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.

E6.2 The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the office facilities.

E6.3 The office facilities will be provided from the date of the commencement of the Work to the date of Total Performance.

E7. PROTECTION OF EXISTING TREES

E7.1 Take the following precautionary steps to prevent damage from construction activities to existing trees as shown on the Site Plan:

(a) Do not stockpile materials and soil or park vehicles and equipment within 2 meters of trees.

(b) Trees identified to be at risk by the Contract Administrator are to be strapped with 19 x 89 x 2400 mm wood planks, or suitably protected as approved by the Contract Administrator.

(c) Excavation shall be performed in a manner that minimizes damage to the existing root systems. Where possible, excavation shall be carried out such that the edge of the excavation shall be a minimum of 20 times the trunk diameter from the closest edge of the trunk. Where roots must be cut to facilitate excavation, they shall be pruned neatly at the face of excavation.

(d) Operation of equipment within the drip line of the trees shall be kept to the minimum required to perform the Work required. Equipment shall not be parked, repaired, refuelled; construction materials shall not be stored, and earth materials shall not be stockpiled within the drip lines of trees. The drip line of a tree shall be considered to be the ground surface directly beneath the tips of its outermost branches. Ensure that the operations do not cause flooding or sediment deposition on areas where trees are located.

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

E7.2 All damage to existing trees caused by the Contractor's activities shall be repaired to the requirements and satisfaction of the Contract Administrator and the City Forester or his designate.

E7.3 No separate measurement or payment will be made for the protection of trees.

E7.4 Do not trim Elm trees between April 1 and July 31, inclusive.

E7.5 Auguring under existing trees will be the only acceptable method of underground installations. Any other excavations must be approved by the Forestry Branch.

E8. SITE SECURITY

E8.1 During the project the Contractor shall be responsible for maintaining only authorized Site access 24 hours a day. Any existing security fencing, etc. that may be altered during construction will need to have an equivalent replacement. No separate measurement for payment shall be made for this work.

E9. WATER USED BY CONTRACTOR

E9.1 Further to clause 3.7 of CW 1120-R1, the Contractor shall pay for all costs associated with obtaining water in accordance with the Waterworks By-law. Sewer charges will not be assessed for water obtained from a hydrant.

E10. TRAFFIC CONTROL

E10.1 Description

E10.1.1 The Work covered under this item shall include all operations related to establishing and executing the public access and traffic control plan as hereinafter specified.

E10.1.2 The Work includes furnishing all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Work associated with the public access and traffic control.

E10.2 Notification

E10.2.1 The Contractor shall notify the City of Winnipeg Customer Service at 986-5640, one day in advance of any traffic lane closures.

E10.3 Construction Methods

E10.3.1 General

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

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

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

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

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

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

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

(h) Intersecting street and private approach access shall be maintained at all times.

(i) Should the Contractor be unable to maintain pedestrian or vehicular access to a residence or business, he shall review the planned disruption with the business or residence and the Contract Administrator, and take reasonable measures to minimize the impact. The Contractor shall provide a minimum of 24 hours notification to the affected residence or business and the Contract Administrator, prior to disruption of access.

(j) Pedestrian passage must be maintained in a safe manner acceptable to the Contract Administrator.

E10.4 Measurement and Payment

E10.4.1 Public Access and Traffic Control are considered incidental to the Works of Specification E5 and no additional measurement or payment will be made.

E11. TRAFFIC MANAGEMENT

E11.1 Further to Clause 3.7 of CW 1130:

(a) Traffic at intersections must be maintained during construction. When no work is being performed in the intersection and providing it is safe for vehicles, lane closures in the intersection will not be permitted.

(b) Intersecting street and private approach access shall be maintained at all times.

(c) Should the Contractor be unable to maintain pedestrian or vehicular access to a business, he shall review the planned disruption with the business and the Contract Administrator, and take reasonable measure to minimize the impact. The Contractor shall provide a minimum of 24 hours notification to the affected business and the Contract Administrator, prior to disruption of access.

(d) Pedestrian and ambulance/emergency vehicle and Transit bus access must be maintained at all times.

E11.2 Osborne Street Operational Restrictions:

E11.2.1 Lane closures

(a) Single lane closures:

(i) Two northbound lanes and one southbound lane must be maintained during AM peak traffic

(ii) Two southbound lanes and one northbound lane must be maintained during PM peak traffic.

E11.2.2 Closure of both lanes in a single direction

(a) Detour will provide two adjacent lanes to be closed through the construction area by allowing one traffic lane from each direction to operate on the opposite side of the median. This operation will be permitted to take place on weekends between Friday 20:00 and Monday 04:00 with notice acceptable to the Contract Administrator provided.

E11.2.3 Osborne Street closure

(a) A single weekend closure of Osborne Street through the construction area between Friday 20:00 and Monday 04:00 will be permitted for the erection of girders with the following provisions:

(i) Notice acceptable to the Contract Administrator will be provided;

(ii) A 4 m opening for the passage of emergency vehicles and buses will be available at all times. Winnipeg Transit will provide assistance in managing the passage of their vehicles through the construction area and allow minor delays as deemed necessary while girders are being erected with the goal providing continued operation of this bus route.

E11.3 A second weekend closure of Osborne Street through the construction area between Friday 20:00 and Monday 04:00 will be permitted with the following provisions:

(a) Notice acceptable to the Contract Administrator will be provided.

(b) A 4 m opening for the passage of emergency vehicles and buses will be available at all times. Winnipeg Transit will provide assistance in managing the passage of their vehicles through the construction area and allow minor delays as deemed necessary while girders are being erected with the goal providing continued operation of this bus route.

(c) Subject to a payment of $50,000 which will be deducted from the Contract Lump Sum Prices for “Mobilization and Demobilization” upon completion of the project.

E12. PEDESTRIAN PROTECTION / ACCOMMODATION

E12.1 Description

E12.1.1 This Specification shall cover all operations relating to the provision of safe access for pedestrians and cyclists around the construction site and on the underbridge sidewalk at the East and West sides of the proposed overpass, as specified herein.

E12.1.2 One sidewalk will be available at all times. Appropriate signage, acceptable to the Contract Administrator will be required at the nearest pedestrian and cyclist crossing at both sides of the Work area. A flag person will be required to control the safe passage of pedestrians and cyclists during erection of girders.

E12.1.3 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.

E12.2 Scope of Work

E12.2.1 The Work under this Specification shall involve:

(a) The supply, erection, and maintenance of pedestrian protection, as specified herein;

(b) The provision of all signage necessary to direct pedestrian traffic;

(c) The provision of all other measures necessary to ensure safe pedestrian access through the construction site to the satisfaction of the Contract Administrator; and

(d) It is intended that the Contractor provide pedestrian protection and guidance at all times during the Project.

E12.3 Submittals

E12.3.1 The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the commencement of any scheduled Work on the Site, a proposed schedule, including methods and sequence of operations.

E12.4 Materials

E12.4.1 General

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

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

E12.5 Equipment

E12.5.1 General

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

E12.6 Construction Methods

E12.6.1 Pedestrian Protection Enclosure

(a) A pedestrian protection wall at the location of the underbridge sidewalk on the East and West sides of the proposed overpass, complete with overhead protection, shall be a minimum of 2400 mm high and shall consist of support posts and minimum 13 mm thick plywood. The support posts shall have provision for anchorage to prevent movement or overturning of the pedestrian protection due to wind. The pedestrian protection shall be designed for all applicable loading including wind loading in accordance with the requirements of the National Building Code. Adequate lighting shall be provided attached to the inside of the temporary pedestrian enclosure. Lighting shall be provided for the length of the pathway enclosure.

E12.6.2 Safety Precautions

(a) The Contractor shall provide flagmen, barricades, railings, signs and warning lights as required at all times to secure the safety of the public and shall comply with all provincial statues and laws in force in Manitoba applicable to the Work of this nature.

E12.6.3 Maintenance of the Pedestrian Protection Enclosure

(a) The Contractor shall maintain the Pedestrian Protection Enclosure in good working order at all times to the satisfaction of the Contract Administrator.

(b) The sidewalk shall be kept free of all construction materials, debris, and equipment.

E12.7 Quality Control

E12.7.1 Inspection

(a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.

(b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.

E12.7.2 Access

(a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E12.8 Measurement and Payment

E12.8.1 There will be no measurement for this work. This item of Work shall be considered incidental to "Mobilization and Demobilization" and no separate payment will be paid for the Work.

E13. COORDINATION OF CONSTRUCTION WITH CN RAIL

E13.1 General Requirements

E13.1.1 The Contractor shall be responsible to meet all Canadian National (CN), constraints, requirements, and safety measures.

E13.1.2 CN Safety Requirements are included in Appendix C.

E13.2 Flag Protection of Work

E13.2.1 The City of Winnipeg will be supplying one full-time Flagman for this project.

E13.2.2 Flagman's availability is 6 days per week for a maximum of 10 hours per day.

E14. COORDINATION AND RESTRICTIONS OF CONSTRUCTION WITH MANITOBA HYDRO

E14.1 General Requirements

E14.1.1 The Contractor shall be responsible to meet and coordinate works with Manitoba Hydro for the installation of the non-conductive sandwich fence systems.

E14.2 Contacts

E14.2.1 Prior to proceeding with the installation of Type 2, Type 3 and Type 4 fences on the west side, the Contractor must coordinator the works with the following Manitoba Hydro designated personnel:

Mr. Glen Haight (Primary Point of Contact)
Phone No. 360-7429, Cell No. 470-7649

or

Mr. Henry Bergen

Phone No. 360-7425, Cell No. 944-3287, Fax No. 927-9722

E14.3 Restrictions

E14.3.1 Access to the west Work area is restricted before October, 2010.

E14.3.2 Equipment may require electrical grounding, pending on the results of Manitoba Hydro's grounding study.

E14.3.3 Construction vibration may throw some sensitive relay switches off in the Hydro Substation and the Contractor may delay due to this problem.

E14.3.4 Overhead transmission lines may not be able to shut down on weekends during the summer months.

E14.3.5 Any construction activities at the west side shall provide minimum interference with the Hydro Substation.

E15. ENCROACHMENT ON PRIVATE PROPERTY

E15.1 Further to Section 3.11 of CW 1130 of the General Requirements, the Contractor shall confine his Work to the public right-of-ways and construction easements at all times, except if he has received written permission from the property owner. The Contractor shall provide the Contract Administrator with a copy of any written permission he has received to enter onto private property.

E15.2 The Contractor's construction activities shall be confined to the minimum area necessary for undertaking the Work and he shall be responsible for all damage to private property resulting from his Work. Particular care shall be taken to assure not damage is done to building, fencing, trees and plants, and provision shall be made to maintain full drainage for private properties during construction.

E16. DAMAGE TO EXISTING STRUCTURES AND PROPERTY

E16.1 Further to Section 3.13 of CW 1130 of the General Requirements, special care shall be taken to avoid damage to existing adjacent structures and properties during the course of the Work.

E16.2 Any damage cause by the Contractor or his Subcontractors to the adjacent structures or properties shall be promptly repaired by the Contractor at his own expense to the satisfaction of the Contract Administrator.

E17. STRUCTURAL SHORING

E17.1 Description

E17.1.1 The Work covered under this item shall include all operations relating to supply and installation, and removal of shoring systems at the northwest and southwest required to construct retaining walls, approach roadway, approach span and the manhole at the southwest, supply and installation of steel sheet piling system at the south-east adjacent to the CN Track, as specified herein.

E17.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, safe working plans, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of the Work as hereinafter specified.

E17.2 References and Building Codes

E17.2.1 All applicable sections of the National Building Code of Canada, the Manitoba Building Code and the American Railway Engineering and Maintenance-of-Way Association (AREMA) shall apply to the manufacture, installation, excavation and items and activities incidental to Work included in this Specification.

E17.3 Materials

E17.3.1 General

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

E17.3.2 Concrete

(a) Concrete to be used in soldier pile caissons and working base shall be high early strength, with a minimum 28-day compressive strength of 30 MPa and nominal 20 mm coarse aggregate. Air entrainment is not required.

E17.3.3 Structural Steel

(a) All structural steel shapes shall be minimum CSA G40.21 Grade 300W, HSS sections shall be minimum CSA G40.21 Grade 350W, and sheet piling shall be minimum Grade 45 ASTM A572 material.

E17.3.4 Timber Lagging

(a) Timber lagging shall be species S-P-F, beams and stringers, grade no. 1 or better with an allowable bending stress of 6.6 MPa including all modification factors. The lagging thickness (horizontal dimension) shall be 150 mm minimum for the upper 2000 mm and 200 mm minimum for below 2000 mm depth. The vertical dimension of lagging shall be not less than 50 mm greater than the horizontal dimension.

E17.4 Construction Methods

E17.4.1 General Staging and Construction Requirements

(a) Prepare and submit a Structural Excavation and Shoring Safe Working Plan to the Contract Administrator for review a minimum of two (2) weeks prior to the commencement of this work.

(b) Prior to commencing excavation operations, install sediment control fencing or other such erosion control structures to prevent sediment-laden runoff from leaving the job Site and entering the City land drainage system. The sediment control fencing shall remain in place until all construction activities are complete.

(c) Complete excavations in accordance with the specified procedures and to the elevations and dimensions shown on the drawings or to adjusted elevations as directed by the Contract Administrator in order to obtain a firm, stable foundation.

(d) Handle, store and dispose of excavated materials in accordance with the Environmental Protection Plan as described in D14 and accepted by the Contract Administrator in accordance with B7.

E17.5 Measurement and Payment

E17.5.1 Structural Shoring

(a) The Structural shoring and other associated works will not be measured. This Item of Work will be paid for in the Contract Lump Sum Price for “Structural Shoring”, performed in accordance with this Specification and accepted by the Contract Administrator in accordance with B7.

E18. HYDRO EXCAVATION AND TEMPORARY PROTECTION OF HYDRO AND MTS DUCTS

E18.1 Description

E18.1.1 General

(a) This Specification shall cover the removal of earthen material immediately adjacent to underground utilities infrastructure by means of high pressure water spray, and the recovery of evacuated material by vacuum type means or equivalent method as approved by the Contract Administrator.

(b) The installation of formboard, lean concrete mix, timber mat top cover for the installation of concrete piles, pier caissons, retaining wall and construction of the west approach span.

(c) The installation of low density styrofoam bead board, lean concrete mix for the installation of pier caissons and pier cap at SU.3.

(d) The removal of the timber mat top cover, lean concrete mix and foam board after the installation of concrete piles, pier caissons, retaining wall and construction of the west approach span and replace them with 25 mm crushed limestone.

(e) The removal of lean concrete mix and low density styrofoam bead board after installation of pier caissons and pier cap at SU.3 and replace them with 25 mm crushed limestone.

E18.2 Equipment

E18.2.1 Hydro Excavation unit shall be capable of maintaining a minimum working pressure of 10,000 psi, at a rate of flow of 10 to 12 gallons per minute. Unit should be adjustable, so as to provide adequate pressure to remove earthen material identified by the Contract Administrator.

E18.2.2 Spray head shall be equipped with a rotating type nozzle, in order to provide a wider path of cut.

E18.3 Construction

E18.3.1 Hydro-Removal of Earthen Material

(a) Earthen material adjacent to utility entity shall be sprayed with high pressure water so as to remove all such material identified by the Contract Administrator.

E18.3.2 Recovery of Excavated Material

(a) The recovery of excavated material shall be done using vacuum type method, or other type method as approved by the Contract Administrator.

(b) The recovery of material shall follow immediately behind the excavation, to avoid excavated areas from filling with excavated material.

(c) The use of mechanical sweepers will not be allowed.

(d) Depose of material in accordance with Section 3.4 of CW-1130.

E18.3.3 Backfill of Hydro Excavated Hole

(a) The Contractor shall be responsible for the removal of Hydro and MTS ducts' lean mix concrete protection, formboard and replace with 20 mm crushed limestone.

(b) Removal measures cannot utilize jackhammers but must utilize drilling and hydraulic splitters or other non-impact equipment.

E18.4 Measurement and Payment

E18.4.1 Hydro Excavation and Temporary Protection of Hydro and MTS Ducts

(a) Hydro Excavation of earthen material and temporary protection of hydro ducts will not be measured. This Item of Work will be paid for in the Contract Lump Sum Price for "Hydro Excavation and Temporary Protection of Hydro and MTS Ducts", performed in accordance with this Specification and accepted by the Contract Administrator in accordance with B7.

E19. SUBDRAIN SYSTEMS

E19.1 Description

E19.1.1 This Specification shall cover the supply and installation of the subdrain pipe and wall drain systems located behind retaining walls and each abutment.

E19.1.2 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.

E19.2 Material

E19.2.1 General

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

E19.2.2 Drain Pipes, Fittings, and Accessories

(a) Drain pipes, fittings, and other accessories and appurtenances for the tunnel substructure drain pipe system, shall conform to the requirements of the City of Winnipeg Standard Construction Specification CW 3610 and requirements of the latest revision of CSA G401.93, for Corrugated Steel Pipe (CSP). Corrugated steel pipe shall be perforated aluminized Type 2, 1.6 mm gauge, diameter as shown on the Contract drawings.

(b) All other drain pipes, fittings, and other accessories and appurtenances shall conform to the requirement of Standard Construction Specification CW 2310 and CW 2131.

E19.2.3 Filter Fabric

(a) Filter fabric shall either Mirafi P600X Woven by Dominion Textile Inc. or Typar Style 3607 by Dupont Company or equal as accepted by the Contract Administrator in accordance with B7, and shall conform to the requirements of Standard Construction Specification CW 3616.

E19.3 Equipment

E19.3.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E19.4 Construction Methods

E19.4.1 Subdrain Piping System

(a) Install a perforated drain pipe system behind retaining walls and each abutment. The supply and installation of this drain pipe system shall include the drain pipe, all required fittings, drain pipe backfill materials, and the filter fabric.

(b) The drain pipe shall be laid to the line and grade shown on the Contract 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.

E19.5 Measurement and Payment

E19.5.1 Subdrain Systems

(a) The Subdrain Systems will not be measured. This Item of Work will be paid for in the Contract Lump Sum Price for the “Excavation and Backfill”, performed in accordance with this Specification and accepted by the Contract Administrator in accordance with B7.

E20. EXCAVATION AND BACKFILL

E20.1 Description

E20.1.1 The Works in this section include the following:

(a) Excavation and backfilling required to construct the retaining walls, abutments, approach spans, approach roadways, approach and sleeper slabs and a manhole.

(b) Supplying and installation of perforated and non-perforated drain pipe with crushed rock wrapped in filter fabric to provide subsurface drainage behind retaining walls and each abutment.

E20.1.2 The Works also include the following:

(a) The design, fabrication, erection, and removal of all temporary shoring, and such temporary protective measures as may be required to construct the Works.

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

E20.1.3 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.

E20.2 Equipment

E20.2.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E20.3 Materials

E20.3.1 Excavation

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

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

(c) Excavated material shall be unclassified excavation and shall include the excavation and satisfactory disposal of all cleared and grubbed materials, earth, gravel, sandstone, loose detached rock, shale, rubbish, cemented gravel or hard pan, disintegrated stone, rock in ledge or mass formation wet or dry, trees, shrubs, or all other material of whatever character which may be encountered.

E20.3.2 Backfilling

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

(b) All materials shall 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, 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.

(c) 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.

(d) All granular backfill, including levelling base fill, 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

(e) Clay backfill for structures shall be of a type accepted by the Contract Administrator, preferably native material if deemed suitable by the Contract Administrator.

(f) Excavated material may be used for backfilling provided it meets the above requirements. Excavated granular material intended to be used for backfilling is not be contaminated by top soil or organic materials.

E20.3.3 Galvanized Corrugated Steel Drain Pipe

(a) Perforated drain pipe shall be 150 mm diameter, 1.3 mm core thickness galvanized corrugated steel drain pipe with six (6) rows of 10 mm diameter perforations as manufactured by Armtec or approved equal.

(b) Non-perforated drain pipe shall be 150 mm diameter, 1.3 mm core thickness galvanized corrugated steel drain pipe as manufactured by Armtec or approved equal.

E20.3.4 Non-Woven Geotextile, Class 1

(a) Armtec 150 as manufactured by Mirafi Construction Products or approved equal.

E20.4 Construction Methods

E20.4.1 Excavation

(a) Excavations shall be completed to the elevations required to construct the Works or to such other elevations as may be directed by the Contract Administrator in the field. Excavation sequence shall be done in a “top down” direction, in order to maintain stability. The dimensions of the excavation shall be such as to give sufficient clearances for the construction of forms and their subsequent removal.

(b) All material shall be brought to the surface by approved method, and shall be disposed of away from the site.

(c) After each excavation is completed, the Contractor shall notify the Contract Administrator.

(d) The Contractor shall excavate only material that is necessary for the expeditious construction of the structure or as set out by the Contract Administrator in the field. If the Contract Administrator permits the excavation of runways, existing stock piling, or trenches within the right-of-way, the Contractor shall, on completion of the Work, backfill the runways and trenches to the elevation of the original ground existing at the time of excavation and compact the backfill material, all at his own expense and as directed by the Contract Administrator.

(e) All excess excavated material shall become the property of the Contractor and shall be removed from the site.

E20.4.2 Backfilling

(a) The Contract Administrator shall be notified at least one (1) working day in advance of any backfilling operations. No backfill shall be placed against any concrete until accepted by the Contract Administrator.

(b) All backfill material shall be supplied, placed, and compacted in lifts of 150 mm (maximum) to a minimum of 95% of Standard Proctor Dry Density. Lifts shall be brought up on all sides at the same time.

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

(d) The Standard Proctor Density for granular and clay backfill material shall be determined at the optimum moisture content in accordance with standard laboratory Proctor Compaction Test Procedure.

(e) The field density of the compacted layers shall be verified by Field Density Tests in accordance with ASTM Standard, Test for Density of Soil in Place by the Sand-Cone Method, or equivalent as accepted by the Contract Administrator.

(f) The frequency and number of tests to be made shall be as determined by the Contract Administrator.

(g) All workmanship and materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work. The Contractor shall be wholly responsible for the control of all operations incidental 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 the requirements of this Specification.

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

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

E20.4.3 Galvanized Corrugated Steel Drain Pipe Installation

(a) Install perforated drain pipe, with perforations facing down, for the full length of the deck extensions at each end of the overpass. This shall be centred on the 450 x 450 mm crushed drainage stone as shown on the drawings.

(b) Install non-perforated drain pipe beyond the deck extensions straight in line with the perforated drain pipe. This shall extend south until it daylights through the embankment. Backfill around this pipe shall be compacted suitable site material.

E20.4.4 Installation of Non-Woven Geotextile, Class 1

(a) The non-woven geotextile, Class 1, shall be installed around the 450 x 450 mm crushed drainage stone as shown on the drawings and shall overlap a minimum of 150 mm at all seams.

E20.5 Measurement and Payment

E20.5.1 The excavation and backfilling required for the construction of retaining walls, abutments, approach spans, approach and sleeper slabs and a manhole will not be measured. They will be paid for at the Contract Lump Sum Price for ”Excavation and Backfilling”, which price will be payment in full for supplying all materials/ equipment and performing all operation herein described and all other items incidental to the Work included in this Specification and accepted by the Contract Administrator.

E21. CAST-IN-PLACE PILE FOUNDATION

E21.1 Description

E21.1.1 The Work covered under this Item shall include all concreting operations related to construction of cast-in-place concrete pile foundations, piles for the bridge, retaining walls, transit station building, west side pedestrian ramp, east side pedestrian plaza, and wind baffle building, including the supply and placing of reinforcing steel in accordance with this Specification and as shown on the drawings.

E21.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E21.2 Materials

E21.2.1 General

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

E21.2.2 Handling and Storage of Materials

(a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN3-A23.1-2004.

E21.2.3 Testing and Approval

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

(b) All materials shall conform to CSA Standard CAN/CSA-A23.1-2004.

(c) All Testing of materials shall conform to CSA Standard CAN/CSA-23.2-2004.

E21.2.4 Cement

(a) Cement shall be Type HS or HSb, high-sulphate-resistant hydraulic cement, conforming to the requirements of CSA A3000-2008.

E21.2.5 Supplementary Cementing Materials

(a) Use of pozzolans, fly ash, or silica fume will not be permitted for use in structural concrete supplied under this Specification.

E21.2.6 Water

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

E21.2.7 Aggregate

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

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

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

Gradation of Fine Aggregates	
Canadian Metric Sieve Size	Percent of Total Dry Weight Passing Each Sieve
10,000	100%
5,000	95% - 100%
2,500	80% - 100%
1,250	50% - 90%
630	25% - 65%
315	10% - 35%
160	2% - 10%
80	0% - 3%

(iii) The fineness modulus of fine aggregate shall not be less than 2.2 nor more than 3.1 unless otherwise approved by the Contract Administrator.

Coarse Aggregate (20 mm Nominal)

(iv) Standard course aggregate shall be used for cast-in-place concrete foundation required in this Specification.

(v) 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 shown in the following table:

Gradation of 20 mm Coarse Aggregate	
Canadian Metric Sieve Size	Percent of Total Dry Weight Passing Each Sieve
28,000	100%
20,000	90% - 100%
10,000	25% - 60%
5,000	0% - 10%
2,500	0% - 5%
80	0% - 1%

E21.2.8 Admixtures

(a) No admixtures other than air-entraining agent shall be used without the written authorization of the Contract Administrator, unless otherwise specified in these Specifications. It shall be the Contractor's responsibility to ensure that any admixture is compatible with all other constituent materials.

E21.2.9 Reinforcing Steel

(a) The reinforcing steel shall conform to Specification E27.

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

E21.2.10 Miscellaneous Materials

(a) Miscellaneous materials shall be of the type specified on the drawings or approved by the Contract Administrator.

E21.3 Concrete Mix Design

E21.3.1 The concrete shall conform to Specification E25.

E21.3.2 The concrete shall be placed by the tremie method if dewatering is not successful.

E21.4 Construction Methods

E21.4.1 Location and Alignment of Piles

(a) Pile construction shall not commence until the Contractor has obtained clearance from the appropriate Utility Authorities.

(b) Piles shall be placed in the positions shown on the drawings and as directed by the Contract Administrator in the field.

(c) The deviation of the axis of any finished pile shall not differ by more than 1 percent from the vertical.

E21.4.2 Buried Utilities

(a) The Contractor shall exercise extreme caution when constructing the pile foundations in the vicinity of existing buried utilities. The drawings show the approximate locations of existing buried utilities. The Contractor shall be responsible for obtaining the exact location of the buried utilities from the appropriate Utility Authorities prior to installing the piles.

(b) The proposed locations of the pile foundations may be changed by the Contract Administrator if they interfere with the buried utilities.

(c) The Contractor shall be responsible for all costs that may be incurred for repair/rectification of any damage caused to the existing buried utilities as a result of the Contractor's operations in constructing cast-in-place concrete piles, as determined by the Contract Administrator.

E21.4.3 Excavation

(a) Excavations for piles shall be made with equipment designed to remove a core of the diameter shown on the drawings.

(b) Upon reaching the required elevation, the bottom of the excavation shall be cleaned as directed by the Contract Administrator in the field.

(c) All excavated material from the piles shall be promptly hauled away from the Site to an approved disposal area as located by the Contractor.

(d) Upon completion of the cleaning out of the bottom to the satisfaction of the Contract Administrator, the reinforcement and anchor bolts shall be set in place and the concrete poured immediately. Under no circumstances shall a hole be left to stand open after boring has been completed.

(e) If any hole is condemned because of caving, it shall be filled with lean-mix concrete and a new hole bored as near as possible to the location shown on the drawings. In locations where underground utilities have been exposed, the underground utilities shall be covered with clean sand to 300 mm above the utility. Payment will not be made for condemned piles.

E21.4.4 Sleeving

(a) Timber or steel sleeving shall be used to temporarily line the bore to prevent bulging or caving of the walls and to protect men at work in the bore.

(b) The sleeving shall be designed by the Contractor and constructed to resist all forces that may tend to distort it.

(c) The sleeving shall be withdrawn as the concrete is placed in the bore. The sleeving shall extend at least 1 m below the top of the freshly deposited concrete at all times.

(d) The clearance between the face of the bore hole and the sleeving shall not exceed 75 mm.

E21.4.5 Inspection of Bores

(a) Concrete shall not be placed in a bore until the bore has been inspected and approved by the Contract Administrator.

(b) The Contractor shall have available suitable light for the inspection of each bore throughout its entire length.

(c) All improperly set sleeving, bore, or bottom shall be corrected to the satisfaction of the Contract Administrator.

E21.4.6 Placing Reinforcing Steel

(a) Reinforcement shall be:

(i) placed in accordance with the details shown on the drawings

(ii) rigidly fastened together, and

(iii) lowered into the bore intact before concrete is placed.

(b) Spacers shall be utilized to properly locate the reinforcing steel cage in the bore.

E21.4.7 Forms

(a) For bored piles, the top of the piles shall be formed with tubular forms (Sonotube) to a minimum depth of 1000 mm below final grade.

(b) The forms shall be sufficiently rigid to prevent lateral or vertical distortions from the loading environment to which they shall be subjected. Forms shall be set to the design grades, lines, and dimensions, as shown on the drawings.

E21.4.8 Placing Concrete

(a) Care shall be taken to ensure that anchor bolts are vertically aligned and that anchor bolts and conduits are properly positioned prior to placement of concrete.

(b) Concrete shall not have a free fall of more than 2.0 m and shall be placed so that the aggregates will not separate or segregate. The slump of the concrete shall not exceed 110 mm. The concrete shall be vibrated throughout the entire length of the pile.

(c) Concrete shall be placed to the elevations as shown on the drawings. The top surface of the pile shall be finished smooth and even with a hand float.

(d) The shaft shall be free of water prior to placing of concrete. Concrete shall not be placed in or through water unless authorized by the Contract Administrator. In the event that tremie concrete is allowed by the Contract Administrator, the concrete shall be placed as specified herein.

E21.4.9 Tremie Concrete

(a) The shaft of the pile shall be pumped clear of water so that the bottom can be cleaned. Pumping shall then be stopped and water shall be allowed to come into the bore until a state of equilibrium is reached. Concrete shall then be placed by means of a tremie pipe. The tremie pipe shall have a suitable gate in the bottom to prevent water from entering the pipe. The bottom of the pipe shall be maintained below the surface of the freshly placed concrete. The pipe shall be capable of being raised or lowered quickly in order to control the flow of concrete.

(b) Tremie concrete shall be poured up to a depth of 600 mm or as the Contract Administrator directs. Pumps shall then be lowered into the bore and the excess water pumped out. The laitance that forms on top of the tremie shall then be removed and the remainder of the concrete shall be placed in the dry.

E21.4.10 Protection of Newly Placed Concrete

(a) Newly laid concrete threatened with damage by rain, snow, fog, or mist shall be protected with a tarpaulin or other approved means.

E21.4.11 Curing Concrete

(a) The top of the freshly finished concrete piles shall be covered and kept moist by means of wet polyester blankets immediately following finishing operations and shall be maintained at above 10ºC for at least seven (7) consecutive days thereafter.

(b) After the finishing is completed, the surface shall be promptly covered with a minimum of a single layer of clean, damp polyester blanket.

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

(d) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3º in one hour or 20º in twenty-four hours.

E21.4.12 Form Removal

(a) Forms shall not be removed for a period of at least 24 hours after the concrete has been placed. Removal of forms shall be done in a manner to avoid damage to, or spalling of, the concrete.

(b) The minimum strength of concrete in place for safe removal of forms shall be 20 MPa.

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

E21.4.13 Patching of Formed Surfaces

(a) Immediately after forms around top of pile have been removed, but before any repairing or surface finishing is started, the concrete surface shall be inspected by the

Contract Administrator. Any repair of surface finishing started before this inspection may be rejected and required to be removed.

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

(c) Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter, and voids left by strutting, and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched and then applying patching mortar. A slurry grout consisting of water and cement shall be 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 and it shall be touched up until it is satisfactory to the Contract Administrator. The patch shall be cured as specified in this Specification, and the final colour shall match the surrounding concrete.

E21.4.14 Cold Weather Concreting

(a) Protection of concrete shall be considered incidental to its placement. The temperature of the concrete shall be maintained at or above 10ºC for a minimum of three (3) days or till the concrete has reached a minimum compressive strength of 20 MPa, by whatever means are necessary. Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at his own expense. Also, concrete allowed to freeze prior to the three (3) days will not be accepted for payment.

E21.5 Quality Control

E21.5.1 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 any materials or Works that are not in accordance with the requirements of this Specification.

E21.5.2 The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Contract. All material shall be free of surface imperfections and other defects.

E21.6 Measurement and Payment

E21.6.1 Cast-in-Place Concrete Pile

(a) Construction of Cast-In-Place Concrete Pile Foundations will not be measured. This Item of Work will be paid for in the Contract Lump Sum Price for the “Cast-in-Place Concrete Piles”, performed in accordance with this Specification and accepted by the Contract Administrator.

E22. ROCK-SOCKETED CAISSON

E22.1 Description

E22.1.1 This Specification shall cover all operations related to supply and installation of rock-socketed caissons for piers, including but not limited to overburden drilling, rock coring, water control, supply and install of steel casings, supply and placement of concrete and reinforcing steel, removal of temporary steel casings and disposal of excavated material.

E22.1.2 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.

E22.1.3 The Contractor is responsible for obtaining CN Rail Protection for installation of the rock-socketed caissons. All costs associated with CN Flag-persons shall be included herein this pay item supply and installation of rock-socketed caissons.

E22.2 Definitions

E22.2.1 Overburden: All material encountered above the bedrock including imported fill and native soils.

E22.2.2 Weathered Rock Zone: Weathered rock encountered above the sound bedrock including voids and soil filled cavities which would require temporary or permanent steel casing to support the caisson hole.

E22.2.3 Sound Rock: Rock which may contain fractures but a casing is not required to support the caisson hole.

E22.3 Provisional Pay Items

E22.3.1 Base tender on number of caissons shown on the drawings including all labour and material required to install rock-socketed caisson to Elevation 209.0 m.

E22.3.2 Provide unit price for additional length of rock-socket into sound bedrock.

E22.3.3 Provide unit price for add length of the caisson shaft into weathered rock zone

E22.3.4 Provide unit price for subtracted length of the caisson shaft into weathered rock zone.

E22.4 Elevations on Drawings

E22.4.1 The caisson elevations shown on the drawings are approximate only. Refer to the test hole logs and all other available information to gain more knowledge about the surface and subsurface conditions.

E22.5 Materials

E22.5.1 General

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

E22.5.2 Handling and Storage

(a) All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA A23.1 (2004). Materials damaged by careless or negligent handling or storage by the Contractor shall be replaced at the Contractor's expense.

E22.5.3 Testing

(a) 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.

(b) 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.

E22.5.4 Steel Casings

(a) Steel casings shall be as follows:

(i) 914 mm diameter x 20 mm thick and 1067 mm diameter x 20 mm thick permanent casing as indicated on the drawings, conforming to CSA G 40.21, Grade 300W.

(ii) 1524 mm diameter x 20 mm thick permanent casing as indicated on the drawings, conforming to CSA G 40.21, Grade 300W. 1524 mm dia. steel casing shall be hot dip galvanized for the top 5.5 metres of pile length.

(iii) Galvanizing shall be in accordance with CSA G164.

E22.5.5 Concrete

(a) The concrete shall conform to Section E25 of this Specification.

(b) The concrete shall be placed by the tremie method if the caisson excavation cannot be kept free of water.

E22.5.6 Reinforcing Steel

(a) The reinforcing steel shall conform to Section E27 of this Specification.

E22.6 Equipment

E22.6.1 All equipment shall be of a type accepted by the Contract Administrator and shall be kept in good working order.

E22.6.2 Tremie Equipment

(a) The tremie pipe shall consist of a tube, having a diameter of not less that 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 accepted by the Contract Administrator.

E22.7 Construction Methods

E22.7.1 Location and Alignment of Caissons

(a) 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.

(b) Alignment shall not deviate more than 2 percent of caisson length out of plump and not more than 75 mm off centre at top.

E22.7.2 Cut-off of Steel Casings

(a) The casings shall be set to the elevations shown on the drawings. All costs associated with the casing cut-offs shall be incidental to the appropriate Contract Unit Price for “Supply Steel Casings”.

E22.7.3 Dewatering

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

(b) The caisson hole shall be dewatered to facilitate rock socket inspection by the Contract Administrator.

(c) All costs associated with the dewatering shall be incidental to the appropriate Contract Unit Price for “Supply and Install Rock-Socketed Caissons”.

E22.7.4 Rock-Socketed Caisson Installation

(a) The Contractor shall bore shaft holes to diameters indicated on the drawings at each caisson location down to bedrock surface.

(b) Upon completion of shaft to rock surface, provide and install temporary steel casing embedded into rock surface to allow for coring and inspection of rock socket. Casing to be removed during concreting operations.

(c) The Contract Administrator may determine that 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 soil and or rock indicate such a requirement at the time of construction.

(d) The Contractor shall bore rock sockets using core barrels to diameters indicated on drawings. The sockets shall be advanced a minimum of 3500 mm into sound bedrock as determined by the Contract Administrator. Ensure loose material is removed using compressed air and the caisson is free from water and foreign material. Allow the Contract Administrator to perform downhole inspection and or video camera inspection.

(e) 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 an acceptable quality of sound bedrock.

(f) Upon acceptance 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.

E22.7.5 Tremie Concrete Procedure

(a) 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.

(b) Tremie concrete shall be deposited in a manner accepted by the Contract Administrator. Tremie concrete shall not be placed without the Contract Administrator's approval.

(c) 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.

(d) 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:

(e) Free movement of the discharge end over the entire top surface of the work.

(f) Rapid lowering when necessary to retard or stop the flow of concrete.

(g) 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.

(h) 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.

(i) 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 caisson shaft. The bucket shall always be within the deposited concrete when the bottom is opened.

(j) Where tremie concrete is used, in addition to the heating and hoarding requirements in E22.7.6, the Contractor shall heat the water inside the caisson shaft to a minimum temperature of 5°C, and shall maintain the water above the deposited concrete at this temperature for a period of at least 7 days.

E22.7.6 Heating and Hoarding

(a) The Contractor shall make provisions for heating the concrete, the reinforcing steel and the 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 E25.6.19.

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

E22.8 Measurement and Payment

E22.8.1 Supply and Install Rock-Socketed Caissons

(a) 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.

E22.8.2 Additional Length of Rock-Socket in Sound Bedrock

(a) Additional length of rock-socket in sound bedrock shall be paid at the Contract Unit Price for the provisional item " Additional Length of Rock – Socket in Sound Bedrock" 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.

E22.8.3 Added Length of the Caisson Shaft into Weathered Rock Zone

(a) Added length of the caisson shaft into weathered rock zone shall be paid at the Contract Unit Price for "Added Length of the Caisson Shaft into Weathered Rock Zone" 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.

E22.8.4 Subtracted Length of the Caisson Shaft into Weathered Rock Zone

(a) Subtracted length of the caisson shaft into weathered rock zone shall be credited at the Contract Unit Price for "Subtracted Length of the Caisson Shaft into Weathered Rock Zone" 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.

E23. STEEL BEARING PILES

E23.1 Description

E23.1.1 This Specification shall cover the supply and driving of steel bearing piles including concrete encasement and the supply and placement of reinforcing steel at the west abutment (SU.1), the supply and driving of steel bearing piles ay the east abutment (SU.4).

E23.1.2 The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all other things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E23.2 Materials

E23.2.1 General

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

E23.2.2 Handling and Storage of Materials

(a) The method of handling and storing steel bearing piles shall be such so as to prevent any damage to the pile and to ensure that the design strength will not be affected by deterioration or deformation. The Contractor, in handling or lifting the piles, will not be permitted to drag them along the ground.

(b) Any piles excessively damaged 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.

E23.2.3 Steel “H” Piles

(a) Steel “H” piles shall be structural HP310X110 steel members manufactured in accordance with the latest CSA Standard CAN3-S16.1. Steel shall conform to the latest CSA Standard CAN/CSA-G40.2, Grade 350 W.

(b) Pile driving points shall be Point No. HPP-S-12, by Titus Steel Co. Ltd., Mississauga, Ontario, or Pruyn HP75750, by Associated Pile and Fitting Corporation, Clifton, NJ, USA.

(c) All welding shall conform to the latest CSA Standard W59, electric arc method.

E23.3 Equipment

E23.3.1 Pile driving equipment to be used by the Contractor shall be of such a capacity that the required bearing and penetration shall be obtained without damage being done to the piles.

E23.3.2 The equipment shall be capable of driving the piles to practical refusal with a driving energy of at least 40,000 Joules.

E23.3.3 Pile driver leads shall be used to support the piles while they are being driven. Leads shall be of sufficient length to be supported firmly on the ground. The use of hanging or swinging leads will not be allowed unless they can be held in a fixed position during the driving operations. Batter piles shall be driven with inclined leads.

E23.3.4 The Contractor shall furnish the Contract Administrator with the manufacturer’s Specifications and catalogue for all mechanical hammers used, showing the data necessary for computing the bearing value of the pile driven. Gravity or drop hammers shall be weighed in the presence of the Contract Administrator, or a certificate of mass shall be furnished to the Contract Administrator. Hammers so weighted shall have the exact mass marked on them. Gravity hammers shall weight at least 1.5 t, but in no case shall the mass of the hammer be less than the combined mass of the pile and pile cap.

E23.3.5 The heads of steel bearing piles shall be cut squarely if required and protected by a cap of a design approved by the Contract Administrator. The cap shall be designed to hold the axis of the pile in line with the axis of the hammer. The top of the cap shall have a timber shock block.

E23.4 Construction Methods

E23.4.1 Location and Alignment of Piles

(a) The piles shall be located at the positions shown on the drawings or as directed by the Contract Administrator. Batter piles shall be driven to the batter specified and shall not be jacked or pulled into their final positions.

E23.4.2 Driving of Piles

(a) All pile driving points shall be welded by the Contractor prior to commencement of pile driving operations, incidental to the works of this Specification.

(b) The piles shall be driven to the positions shown on the drawings and as directed by the Contract Administrator. Piles shall not deviate more than 2 percent for battered piles, nor more than 2 percent out-of-plumb for vertical piles. Piles shall not be more than 75 mm off centre, measured at time of cut off.

(c) 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 Contractor will be required to remove any surface and/or shallow depth obstruction(s) to obtain the required penetration of the pile.

(d) 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.

(e) If, during the piling operations, upheaval of pile occurs, the Contractor will be required to redrive the lifted piles down to their original elevations. The Contractor will also be required to excavate material that has boiled up during pile driving operations. The elevation of all piles previously driven or redriven shall be observed to detect uplift. If uplift of 5 mm or more occurs in any pile, that pile shall be redriven to its original elevation and thereafter to the required final driving resistance.

(f) Driving of all piles shall be continuous without intermission until the pile has been driven to final elevation.

(g) 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.

(h) Preboring will not be allowed unless it is approved in writing by the Contract Administrator. If, in the judgement 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.

(i) Any piles that are excessively crushed or bent through negligence or carelessness of the Contractor shall be removed or otherwise replaced as directed by the Contract Administrator, at the expense of this Contractor, 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 this Contractor at his own expense.

E23.4.3 Splicing of Piles

(a) Full-length piles shall be used where practicable. In exceptional circumstances, splicing of piles may be permitted. The method of splicing shall be as shown on the drawings, and the following:

(b) Spices shall be allowed provided that the pieces spliced are not less than three (3) metres long.

(c) All splices shall be 100 percent butt welded.

(d) The butting ends of the driven pile and its extension shall be cut square to give full bearing between the mating surfaces.

(e) The butting surface of the extension piece shall be bevelled to facilitate a full-penetration butt weld. Temporary clamping plates may be used as required.

(f) Before welding over previously-deposited metal, the slag shall be cleaned off. This requirement shall apply to successive layers, to successive beads, and to the cratered area when welding is resumed after any interruption.

(g) All butt welds shall have the root of the initial weld gouged, chipped, or otherwise removed to sound metal before welding is started from the second side. The pile material shall be preheated to a minimum of 40ºC if the air temperature is below freezing.

(h) Welding shall meet the requirements of CSA Standard W59-M1989 and shall be done by a welder qualified under the provisions of CSA Standard W47.1-92.

E23.4.4 Cut-Off of Piles

(a) After piles have been driven to the required penetration (and, if required, redriven), the Contractor shall mark the required cut-off elevation on each pile. The top of all piles shall be neatly cut off (true and level) at the cut-off elevation.

E23.4.5 Steel Bearing Pile Extensions

(a) Steel bearing pile extensions shall be avoided, but when necessary and as directed by the Contract Administrator, they shall be made in accordance with E23.4.3.

E23.5 Quality Control

E23.5.1 Inspection

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

E23.5.2 Access

(a) The Contractor Administrator shall be afforded full-access for the inspection and control testing of the precast piles at the Site of Work to determine whether the steel piles are being supplied in accordance with this Specification.

E23.5.3 Pile Driving Records

(a) The Contract Administrator will keep a record of each and every pile driven. The records shall give the date, time, diameter, length, location, type, total depth of penetration, rate of penetration, number of blows per 300 mm, penetration for the last five blows, steam, air or diesel pressure, and any 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.

(b) 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.

E23.6 Measurement and Payment

E23.6.1 The supply and installation of steel bearing piles will not be measured. This Item of Work will be paid for in the Contract Lump Sum Price for the “Steel Bearing Piles”, performed in accordance with this Specification and accepted by the Contract Administrator.

E24. DYNAMIC TESTING OF DRIVEN PILES

E24.1 Description

E24.1.1 The dynamic testing shall be performed to monitor and confirm hammer and driving system performance, assess pile installation stresses and integrity, as well as to evaluate pile capacity. The Contract Administrator shall secure the services of an independent Dynamic Testing Consultant with demonstrated experience in similar projects. Dynamic testing shall be performed on at least 4 piles (2 at each abutment). At least 14 days notice is required by the Contract Administrator to arrange for a testing company to conduct the dynamic testing work.

E24.1.2 Dynamic testing involves attaching two strain transducers and two accelerometers to the pile approximately 3 pile diameters below the pile head during initial driving and at a convenient location near the pile head during re-strike testing. A cable connects the gages with the Pile Driving Analyzer located at ground level and at a safe place near the pile to collect the dynamic measurements.

E24.2 Reference and Related Specifications

E24.2.1 All related Specifications and reference Standards shall be current issue or latest revision at the first date of tender advertisement.

E24.3 References

E24.3.1 ASTM D-4945-00, “Standard Test Method for High Strain Dynamic Testing of Piles”.

E24.3.2 Specification 312, “Specifications for Supplying and Driving Steel Bearing Pile”.

E24.4 Submittal

E24.4.1 At least 14 days prior to driving the test piles, the Contractor shall submit Specifications for the pile driving equipment to the Contract Administrator.

E24.5 Equipment and Personnel

(a) The dynamic testing work will be carried out using the Contractor’s pile driving equipment and the Pile Driving Analyzer (PDA) equipment provided by the Dynamic Testing Consultant.

(b) The PDA testing equipment shall conform to the requirement of ASTM D-4945-00, “Standard Test Method for High Strain Dynamic Testing of Piles”. An engineer with documented experience shall operate the Pile Driving Analyzer in the field. An engineer with at least five years related experience shall carry out the analysis of the PDA data and sign the engineering reports.

(c) The Contractor shall provide the pile driving equipment, operators, labor and power supply to the test pile locations for the duration of the dynamic testing. The Contractor shall provide a step ladder or other safe lifting means to enable attachment of cables to the pile head. The pile driving equipment shall be the same as that to be used for the pile driving work. The power supply shall consist of a regular power source (line power or portable generator) providing 1,800 watts of 115 volt AC power with a frequency of 60 Hz. Direct current welders or non-constant power sources are unacceptable.

E24.6 Execution

E24.6.1 Construction Access

(a) Prior to lifting the pile to be dynamically tested, the Contractor shall provide a minimum of 1 m of clear access around the pile head for pile preparation. The Dynamic Testing Consultant shall then drill and prepare holes for gage attachment.

(b) The Dynamic Testing Consultant shall attach the gages to the pile after the pile has been driven to the depth identified by the Contract Administrator. Driving shall then continue using routine pile installation procedures. When the level of the gages is within 0.3 m of the ground surface, water surface, or a pile template, driving shall be halted to remove the gages from the pile. If additional driving is required, the pile shall be spliced and the gages shall be reattached to the head of the extension pile segment prior to the resumption of driving.

(c) The Contractor must take good care to ensure that no damage is done to the dynamic monitoring transducers, cables, or equipment.

E24.7 Testing Procedures

E24.7.1 Preconstruction Wave Equation Analyses

(a) After the Contractor had submitted Specifications for the pile driving equipment to the Contract Administrator. The Dynamic Testing Consultant shall use the submitted information to perform wave equation analysis and shall prepare a summary report of the wave equation results. The wave equation analyses shall be used to assess the ability of the proposed driving system to safely install the pile to the required capacity and/or desired penetration depth within the allowable driving stresses.

(b) Approval of the proposed driving system by the Contract Administrator shall be based upon the wave equation analyses indicating that the proposed driving system can drive the pile to achieve the required static pile capacity of at least 2.0 times the pile design capacity at a driving resistance not greater than 20 blows per 25 mm penetration, within allowable driving stress limits for the pile material.

(i) Maximum allowable driving stresses (tension and compression) for Steel Piles:= 0.90 f_y

(c) A new pile driving system, modifications to existing system, or new pile installation procedures shall be proposed by the Contractor if the results of the wave equation analysis indicate that the required capacity is not achieved, excessive blows are required (i.e., greater than 15 blows per 25 mm) or driving stresses exceed the maximum allowable limits.

E24.7.2 Dynamic Testing Program

(a) Approximately two days before the pile evaluation work is to be undertaken, the Contractor and Contract Administrator shall meet on-site to select the piles that will be evaluated. The selected piles shall be driven to attain static capacity of at least 2.0 times the pile design capacity. Adjustments to the preliminary driving criteria may be made by the Contract Administrator based upon the dynamic testing results. All or part of the tested piles as determined by the Contract Administrator shall be re-struck with dynamic testing after a minimum waiting period of 7 days, to evaluate the setup effect on pile capacity. The recommended setup waiting period will be determined from this testing program.

(b) The re-strike driving sequence shall be performed with a warmed up hammer and shall consist of striking the piles for about 10 blows or until the pile penetrates an additional 50 mm, whichever occurs first.

(c) The Contract Administrator may request additional piles to be dynamically tested if the hammer and/or driving system is replaced or modified, the pile type or installation procedures are modified, the pile capacity requirements are changed, unusual blow counts or penetrations are observed or any other piling behaviour that differs from normal installation.

E24.7.3 Dynamic Testing Reports

(a) Within one day pile testing, the Dynamic Testing Consultant shall prepare a hand written daily field report summarizing the dynamic testing results. As a minimum, the daily reports shall include the calculated driving stresses, transferred energy, and estimated pile capacity at the time of testing. Variations from previous trends in the dynamic test data shall also be noted. Daily field reports shall be faxed or emailed to the Contract Administrator.

(b) The Dynamic Testing Consultant shall prepare and submit a written report not later than 7 days after the test completion. This report shall include the results of dynamic test(s) and shall contain a discussion of the pile capacity obtained from the dynamic testing. The report shall also discuss hammer and driving system performance, driving stress levels, and pile integrity. CAPWAP analyses shall be performed on dynamic testing data obtained from the end of initial driving and the beginning of re-strike of all tested piles or as instructed by the Contract Administrator. CAPWAP analyses shall be performed by an engineer with demonstrated experience.

(c) The Contract Administrator may request additional analyses at selected pile penetration depths.

E24.8 Measurement and Payment

(a) The Contract Administrator shall pay for the dynamic load test(s).

(b) The other associated works and costs described herein shall be considered incidental to the Contract Lump Sum Price for “Steel Bearing Piles” and no separate measurement or payment will be made.

E25. STRUCTURAL CONCRETE

E25.1 Description

E25.1.1 This Specification shall cover all operations relating to the preparation of Portland Cement structural concrete for, and all concreting operations related to, the construction of structural concrete works as specified herein and as shown on the drawings.

E25.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

E25.2 Scope of Work

E25.2.1 Supplying and placing structural concrete for retaining walls and footings.

E25.2.2 Supplying and placing structural concrete for slope paving and floorslab.

E25.2.3 Supplying and placing structural concrete for manholes and footings.

E25.2.4 Supplying and placing structural concrete for control building thickened slab.

E25.2.5 Supplying and placing structural concrete for pile caps, grade beams and trenches.

E25.2.6 Supplying and placing structural concrete for abutments.

E25.2.7 Supplying and placing structural concrete for pier caps.

E25.2.8 Supplying and placing structural concrete for in-fill between steel girders.

E25.2.9 Supplying and placing structural concrete for deck slabs, sidewalks, curbs and barriers.

E25.2.10 Supplying and placing structural concrete for approach, transition and roadway expansion joint slabs.

E25.2.11 Supplying and placing structural concrete for west side pedestrian ramps, concrete sidewalks.

E25.2.12 Supplying and placing structural steel for east side pedestrian plaza and concrete sidewalks.

E25.3 Submittals

E25.3.1 General

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

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

E25.3.2 Concrete Mix Design Requirements

(a) The Contractor shall submit a concrete mix design statement to the Contract Administrator for each of the concrete types specified herein that reflects the specified performance properties of the concrete. The mix design statement shall contain all the information as outlines on the concrete mix design statement as shown on the Manitoba Ready Mix Concrete Association website (www.mrmca.com). In addition, the mix design statement must indicate the expected method of placement (buggies, chute, or pump) methods are to be used, the method of placement must include a clear description of the pumping methods (line, vertical drop, length of hose, etc.).

(b) The Supplier shall submit directly, in confidence, to the City of Winnipeg, the concrete mix designs for each of the concrete types specified herein. The purpose of this confidential submission will be for record keeping purposes only. The concrete mix design shall contain a description of the constituents and proportions, and at the minimum the following:

(i) Cementitious content in kilograms per cubic metre or equivalent units, and type of cementitious materials;

(ii) Designated size, or sizes, of aggregates, and the gradation;

(iii) Aggregate source location(s);

(iv) Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis;

(v) Maximum allowable water content in kilograms per cubic metre or equivalent units and the water/cementitious ratio;

(vi) The limits for slump;

(vii) The limits for air content; and

(viii) Quantity of other admixtures.

(c) The concrete mix design statements must be received by the Contract Administrator a minimum of ten (10) Business Days prior to the scheduled commencement of concrete placement for each of the concrete types. The concrete mix designs must be received by the City of Winnipeg a minimum of five (5) Business Days prior to the scheduled commencement of concrete placement for each the concrete types.

(d) The mix design statement shall also include the expected slump measurement for each concrete type. The tolerances for acceptance of slump measurements in the field, by the Contract Administrator, shall be in accordance to CSA A23.1-04 Clause 4.3.2.3.2.

(e) Any change in the constituent materials of any approved mix design shall require submission of a new concrete mix design statement, mix design, and mix design test data. If, during the progress of the Work, the concrete supplied is found to be unsatisfactory for any reason, including poor workability, the Contract Administrator may require the Contractor to make any necessary adjustments and associated resubmissions.

E25.3.3 Concrete Mix Design Test Data

(a) Concrete

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

(ii) The Contractor shall submit at a minimum, the test data to prove that the minimum compressive strength, flexural strength for Fibre Reinforced Concrete (FRC) only, air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. In addition, test data shall be submitted to support requirements for post-cracking residual strength index (Ri) and fibre dispersion in accordance with the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6-06, Section 15, Fibre Reinforced Structures, Clause 16.6.

(iii) All tests shall be based on the concrete samples taken from the point of discharge into the formwork. For example, at the concrete chute from the delivery truck if being placed by buggies, or at the end of the pump line should the Contractor choose to pump the concrete into place.

(b) Aggregates

(i) The Contractor shall furnish, in writing to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, the location of the sources where aggregate will be obtained in order that some may be inspected and tentatively accepted by the Contract Administrator. Changes in the source of aggregate supply during the course of the Contract shall not be permitted without notification in writing to and the expressed approval of the Contract Administrator.

(ii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on sieve analysis of fine and coarse aggregates in accordance with CSA Standard Test Method A23.2-2A.

(iii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on tests for organic impurities in fine aggregates for concrete, in accordance with CSA Standard Test Method A23.2-7A.

(iv) The Contractor shall submit to the Contract Administrator for review and approval recent test information on relative density and absorption of coarse aggregate, in accordance with CSA Standard Test Methods A23.2-12A.

(v) The Contractor shall submit to the Contract Administrator for review and approval recent test information on petrographic examination of aggregates for concrete, in accordance with CSA Standard Test Methods A23.2-15A. The purpose of the petrographic analysis is to ensure the aggregates provided are of the highest quality for use in the production of concrete and will produce a durable overlay. An acceptable aggregate will have an excellent rating as judged by an experienced petrographer, with a (weighted) petrographic number typically in the range of 100 to 120.

(vi) The Contractor shall submit to the Contract Administrator for review and approval recent test information on resistance to degradation of large-size coarse aggregate by abrasion and impact in the Los Angeles Machine, in accordance with CSA Standard Test Method A23.2-16A.

(vii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on potential alkali reactivity of cement aggregate combinations (mortar bar method), in accordance with CSA Standard Test Method A23.2-27A.

(c) The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

E25.3.4 Notification of Ready Mix Supplier

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

E25.3.5 Temporary False Work, Formwork and Shoring Works

(a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, detailed design calculations and shop drawings for any temporary Works, including falsework, formwork, and shoring, that are sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.

(b) Design Requirements

(i) The Contractor shall design falsework, formwork and shoring for the new Bridge deck slab overhangs to be released prior to the placement of the High Performance Concrete (HPC) deck overlay and the sidewalk slab. The formwork shall not extend beneath the underside of the existing deck.

(ii) All forms shall be of wood, metal or other materials as approved by the Contract Administrator.

(iii) The falsework, formwork, and shoring for these Works shall be designed by a Professional Engineer registered in the Province of Manitoba. Falsework shall be designed according to the requirements of CSA S269.1, “False Work for Construction Purposes.” The shop drawings shall bear the Professional Engineer's seal. Shop drawings submitted without the seal of a Professional Engineer will be rejected. The submission of such shop drawings to the Contract Administrator shall in no way relieve the Contractor of full responsibility for the safety and structural integrity of the formwork and shoring.

(iv) The falsework, formwork, and shoring for these Works shall be designed 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-M92. All proposed fastening methods to the existing deck superstructure must be submitted to the Contract Administrator for review and approval.

(v) 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.

(vi) As a minimum, the following spacings shall apply, for studding and waling:

- 20-mm plywood: studding 400 mm centre to centre (max.),
  walers 760 mm centre to centre (max.)

(vii) Forms shall be designed and constructed so that the completed Work will be within minus 3 mm or plus 6 mm of the dimensions shown on the drawings.

(viii) Formwork shall be designed to provide chamber, where applicable, to maintain the specified tolerance to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete, due to construction loads.

(ix) Slots, recesses, chases, sleeves, inserts, bolts, hangers, and other items shall be accommodated in the design, in coordination and cooperation with the trade concerned. No openings in structural members are to be shown on the shop drawings without the prior written approval of the Contract Administrator.

(x) Shores shall be designed with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.

(xi) Mud sills of suitable size shall be designed beneath shores, to be bedded in sand or stone, where they would otherwise bear on soil. The soil below shores must be adequately prepared to avoid settlement during or after concreting. Shores must not be placed on frozen ground.

(xii) Shores shall be braced 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.

(xiii) All exposed edges shall be chamfered 20 mm unless otherwise noted on the drawings.

(xiv) Formwork shall be designed to have sufficient strength and rigidity so that the resultant finished concrete conforms to the shapes, lines, and dimensions of the members shown on the drawings.

(xv) Forms shall be designed to be sufficiently tight to prevent leakage of grout or cement paste.

(c) Shop drawings shall show design loads, type, and number of equipment to be used for placing the concrete, method of construction, method of removal, type and grade of materials, and any further information that may be required by the Contract Administrator. The Contractor shall not proceed with any Work on site until the shop drawings have been reviewed and approved in writing by the Contract Administrator. Falsework must be designed to carry all loads associated with construction of overhangs including deflection due to dead loads, placement of concrete, hoarding, construction live loads, and any other loads that may occur.

(d) For timber formwork and falsework, the shop drawings shall specify the type and grade of lumber and show the size and spacing of all members. The shop drawings shall also show the type, size and spacing of all ties or other hardware, and the type, size and spacing of all bracing.

E25.3.6 Screed for Deck Slab Concrete

(a) Plans for anchoring support rails shall be submitted to the Contract Administrator for review and acceptance at least ten (10) Business Days prior to the scheduled commencement of concrete placement. The Contract Administrator's written acceptance must be received by the Contractor prior to the installation of any anchorage devices.

E25.3.7 Concrete Deck Slab Pour Sequence and Schedule

(a) The Contractor shall pour the deck slab concrete in accordance with the pour sequence as outlined in the drawings. Should the Contractor opt to submit an alternate construction pour sequence for the deck slab concrete, the Contractor shall submit the proposed alternate construction pour sequence to the Construction Administrator for review, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement.

(b) The Contractor shall submit to the Contract Administrator for review, at least ten (10) Business Days prior to the placement of concrete, details of the construction joints.

(c) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to scheduled commencement of concrete placement, the proposed concrete placement schedule for all other structural concrete placements of this Specification.

E25.4 Materials

E25.4.1 General

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

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

E25.4.2 Handling and Storage of Materials

(a) All materials shall be handled and stored in a careful and workmanship like manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA-A23.1-04.

E25.4.3 Concrete

(a) Concrete materials susceptible to frost damage shall be protected from freezing.

(b) Concrete shall have nominal compressive strengths (f'c) and meet the requirements for hardened concrete as specified in the following Table E25.1.

TABLE E25.1
REQUIREMENTS FOR HARDENED CONCRETE

Type of Concrete	Location	Nominal Compressive Strength [MPa]	Class of Exposure	Air Content Category	Max Aggregate Size	Special Requirements	Post Residual Cracking Index
Type 1	Piles, Pile Caps, Grade Beams, Planters, Caissons, Retaining Walls, Footings, Abutments, Manhole, Slope Paving	35 @ 56 Days	S-1	2	20 mm		
Type 2	Pier Caps, Pedestrian Ramp, Pedestrian Plaza, Sidewalks, Transit Station Building Concrete Trenches, Wind Baffle Concrete Beams	35 @ 28 Days	C-1	1	20 mm	-	-
Type 3	Deck Slab, Traffic Barriers, Median, Curbs, Sidewalks, Approach and Transition Slabs	35 @ 28 Days	C-1	1	20 mm	Synthetic Fibres	0.15

E25.4.4 Working Base Concrete

(a) Working base concrete shall be placed in the locations as shown on the drawings.

E25.4.5 Aggregates

(a) General

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

(iii) The potential for deleterious alkali-aggregate reactivity shall be assessed in accordance with CSA A23.2-27A-04. Current (less than 18 months old) test data

evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA A23.2-14A-04 or CSA A23.2-25A-04 is required.

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

(a) Fine Aggregate

(v) Fine aggregate shall meet the grading requirements of CSA A23.1-04, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75 um sieve. Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.

(vi) Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12.

(a) Coarse Aggregate - Standard

(vii) The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CSA A23.1-04, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than 2% shall pass a 75 um sieve. Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; shall have a minimum of two fractured faces; and shall have an absorption not exceeding 3%.

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

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

(x) Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12, for concrete exposed to freezing and thawing.

E25.4.6 Admixtures

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

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

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

E25.4.7 Cementitious Materials

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

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

(c) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class CI or F and the substitution shall not exceed 30% by mass of cement.

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

E25.4.8 Water

(a) Water to be used for all operations in the Specification, including mixing and curing of concrete or grout, surface texturing operations, and saturating the substrate shall conform to the requirements of CSA A23.1-04 and shall be free of oil, alkali, acidic, organic materials or deleterious substances. The Contractor shall not use water from shallow, stagnant or marshy sources.

E25.4.9 Synthetic Fibres

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

E25.4.10 Formwork

(a) Formwork materials shall conform to CSA Standard A23.1-04, and American Concrete Publication SP4, “Formwork for Concrete.”

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

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

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

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

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

(g) 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 shall be subjected.

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

(i) Stay-in-place formwork or falsework is not acceptable and shall not be used by the Contractor unless specifically shown on the drawings.

E25.4.11 Form Coating

(a) Form coating shall be "Sternson C.R.A." by Sternson, "SCP Strip Ease" by Specialty Construction Products, or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.12 Permeable Formwork Liner

(a) Formwork liner shall be Texel Drainaform, Hydroform, or equal as accepted by the Contract Administrator, in accordance with B7. This formwork liner shall be used on all exposed substructure and superstructure formed surfaces, except soffit surfaces, or where a normal form finish is specified.

(b) Paper-lined forms shall be used on all soffit surfaces, such as deck slab overhangs. The Contractor shall provide conclusive evidence that the paper-lined form proposed for use will not stain or otherwise blemish the hardened concrete surface.

E25.4.13 Architectural Formwork Liner

(a) The Contractor shall supply and install the architectural concrete finish formwork liner for use at the locations as shown on the drawings in accordance with the Manufacturer's recommended procedures. Approved products are #154 (½" sine wave) by Scott Systems.

E25.4.14 Curing Compound

(a) Curing compounds shall be liquid membrane-forming and conform to the requirements of ASTM Standard C309-98a.

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

(c) WR Meadows 1215 WHITE Pigmented Curing Compound is an approved product, or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.15 Curing Blankets

(a) Curing blankets for wet curing shall be 100 percent polyester, 3 mm thick, white in colour. An approved product is "Mirafi Geotextile P150". Alternately, a 10 oz burlap, 5 mil polyethylene, curing blanket white in colour shall be used; "Curelap" manufactured by Midwest Canvas, together with a second layer of burlap, or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.16 Bonding Agents

(a) Latex Bonding Agent

(i) Latex bonding agent shall be Acryl-Stix, SikaCem 810, or equal as accepted by the Contract Administrator, in accordance with B7. Polyvinyl acetate-based latexes will not be permitted. Planicrete AC by MAPEI is approved for use as a latex bonding agent on concrete greater than 28 days in age.

(b) Bonding Grout

(i) The grout for bonding the new deck slab concrete to the existing concrete deck slab concrete shall be mixed in an agitating hopper slurry pump and shall consist of the following constituents, by weight:

- 1 part water;
- 1 part latex bonding agent; and
- 1½ parts Type GUSF Portland cement.

(ii) The consistency of the bonding grout shall be such that it can be brushed on the existing concrete surface in a thin, even coating that will not run or puddle in low spots.

E25.4.17 Epoxy Adhesive

(a) Epoxy adhesive for bonding concrete to steel shall be one of the following approved products: Sternson ST432 or ST433, Dural Duralbond, Capper Capbond E, Sikadur 32 Hi-bond, Concressive 1001 LPL, Meadows Rezi-Weld 1000, or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.18 Epoxy Grout

(a) Epoxy grout shall be one of the following approved products: Sternson Talygrout 100, Sika Sikadur 42, CPD Epoxy Grout by Specialty Construction Products, Meadows Rezi-Weld EG-96, or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.19 Cementitious Grout

(a) Cementitous grout shall be nonshrink and nonmetalic. Approved products are Sternson M-bed Standard, Specialty Construction Products CPD Non-Shrink Grout, Sika 212 Non-Shrink Grout, or equal as accepted by the Contract Administrator, in accordance with B7. The minimum compressive strength of the grout at 28 days shall be 40 MPa.

E25.4.20 Patching Mortar

(a) 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. The quantity of mixing water shall be no more than necessary for handling or placing.

E25.4.21 Flexible Joint Sealant

(a) Flexible joint sealant for all horizontal, vertical, and sloping joints shall be guaranteed non-staining, grey polyurethane, accepted by the Contract Administrator and applied in strict accordance with the details shown on the drawings and the Manufacturer's instructions including appropriate primers if recommended. Approved products are Vulkem 116 by Mameco, Sonolastic NP1 by Sonneborn, Sikaflex-1a by Sika, Bostik 915 by Bostik, or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.22 Fibre Joint Filler

(a) Fibre joint filler shall be rot-proof and of the preformed, nonextruding, resilient type made with a bituminous fibre such as Flexcell and shall conform to the requirements of ASTM Standard D1751-99 or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.23 Precompressed Foam Joint Filler

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

E25.4.24 Low Density Styrofoam

(a) Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B7.

E25.4.25 Backup Rod

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

E25.4.26 Screed Bases and Chairs

(a) Screed bases shall be Hilti HAS 304 stainless steel threaded rods, or equal as accepted by the Contract Administrator, in accordance with B7.

(b) Screed chairs shall be Mega Screed as supplied by Brock White Canada Company, or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.27 Dampproofing

(a) Dampproofing materials shall be applied to all buried concrete surfaces in contact with the soil to within 300 mm of Finished Ground Elevation, with the exception of those surfaces cast directly against the soil or in contact with prefabricated drainage composite. Dampproofing materials shall be mineral colloid emulsified asphalt complying with Canadian General Standards Board Specification No. 37.16-M89. Acceptable product is Bakelite/Flintguard 710-11 Foundation Coating as manufactured by Bakor, Elsro Fibrated Foundation Coating, Insulmastic 7103 Fibered Waterproofing, or equal as accepted by the Contract Administrator, in accordance with B7.

(b) All damaged concrete, including tie holes to be filled with non-shrink grout prior to application of dampproofing.

(c) Primer for dampproofing shall be asphalt primer, penetrating type conforming to CGSB 37-GP-9Ma. Acceptable products are Bakor Penetrating 910-01 Asphalt Primer as manufactured by Bakor Inc., Elsro Asphalt Primer No. 510, Insulmastic 7501 C/B Roof & Foundation Primer, or equal as accepted by the Contract Administrator, in accordance with B7.

E25.4.28 Galvanized Dowels and Galvanized Expansion Sleeves

(a) Dowels and expansion sleeves shall be fabricated in accordance with CSA Standard CAN/CSA-G30.18-M92.

(b) The dowels shall be galvanized in accordance with CSA Standard G164-M92, to a minimum net retention of 610 g/m^2.

E25.4.29 Miscellaneous Materials

(a) Miscellaneous materials shall be of the type specified on the drawings or as accepted by the Contract Administrator, in accordance with B7.

E25.4.30 Benchmark Plugs

(a) Benchmark plugs shall be supplied by the City. Installation by the Contractor shall be considered incidental to these Works. Installation locations shall be determined by the Contract Administrator.

E25.5 Equipment

E25.5.1 General

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

E25.5.2 Vibrators

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

(b) The Contractor shall use rubber coated vibrators for consolidating concrete containing epoxy-coated reinforcing steel, such as in locations that the existing deck reinforcing is exposed.

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

E25.5.3 Placing and Finishing Equipment for Bridge Deck Concrete

(a) Placing Equipment

(i) Adjacent exposed deck reinforcing steel shall be adequately protected during concrete placement.

(b) Screed for Deck Slab Concrete

(i) The Contractor may choose to use a mechanical or non-mechanical screed to strike the surface of the deck slab concrete.

(ii) Screed rails are required and shall be sufficient in number and length to ensure that the concrete cover is maintained and the finished elevation of the deck slab concrete meets the design elevations.

(iii) Screed guides shall be placed and fastened in position to ensure finishing of the concrete to the required profile. Supporting rails, upon which the finishing machine travels, shall be placed outside the area to be concreted. Provisions for anchorage of supporting rails shall provide for horizontal and vertical stability; positive anchorage may be required by the Contract Administrator. A hold-down device shot into concrete will not be permitted, unless the concrete is to be subsequently resurfaced.

(iv) The mechanical screed on guides or rails shall be supported so that they are completely clear of the finished surface.

(v) Internal vibration of the concrete will be required with mechanical screeding. Care shall be taken not to overwork the concrete surface.

(vi) Care shall be taken to ensure that the screed bars are seated uniformly on the screed chairs and that the ends of the screed bars do not overhang the screed chairs by more than 75 mm.

(vii) Screed surface touching concrete shall not be made of aluminum (magnesium acceptable).

(viii) The supply, setup, operation, and takedown of the screed for deck slab concrete shall be considered incidental to the placement of the deck slab concrete. No separate measurement or payment shall be made for this Work.

(c) Moveable Work Bridges for Deck Slab Concrete

(i) At least two moveable Work Bridges will be required (one for finishing operations and one for curing operations), independent of the screeding and finishing machines for the deck slab concrete.

(ii) These moveable Work Bridges shall travel guided on rails supported clear of the finished deck slab.

(iii) The Contractor shall install a sturdy walkway with safety railing on each side of the Work area for the purpose of providing access to the Work Bridge.

(iv) The supply, set up, operation, and takedown of the moveable Work Bridges shall be considered incidental to the placement of the Bridge Deck concrete. No separate measurement or payment shall be made for this Work.

E25.5.4 Placing and Finishing Equipment for Approach Slab Concrete

(a) Mechanical Screed for Approach Slab Concrete

(b) The mechanical screed shall be:

(i) Constructed to span the full width of the approach slab being placed;

(ii) Supported on screed rails positioned above the surface being screeded;

(iii) Sufficiently strong (truss type) to retain its shape under all working conditions, especially if any Work scaffolds are supported on the same screed rails;

(iv) Capable of producing the required flatness tolerance as specified in Clause E26.7.7 of Specification E26.

(v) The supply, setup, operation, and takedown of the movable mechanical screed shall be considered incidental to the placement of the approach slabs, and no separate measurement or payment shall be made for this Work.

(c) Movable Work Bridge for Approach Slab Concrete Works

(i) The Contractor shall provide a movable Work Bridge, spanning the approach slab at right angles to the centreline of roadway in order to facilitate a broom finish, the application of curing compound, the inspection of the freshly-placed concrete, and any remedial Work required to be done to the screeded surface, including filling in any holes left by the screed bars. After the surface has been screeded, all further Work that may be required shall be done from the Work Bridge.

(ii) The Contractor shall install a sturdy walkway with safety railing on each side of the Work area, as required, for the purpose of providing safe access to the Work Bridge.

(iii) The supply, setup, operation, and takedown of the movable Work Bridge shall be considered incidental to the placement of the approach slabs, and no separate measurement or payment shall be made for this Work.

E25.6 Construction Methods

E25.6.1 General

(a) It is intended that this Section cover all construction Work associated with Structural Concreting operations.

(b) Rate of application shall be the rate required to meet the requirements of ASTM C309-98a for the texture of concrete the curing compound is being applied to.

E25.6.2 Temporary False Work, Formwork, and Shoring

(a) Construction Requirements

(i) The Contractor shall construct falsework, formwork and shoring for the new deck slab concrete overhangs strictly in accordance with the accepted shop drawings.

(ii) All forms shall be of wood, metal or other materials as approved by the Contract Administrator. No formwork shall extend beneath the underside of the superstructure.

(iii) The falsework, formwork, and shoring for these Works shall be released prior to placement of the HPC overlay and Median Slab.

(iv) The falsework, formwork, and shoring for these Works shall be erected, and braced, as designed, and maintained to safely support all vertical and lateral loads until such loads can be supported by the concrete. All proposed fastening shall be as shown on the accepted shop drawings.

(v) 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.

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

(vii) Slots, recesses, chases, sleeves, inserts, bolts, hangers, and other items shall be formed or set in coordination and cooperation with the trade concerned. No openings shall be made in structural members that are not shown on the shop drawings without the prior written approval of the Contract Administrator.

(viii) Shores shall be provided with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.

(ix) Mud sills of suitable size shall be provided beneath shores, bedded in sand or stone, where they would otherwise bear on soil. The soil below shores must be adequately prepared to avoid settlement during or after concreting. Shores must not be placed on frozen ground.

(x) Shores shall be braced 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.

(xi) All exposed edges shall be chamfered 20 mm unless otherwise noted on the drawings.

(xii) Formwork shall have sufficient strength and rigidity so that the resultant finished concrete conforms to the shapes, lines, and dimensions of the members shown on the drawings.

(xiii) Forms shall be constructed so as to be sufficiently tight to prevent leakage of grout or cement paste.

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

(c) Forms for the concrete barriers shall be accordingly aligned to each other and to the geometry shown on the drawings so as to provide a smooth, continuous barrier. Any misalignments in the barrier shall be cause for rejection and removal of same. No snap ties within the barriers shall be placed below 250 mm above the top of the upper lift elevation.

(d) Forms shall be clean before use. Plywood and other wood surfaces shall be sealed against absorption of moisture from the concrete by a field applied form coating or a factory applied liner as accepted by the Contract Administrator.

(e) Where prefabricated panels are used, care shall be taken to ensure that adjacent panels remain flush. Where metal forms are used, all bolts and rivets shall be counter sunk and well ground to provide a smooth, plane surface.

(f) 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 30 mm in diameter. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest possible size. Torch cutting of steel hangers and ties will not be permitted. Formwork hangers for exterior surfaces of decks and curbs shall be an acceptable break-back type with surface cone, or removable threaded type. Cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in colour.

(g) 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.

(h) It shall be permissible to use the forms over again where possible to a maximum of three 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.

(i) 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.

(j) 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, incidental to the Work of this Specification, and the entire site shall be left in a neat and clean condition.

E25.6.3 Concrete Construction Joints

(a) Concrete construction joints shall be located only where shown on the drawings or as otherwise directed in writing by the Contract Administrator. Concrete construction joints shall be formed at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints.

(b) Forms shall be re-tightened and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.

(c) After the forms are stripped off the construction joint, the entire face of the joint, including the reinforcing steel, shall be thoroughly cleaned down to sound concrete and the surface roughened.

(d) Refer to, E25.6.13, “Preparation for Concreting Against Hardened Concrete”, for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

E25.6.4 Bridge Deck Screeds

(a) Setting Deck Screeds

(i) The Contractor shall adjust screeds to maintain uniform slab thickness. Adjust screed heights to plan elevations or to such other elevation as may be determined by the Contract Administrator in the field. Screed bases shall be permitted to be drilled and grouted into existing concrete and shall be adjustable to achieve the required elevations.

(ii) The screed chairs and screed rail supports shall be spaced to prevent deflections of the screed bars or screed rails during screeding operations.

E25.6.5 Concrete Bridge Traffic Barrier Joints

(a) Finishing of Concrete Barrier Joints

(i) The installation of the fibre joint filler and the emseal joint sealing shall be undertaken as shown on the drawings.

(ii) Furnish fibre joint filler for each joint in a single piece for the required depth and width for each joint, unless otherwise approved by the Contract Administrator. If permitted, multiple pieces shall be fastened together for a given joint by butting ends and securing in place by stapling or other positive fastening methods.

(iii) The emseal joint sealing at the barrier joints shall be installed as per the Manufacturer's recommendations.

(iv) All joint sealing of Bridge traffic barriers shall take place prior to casting the HPC overlay.

(v) The supply and installation of emseal joint sealing and fibre joint fillers shall be considered incidental to the Work, and no additional measurement or payment shall be made for this Work.

E25.6.6 Anchor Units for Bridge Traffic Barrier Posts and End Rail Units

(a) All anchor units shall be as specified on the drawings.

(b) All anchor units shall be held securely in place so as not to become displaced during concrete placement operations.

E25.6.7 Permeable Formwork Liner

(a) Permeable formwork liner shall be used on all exposed surfaces, except on soffit surfaces, or surfaces where a normal an architectural form finish is specified.

(b) The permeable formwork liner shall be used for only one (1) application.

(c) The supply, setup, application, and removal of permeable formwork liner shall be considered incidental to the placement of structural concrete, and no separate measurement or payment shall be made for this Work.

E25.6.8 Architectural Formwork Liner

(a) Architectural formwork liner shall be used at locations shown on the drawings.

(b) The architectural formwork liner shall be replaced after each use unless specifically allowed to be reused by the Manufacturer, as approved by the Contract Administrator.

(c) The supply, setup, installation, and removal of architectural formwork liner shall be considered incidental to the placement of structural concrete, and no separate measurement or payment shall be made for this Work.

E25.6.9 Benchmarks

(a) The Contractor shall install benchmark plugs supplied by the Contract Administrator at such locations on the structure as may be directed by the Contract Administrator.

E25.6.10 Structure Identification Date

(a) The Contractor shall indent into the exposed concrete a structure identification date at such location at the west end of the structure as shown on the drawings, in accordance with the detail shown on the drawings, or as otherwise directed by the Contract Administrator.

E25.6.11 Approach Slabs Works

(a) The Contractor shall undertake the approach slab Works, as shown on the drawings.

E25.6.12 Supply of Structural Concrete

(a) All structural concrete shall be supplied from a plant certified by the Manitoba Ready Mix Concrete Association. The Contractor, upon request from the Contract Administrator, shall furnish proof of this certification.

(b) All mixing of concrete must meet the provisions of CSA A23.1-04, Clause 5.2, Production of Concrete.

(c) Time of Hauling

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

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

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

(iv) Unless otherwise noted in Table E25.1, “Requirements for Hardened Concrete”, no retarders shall be used.

(v) The concrete, when discharged from truck mixers or truck agitators, shall be of the consistency and workability required for the job without the use of additional mixing water. If the slump of the concrete is less than that designated by the mix design statement, then water can be added on site provided the additional water meets the requirements of CSA A23.1-04 5.2.4.3.2. If additional water is to be added on site, it must be done under the guidance of the Suppliers’ designated quality control person. The Supplier shall certify that the addition of water on site does not change the Mix Design for the concrete supplied. Any other water added to the concrete without such control will be grounds for rejection of the concrete by the Contract Administrator.

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

(d) Delivery of Concrete

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

(e) Concrete Placement Schedule

(i) The Contractor shall submit to the Contract Administrator the proposed concrete placement schedule for all concrete placements for review and approval. If, in the opinion of the Contract Administrator, the volume of the placement is deemed larger than can be placed with the facilities provided, the Contractor shall either:

- Limit the amount to be placed at any time (using adequate construction joints);
- Augment his facilities and Plant in order to complete the proposed placement;
- In the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting; and

(ii) The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

E25.6.13 Preparation for Concreting Against Hardened Concrete

(a) All hardened concrete against which new concrete is to be placed shall be prepared in the following manner:

(i) Concrete shall be removed to sound concrete or to the limits as shown on the drawings, whichever is greater. The resulting surface shall be roughened to remove latent cement and miscellaneous debris.

(ii) All existing surfaces and exposed reinforcing steel are to be sandblasted to reveal a clean substrate and kept clean until concrete placement. Sandblasting shall be followed by a high pressure water wash to remove all residues.

(iii) Immediately prior to placing new concrete, bonding grout shall be thoroughly brushed onto the entire surface of the existing hardened concrete in a thin and even coating that will not run or puddle.

(iv) For the Bridge median slab, during concreting of the deck slab, the top surface of the concrete shall be roughened using a small rake running longitudinally between barrier dowels.

E25.6.14 Placing Structural Concrete

(a) General

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

(b) Dry Run for Deck Slab Screed Machine

(i) The Contractor shall conduct a dry run of the screed machine in the presence of the Contract Administrator to verify that the screed supporting rails are properly set to ensure compliance with the specified longitudinal and transverse deck grades. Sufficient screed supporting guide rails to provide the required coverage for the entire pour, as approved by the Contract Administrator, shall be set out and adjusted for height at least one (1) Working Day prior to the proposed pour. The Contract Administrator will verify that the screed machine and screed rails have been adjusted so that the height of the screed above the existing concrete at each point meets the requirements. To confirm the Contractor's adjustments of the machine and screed rails, the screed machine shall be "dry run", and screed clearance measurements taken at each support point by the Contractor. Resetting of the machine and/or screed rails shall be done by the Contractor as required by the Contract Administrator.

(c) Placing Structural Concrete

(i) Placement of deck concrete shall not be permitted when the surface moisture evaporation exceeds 0.75 kg/m2/h. Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator.

(ii) The nomograph, Figure D1, Appendix D of CSA Standard A23.1-04 shall be used to estimate surface moisture evaporation rates.

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

(iv) 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.

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

(vi) 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.

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

(viii) Placing of concrete, once started, shall be continuous. No concrete shall be placed on concrete which has sufficiently hardened to cause the formation of seams or “cold joints” within the section. If placing must be interrupted, construction joints shall be located where shown on the drawings or as accepted by the Contract Administrator.

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

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

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

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

(xiii) Concrete shall not be placed during rain or snow unless adequate protection is provided for formwork and concrete surfaces, to the satisfaction of the Contract Administrator.

(xiv) Before any concrete is placed for the approach slabs, or Bridge deck slab, the Contractor shall demonstrate to the satisfaction of the Contract Administrator before each pour that all necessary adjustments have been made to provide the required camber, crown, slab thickness, and concrete cover. This demonstration may be carried out by means of an attachment securely fastened to the finisher's strike-off machine and moving the machine and the strike-off across the deck over the reinforcing steel with a minimum 3 mm clearance between the steel and attachment.

E25.6.15 Finishing of Concrete Surfaces

(a) Finishing Operations for Unformed Surfaces

(i) The Contractor shall ensure that sufficient personnel are provided for the finishing of the slab surfaces. In the event that the depositing, vibrating, and screeding operations progress faster than the concrete finishing, the Contractor shall reduce the rate of concrete placement or cease the depositing of concrete until the exposed area of unfinished concrete has been satisfactorily minimized. The Contract Administrator's judgement in this matter shall be final and binding on the Contractor. All loads of concrete that exceed the 120 minute discharge time limit during the delay, while the finishing operations catch up, shall be rejected.

(b) Type 1 Finish – Exposed Formed Surfaces

(i) A permeable formwork liner finish shall be applied to all exposed formed surfaces including all exposed concrete surfaces not included in Type 2, Type

3, Type 4 finishes, but excluding soffit surfaces where an architectural form finish is specified.

(ii) Exposed surfaces imply all surfaces exposed to view including surfaces to 300 mm below finish grade elevations.

(iii) All surfaces to receive a formwork liner finish shall be formed using an approved permeable formwork liner.

(iv) The surfaces shall be patched as specified in this Specification.

(c) Type 2 Finish – Unformed Surfaces

(i) All unformed concrete surfaces, with the exception of the approach slab concrete shall be finished as outlined hereinafter.

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

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

(iv) After screeding, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared. Concrete surfaces after floating shall have a uniform, smooth, granular texture.

(d) Type 3 Finish – Approach Slab Concrete

(i) After final floating, the slab surface shall receive coarse transverse scored texture by drawing a steel tined broom uniformly across the slab surface, to the satisfaction of the Contract Administrator.

(e) Type 4 Finish - Surfaces Below Finished Grade

(i) All surfaces below 300 mm below finished grade except underside of footings shall be patched in accordance with the requirements of Sections E25.4.20, E25.4.16, and E25.6.18 of this Specification.

(ii) All surfaces below 300 mm below finish grade shall receive dampproofing in accordance with E25.4.27 of this Specification.

(f) Working Base Concrete Finish

(i) During placing, concrete working base shall be vibrated, screeded and floated.

(ii) The supply, set up, operation, and finishing of working base concrete shall be considered incidental to the placement of working base concrete, and no separate measurement or payment shall be made for this Work.

E25.6.16 General Curing Requirements

(a) Refer to E25.6.19 for cold weather curing requirements an E25.6.20 of this Specification for hot weather curing requirements.

(b) The use of curing compound shall not be allowed on concrete areas that are to receive additional concrete, dampproofing, a waterproofing membrane, or an asphalt overlay.

(c) Freshly finished concrete shall have either a curing compound applied, or shall be moist cured by immediately applying wet curing blankets to the exposed concrete surface immediately following finishing operations for at least seven (7) consecutive days thereafter. Construction joints shall be cured by means of wet curing blankets only.

(d) Curing compound shall be applied at the rate required by ASTM P198 for the accepted product. The compound must be applied uniformly and by roller. Spraying of the compound will not be permitted.

(e) Concrete shall be protected from the harmful effects of sunshine, drying winds, surface dripping, running water, vibration, and mechanical shock. No machinery shall travel in the vicinity of freshly placed concrete for a period of 24 hours. Concrete shall be protected from freezing until at least 24 hours after the end of the curing period.

(f) Changes in temperature of the concrete shall be uniform and gradual and shall not exceed 3ºC in one hour or 20ºC in 24 hours.

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

(h) Formed surfaces shall receive, immediately after stripping and patching, the same curing as finished surfaces, with the exception of the Bridge deck overhang surfaces.

(i) For curing of barriers, formwork shall remain in place for six (6) consecutive days following concreting. The top surface of the concrete surface shall be moist cured during this timeframe.

(j) The median slab shall be moist cured in accordance with E25.6.16(c).

(k) After the finishing and brooming is completed, the surface shall be sprayed with an initial coating of curing compound. As soon as initial set has occurred, the slab surface shall receive a second roller-applied application of curing compound, to the satisfaction of the Contract Administrator.

E25.6.17 Form Removal

(a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to form removal. The Contractor shall not commence any form removal operations without the prior written acceptance of the Contract Administrator.

(b) All forms shall remain in place and the concrete shall not be loaded for a minimum of seven (7) days after initial concrete placement, unless otherwise authorized by the Contract Administrator in writing.

(c) Notwithstanding the above, the minimum strength of in-place concrete prior to removal of vertical forms for deck extensions 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. Bridge deck overhang forms shall be loosened and may be removed prior to placement of the HPC overlay. Stripping of these forms shall not be permitted until a concrete strength of 28 MPa has been achieved by the deck slab concrete and the concrete Bridge traffic barriers.

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

E25.6.18 Patching of Formed Surfaces

(a) The Contractor shall notify the Contract Administrator at least one (1) Working Day prior to removal of forms. Immediately after forms have been removed and before the Contractor commences any surface finishing or concrete patching operations, all newly exposed concrete surfaces shall be inspected by the Contract Administrator.

(b) Any repair or surface finishing started before this inspection may be rejected and required to be removed.

(c) Patching of formed surfaces shall take place within 24 hours of formwork removal.

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

(e) Minor surface defects caused by honeycomb, air pockets greater than 5 mm in diameter, voids left by strutting, and tie holes shall be repaired by removing the defective concrete to sound concrete, dampening the area to be patched, then applying bonding grout followed by patching mortar. Bonding grout shall be well brushed onto the area immediately prior to patching. When the bonding grout begins to lose the water sheen, the patching mortar shall be thoroughly trowelled into the repair area to fill all voids. It shall be struck off slightly higher than the adjacent

concrete surface and left for one hour before final finishing to facilitate 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.

(f) Concrete shall be cast against forms which will produce plane surfaces with no bulges, indentations, or protuberances other than those shown on the drawings. All objectionable fins, projections, offsets, streaks, or other surface imperfections on the concrete surface shall be removed by means acceptable to the Contract Administrator. Cement washes of any kind shall not be used.

(g) 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.

E25.6.19 Cold Weather Concreting

(a) The requirements of CSA Standard A23.1-04 shall be applied to all concreting operations during cold weather, i.e., if the mean daily temperature falls below 5°C during placing or curing.

E25.6.20 Hot Weather Concreting

(a) General

(i) The requirements of this section shall be applied during hot weather, i.e., air temperatures forecast to go higher than 27°C during placing.

(ii) Concrete at discharge shall be at as low a temperature as possible, preferably as low as 15°C, but not above 25°C. Concrete containing silica fume shall be between 10°C minimum and 18°C maximum at discharge. Aggregate stockpiles should be cooled by water sprays and sun shades.

(iii) The Contractor shall use cold water and/or ice in the mix to keep the temperature of the fresh concrete down, if required. Ice may be substituted for a portion of the mixing water; provided it has melted by the time mixing is completed.

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

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

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

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

(viii) Hot weather curing shall follow immediately after the finishing operation.

(b) Hot-Weather Curing

(i) When the air temperature is at or above 25°C, curing shall be accomplished by fog misting and by using saturated absorptive fabric, in order to achieve cooling by evaporation. Note that fog misting is mandatory for all deck slab and median slab pours at all temperatures.

(ii) Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.

(c) Job Preparation

(i) When the air temperature is forecast to rise to 25°C or higher during the placing period, provisions shall be made by the Contractor for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, the formwork, reinforcement, and concreting

equipment shall be protected from the direct rays of the sun or cooled by mist fogging and evaporation, to the satisfaction of the Contract Administrator.

(d) Concrete Temperature

(i) The temperature of the concrete as placed shall be as low as practicable and in no case greater than the following temperatures, as shown in Table E25.2, "Acceptable Concrete Temperature", for the indicated size of the concrete section.

TABLE E25.2: ACCEPTABLE CONCRETE TEMPERATURES

THICKNESS OF SECTION, M	TEMPERATURES °C	
	MINIMUM	MAXIMUM
Less than:		
1	10	27
1.2	5	25

E25.6.21 Cleanup

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

E25.7 Concrete Quality

E25.7.1 Inspection

(a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.

(b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.

(c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E25.7.2 Access

(a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E25.7.3 Materials

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

(b) All materials shall conform to CSA Standard A23.1-04.

(c) All testing of materials shall conform to CSA Standard A23.2-04.

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

E25.7.4 Quality Assurance and Quality Control

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

(b) The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.

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

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

(e) The Contractor will be required to undertake Quality Control tests, of all concrete supplied. All test results are to be copied to the Contract Administrator immediately after the tests have been performed.

(f) The frequency and number of concrete Quality Control tests shall be in accordance with the requirements of CSA Standard A23.1-04. An outline of the quality tests is indicated below.

E25.7.5 Concrete Testing

(a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C-04, "Slump of Concrete". If the measured slump falls outside the limits in E25.3.2of this Specification, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.

(b) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C-04, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E25.3.2 of this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.

(c) The air-void system shall be proven satisfactory by data from tests performed in accordance with the test method of ASTM C457. The spacing factor, as determined on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C-04, 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) Rapid chloride permeability testing shall be performed in accordance with ASTM C 1202.

(e) Testing for post-cracking residual strength index of FRC shall be tested as follows. One set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure using the same test set up in ASTM C 1399-04 without the steel plate. The average of the peak loads is the cracking load of the concrete (Pcr), and shall be provided to the Contract Administrator. A second set of five concrete beam specimens shall be tested to failure in accordance with ASTM C 1399-04. The average of the peak loads is the post cracking load of the concrete (Ppcr). The Contractor shall submit a summary of the results of all post-cracking residual strength index tests. Specimens shall be sampled in accordance with E25.7.5(g).

(f) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C-04, "Sampling Plastic Concrete".

(g) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C-04, "Making and Curing Concrete Compression and Flexure Test Specimens".

(h) Compressive strength tests at twenty-eight (28) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each twenty-eight (28) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C-04, "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.

(i) Compressive strength tests on specimens cured under the same conditions as the concrete Works shall be made to check the strength of the in-place concrete so as to determine if the concrete has reached the minimum allowable working compressive strength as specified in Table E25.1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field-cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C-04, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

E25.7.6 Corrective Action

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

E25.8 Measurement and Payment

E25.8.1 Structural Concrete

(a) Supplying and placing structural concrete shall not be measured. This Work shall be paid for at the Contract Lump Sum Price for the “Items of Work” listed here below, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work.

(b) Items of Work:

(i) Supply and Place Structural Concrete:

- Retaining Walls and Footing;
- Slope Paving and Floor Slab;
- Manhole and Footings;
- Control Building Thickened Slab;
- Grade Beams and Pile Caps;
- Abutments;
- Pier Caps;
- In-fill Between Steel Girders;
- Deck Slab, Curbs, Barriers and Sidewalks; and
- Approach, Transition and Roadway Expansion Joint Slabs.

(c) Supplying and installing all the listed materials, concrete design requirements, equipment, construction methods, and quality control measures associated with this Specification and drawings shall be considered incidental to "Supply and Place Structural Concrete", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.

E26. HIGH PERFORMANCE CONCRETE (HPC) OVERLAY

E26.1 Description

E26.1.1 This Specification shall cover all operations relating to the preparation of Portland Cement structural concrete for, and all concreting operations related to, the construction of High Performance Concrete (HPC) Overlay Works, as specified herein and as shown on the drawings.

E26.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E26.2 Scope of Work

E26.2.1 The Work under this Specification shall involve the HPC overlay Works, placed on top of the deck replacement concrete.

E26.3 Submittals

E26.3.1 General

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

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

E26.3.2 Concrete Mix Design Requirements

(a) The Contractor shall submit a concrete mix design statement to the Contract Administrator for the High Performance Concrete (HPC) Overlay that reflects the specified performance properties of the concrete. The mix design statement shall contain all the information as outlined on the concrete mix design statement as shown on the Manitoba Ready Mix Concrete Association website (www.mrmca.com). In addition, the mix design statement must indicate the expected method of placement (buggies, chute, or pump). If pumping methods are to be used, the method of placement must include a clear description of the pumping methods (line, vertical drop, length of hose, etc.).

(b) The Supplier shall submit directly, in confidence, to the City of Winnipeg, the concrete mix designs for each of the concrete types specified herein. The purpose of this confidential submission will be for record keeping purposes only. The concrete mix design shall contain a description of the constituents and proportions, and at the minimum the following:

(i) Cementitious content in kilograms per cubic metre or equivalent units, and type of cementitious materials;

(ii) Designated size, or sizes, of aggregates, and the gradation;

(iii) Aggregate source location(s);

(iv) Weights of aggregates in kilograms per cubic metre or equivalent units. Mass of aggregates is saturated surface dry basis;

(v) Maximum allowable water content in kilograms per cubic metre or equivalent units and the water/cementitious ratio;

(vi) The limits for slump;

(vii) The limits for air content; and

(viii) Quantity of other admixtures.

(c) The concrete mix design statements must be received by the Contract Administrator a minimum of ten (10) Business Days prior to the scheduled commencement of concrete placement for each of the concrete types. The concrete mix designs must be received by the City of Winnipeg a minimum of five (5) Business Days prior to the scheduled commencement of concrete placement for each the concrete types.

(d) The mix design statement shall also include the expected slump measurement for each concrete type. The tolerances for acceptance of slump measurements in the field, by the Contract Administrator, shall be in accordance to CSA A23.1-04 Clause 4.3.2.3.2.

(e) Any change in the constituent materials of the approved mix design shall require submission of a new concrete mix design statement, mix design, and mix design test data. If, during the progress of the Work, the concrete supplied is found to be unsatisfactory for any reason, including poor workability, the Contract Administrator may require the Contractor to any necessary adjustments.

E26.3.3 Concrete Mix Design Test Data

(a) Concrete

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

(ii) The Contractor shall submit at a minimum, the test data to prove that the minimum compressive strength, flexural strength for Fibre Reinforced Concrete (FRC) only, air content, and slump of the concrete to be supplied meets or exceeds the performance criteria. In addition, test data shall be submitted to support requirements for post-cracking residual strength index (Ri) and fibre dispersion in accordance with the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6-06, Section 16, Fibre Reinforced Structures, Clause 16.6.

(iii) All tests shall be based on the concrete samples taken from the point of discharge into the formwork. For example, at the concrete chute from the delivery truck if being placed by buggies, or at the end of the pump line should the Contractor choose to pump the concrete into place.

(b) Aggregates

(i) The Contractor shall furnish, in writing to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of concrete placement, the location of the sources where aggregate will be obtained in order that some may be inspected and tentatively accepted by the Contract Administrator. Changes in the source of aggregate supply during the course of the Contract shall not be permitted without notification in writing to and the expressed approval of the Contract Administrator.

(ii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on sieve analysis of fine and coarse aggregates in accordance with CSA Standard Test Method A23.2-2A.

(iii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on tests for organic impurities in fine aggregates for concrete, in accordance with CSA Standard Test Method A23.2-7A.

(iv) The Contractor shall submit to the Contract Administrator for review and approval recent test information on relative density and absorption of coarse aggregate, in accordance with CSA Standard Test Methods A23.2-12A.

(v) The Contractor shall submit to the Contract Administrator for review and approval recent test information on petrographic examination of aggregates for concrete, in accordance with CSA Standard Test Methods A23.2-15A. The purpose of the petrographic analysis is to ensure the aggregates provided are of the highest quality for use in the production of concrete and will produce a durable overlay. An acceptable aggregate will have an excellent rating as judged by an experienced petrographer, with a (weighted) petrographic number typically in the range of 100 to 120.

(vi) The Contractor shall submit to the Contract Administrator for review and approval recent test information on resistance to degradation of large-size coarse aggregate by abrasion and impact in the Los Angeles Machine, in accordance with CSA Standard Test Method A23.2-16A.

(vii) The Contractor shall submit to the Contract Administrator for review and approval recent test information on potential alkali reactivity of cement aggregate combinations (mortar bar method), in accordance with CSA Standard Test Method A23.2-27A.

(c) The Contractor shall submit to the Contract Administrator copies of all material quality control test results.

E26.3.4 Notification of Ready Mix Supplier

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

E26.3.5 Moveable Deck Hoarding

(a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of the HPC overlay work on-site, shop drawings showing the fabricated details of the movable deck hoarding, design loads, method of construction, type and grade of materials, and any further information that may be required by the Contract Administrator.

(b) The movable deck hoarding shall be designed by a Professional Engineer registered in the Province of Manitoba and constructed to the following requirements:

(i) Sufficient clearances shall be provided to enable the placing and finishing the HPC overlay to proceed unhindered inside the hoarding;

(ii) The minimum length of the hoarding shall be 25 m or the length of the structure, whichever is shorter;

(iii) The hoarding shall have a clear, unsupported span of at least the clear deck width, plus room for all of the screeding and finishing operations;

(iv) The roof and sides of the hoarding shall be covered with waterproof and insulated material, with all joints overlapping and rendered waterproof and not subjected to heat loss. The material shall be strong enough to withstand the force of "driving" rain or snow, and at least two thirds of the roof and the entire

sides shall be opaque in order to prevent the deck concrete from being exposed to direct sunlight;

(v) The sides of the hoarding at the junction of the hoarding with the deck shall be constructed to prevent the entrance of rain from the sides. Provisions shall be made for enclosing the ends of the hoarding on short notice in the event that closing of the ends proves necessary during the concrete placing operations; and

(vi) The hoarding shall be constructed on wheels or rollers for ready mobility. Another acceptable method is to have stationary sides, with the roof on wheels or rollers.

E26.3.6 HPC Overlay Pour Sequence and Schedule

(a) The Contractor shall submit to the Contract Administrator for review and approval, at least twenty (20) Business Days prior to the scheduled commencement of the HPC overlay placement:

(i) The proposed sequence of construction for the placement of the HPC overlay.

(b) The Contractor shall submit to the Contract Administrator for review, at least ten (10) Business Days prior to the placement of concrete, details of any proposed construction joints.

(c) The Contractor shall submit to the Contract Administrator for review and approval, at least ten (10) Business Days prior to the scheduled commencement of concrete placement, the proposed placement schedule for the HPC overlay.

E26.4 Materials

E26.4.1 General

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

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

E26.4.2 Handling and Storage of Materials

(a) All materials shall be handled and stored in a careful and workmanship like manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with CSA Standard CAN/CSA-A23.1-04.

E26.4.3 Concrete

(a) Concrete materials susceptible to frost damage shall be protected from freezing.

(b) Concrete shall have nominal compressive strengths (f'c) and meet the requirements for hardened concrete as specified in the following Table E26.1.

TABLE E26.1
REQUIREMENTS FOR HARDENED CONCRETE

Type of Concrete	Location	Nominal Compressive Strength [MPa]	Class of Exposure	Air Content Category	Max Aggregate Size	Special Requirements	Post Residual Cracking Index
Type 4	High Performance Concrete (HPC) Overlay	50 @ 56 Days	C-XL	1	14 mm	Crushed Granite Aggregate; Synthetic Fibres; maximum Shrinkage Strain of 450 microstrains @ 56 Days; Set Retarders permitted	0.15

E26.4.4 Aggregates

(a) General

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

(ii) The potential for deleterious alkali-aggregate reactivity shall be assessed in accordance with CSA A23.2-27A-04. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA A23.2-14A-04 or CSA A23.2-25A-04 is required.

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

(b) Fine Aggregate

(i) Fine aggregate shall meet the grading requirements of CSA A23.1-04, Table 10, FA1, be graded uniformly and not more than 3% shall pass a 75 um sieve. Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.

(ii) Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1-04, Table 12.

(c) Coarse Aggregate – Granite

(i) Only coarse crushed granite aggregate shall be used for the HPC overlay.

(ii) Coarse aggregate shall be 100% crushed, washed granite, low in quartz, clean and free from alkali, organic, or other deleterious matter, shall have two fractured faces, and shall have an absorption not exceeding 3%.

E26.4.5 Admixtures

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

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

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

E26.4.6 Cementitious Materials

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

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

(c) Should the Contractor choose to include fly ash in the concrete mix design, the fly ash shall be Class CI or F and the substitution shall not exceed 30% by mass of cement.

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

E26.4.7 Water

(a) Water to be used for all operations in the Specification, including the mixing and curing of concrete or grout, surface texturing operations, and saturating the substrate shall conform to the requirements of CSA A23.1-04 and shall be free of oil, alkali, acidic, organic materials or deleterious substances. The Contractor shall not use water from shallow, stagnant or marshy sources.

E26.4.8 Synthetic Fibres

(a) The synthetic fibres shall consist of 100% virgin polypropylene as accepted by the Contract Administrator, in accordance with B7. The dosage shall be designed by the Contractor to meet the requirements for post-cracking residual strength index (Ri) and fibre dispersion in accordance to the Canadian Highway Bridge Design Code, CAN/CSA-S6-06, Section 16, Fibre-Reinforced Structures, Clause 16.6.

E26.4.9 Curing Blankets

(a) Curing blankets for wet curing shall be 100 percent polyester, 3 mm thick, white in colour. An approved product is “Mirafi Geotextile P150”. Alternately, a 10 oz burlap, 5 mil polyethylene, curing blanket white in colour shall be used; “Curelap” manufactured by Midwest Canvas, together with a second layer of burlap, or equal as accepted by the Contract Administrator, in accordance with B7.

E26.4.10 Bonding Agents

(a) Latex Bonding Agent

(i) Latex bonding agent shall be Acryl-Stix, SikaCem 810, or equal as accepted by the Contract Administrator, in accordance with B7. Polyvinyl acetate-based latexes will not be permitted.

(b) Bonding Grout

(i) The grout for bonding the HPC overlay concrete to the new concrete deck slab shall be mixed in an agitating hopper slurry pump and shall consist of the following constitutes, by weight:

- 1 part Water;
- 1 part latex bonding agent; and
- 1 ½ parts Type GUSF Portland Cement.

(ii) The consistency of the bonding grout shall be such that it can be brushed onto the existing concrete surface in a thin, even coating that will not run or puddle in low spots.

E26.4.11 Miscellaneous Materials

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

E26.5 Equipment

E26.5.1 General

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

E26.5.2 Vibrators

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

(b) The Contractor shall use rubber coated vibrators for consolidating concrete containing epoxy-coated reinforcing steel, such as in locations that the existing deck reinforcing is exposed.

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

E26.5.3 Finishing Machine for the HPC Overlay

(a) Unless otherwise specified, an approved finishing machine complying with the following requirements shall be used.

(b) A mechanical strike-off shall be required to provide a uniform thickness of concrete in front of the screed.

(c) Design of the finishing machine, together with appurtenant equipment, shall be such that positive machine screeding to the plastic concrete will be obtained with 25 mm of at least 150 mm beyond the line where a sawcut is intended to form the edge of a subsequent placement section and shall overlap the sawn edge of a subsequent placement section and shall overlap the sawn edge of a previously-placed course at least 150 mm.

(d) Finishing machines that are approved for use for placing the HPC overlay are Bidwell Bridge Pavers and Gomaco Bridge Pavers.

(e) The finishing machine shall have a paving carriage with strike-off auger, rotating cylinders, and a finishing pan.

(f) The finishing machine shall be capable of forward and reverse motion under positive control. Provision shall be made for raising the screeds to clear the screeded surface for travelling in reverse.

(g) Supporting rails upon which the finishing machine travels will be required on all pours. The support of these rails shall be fully adjustable to obtain the correct profile.

(h) When placing concrete in a lane abutting a previously completed lane, the side of the finishing machine adjacent to the completed lane shall be equipped to travel on the completed lane.

(i) Vehicles for transporting fresh concrete from the truck to the mechanical screed shall not travel directly on the surface of the new concrete deck slab.

(j) The supply, set up, operation, and takedown of the finishing machine shall be considered incidental to the placement of the HPC overlay and no separate measurement or payment shall be made for this Work.

E26.5.4 Moveable Deck Hoarding

(a) The moveable deck hoarding shall be constructed on wheels or rollers for ready mobility. Another acceptable method is to have stationary sides, with the roof on wheels or rollers.

(b) The rail system for the movable deck hoarding can be the same rail system used for the finishing machine and the Work Bridges, subject to the approval of the Contract Administrator.

(c) The roof of the hoarding shall be checked for damage and water tested before each concrete pour, and all repairs shall be made, as required, before concrete placing will be allowed to begin.

(d) The hoarding shall not be removed from overtop of a newly completed HPC overlay without first obtaining permission from the Contract Administrator.

(e) The supply, setup, operation, and takedown of the movable deck hoarding shall be considered incidental to the placement of the deck slab concrete and HPC overlay, and no separate measurement or payment shall be made for this Work.

E26.5.5 Moveable Work Bridges for Bridge Deck Concrete

(a) At least two moveable Work Bridges will be required (one for finishing operations and one for curing operations), independent of the finishing machine, for the HPC overlay Works.

(b) These moveable Work Bridges shall travel guided on rails supported clear of the finished Bridge deck.

(c) The Contractor shall install a sturdy walkway with safety railing on each side of the Work area for the purpose of providing access to the Work Bridge.

(d) The supply set up, operation, and takedown of the moveable Work Bridges shall be considered incidental to the placement of the Bridge Deck concrete. No separate measurement or payment shall be made for this Work.

E26.6 Construction

E26.6.1 HPC Overlay

(a) General

(i) The HPC overlay shall be constructed in accordance with the requirements of this Specification.

(ii) The new deck slab concrete, and any patching repairs thereto, shall reach a minimum compressive strength of 35 MPa, as determined by field-cured test cylinders, before the HPC overlay is placed.

(b) Surface Preparation

(i) Following the completion of the deck slab concrete, the Contractor shall conduct a final screed survey on the top of the concrete and submit elevations to the Contract Administrator.

(ii) The Contract Administrator shall finalize and provide elevations for the top of the HPC overlay. The Contract Administrator shall provide these elevations for the Contractor within five (5) Business Days from receipt of the final screed survey.

(iii) The new concrete deck surface, onto which the HPC overlay concrete is to be placed shall be roughened as per ICRI Guidance No. 03732 CSP 6 (Medium Scarification).

(iv) It is permissible that the concrete surface may be prepared by rotomilling, using a BobCAT-sized machine. After rotomilling operations have been completed to the satisfaction of the Contract Administrator, the entire rotomilled surface shall receive a high-pressure water blast to remove all surface microfractures to the satisfaction of the Contract Administrator.

(v) The time interval between the surface preparation and the placing of the HPC overlay concrete shall be kept to a minimum, and utmost care shall be taken to keep the prepared surfaces clean during the interval.

(vi) Immediately before proceeding with each HPC overlay concrete placement, the prepared surface shall be inspected for dirt and other deleterious materials that may have been deposited after the completion of cleaning. All such dirt and deleterious material shall be cleaned off in a manner and by procedures satisfactory to the Contract Administrator.

(vii) Placement of the HPC overlay concrete shall not be permitted when the surface moisture evaporation exceeds 0.75 kg/m2/h. Fog misting is mandatory regardless of drying conditions. The Contractor shall use fog misting operations as accepted by the Contract Administrator. The nomograph, Figure D1, Appendix D of CSA Standard A23.1-04 shall be used to estimate surface moisture evaporation rates.

(c) Mixing

(i) A water-reducing admixture for improving Workability will be required. The admixture must be accepted by the Contract Administrator and shall be used in strict accordance with the Manufacturer's instructions.

(d) Dry Run of Finishing Machine

(i) The Contractor is responsible for properly setting the screed supporting rails to ensure compliance with the specified longitudinal and transverse deck grades, without creating potential ponding areas or “bird baths.”

(ii) Sufficient screed supporting guide rails to provide the required coverage for the entire pour, as approved by the Contract Administrator, shall be set out and adjusted for height the day prior to the pour. The Contract Administrator will then check the deck grades, as follows:

- That the screed supporting rail system upon which the finishing machine will travel has been placed outside the area to be concreted. Arrangements for positive anchorage of supporting rails shall provide for horizontal and vertical stability. Hold-down devices shot into the concrete will not be permitted; and

- That the finishing machine and screed rails have been adjusted so that the height of the screed above the existing concrete at each point meets the Contract Administrator’s requirements. To confirm the Contractor’s adjustment of the machine and guide rails, the finishing machine shall be “dry run,” and screed clearance measurements taken at each support point, by the Contractor. Resetting of the machine and/or screed rails shall be done by the Contractor as required by the Contract Administrator.

(e) Placing HPC Overlay

(i) No longitudinal or transverse joints will be allowed unless detailed on the drawings or authorized in writing by the Contract Administrator. Where transverse and longitudinal joints are allowed, the HPC overlay previously placed shall be saw cut full depth to a minimum of 50 mm horizontally back from the formed joint location, to a straight and vertical edge against which the adjacent HPC overlay is to be placed, as approved by the Contract Administrator.

(ii) Immediately before placing the HPC overlay concrete, a thin coating of bonding grout shall be scrubbed into the clean, dry surface of the joint and Bridge deck. Care shall be exercised to ensure that all surfaces receive a thorough, even coating and that no excess of grout is permitted to collect in pockets. The rate of progress in applying grout shall be limited so that the grout does not become dry before it is covered with fresh HPC overlay concrete.

(iii) The Contractor shall take every precaution necessary to secure a smooth-riding High Performance Concrete (HPC) overlay surface, within the tolerances indicated in E26.7.7 in this Specification.

(iv) Concrete shall be placed so as to avoid segregation of constituent materials. The concrete finishing machine shall provide sufficient vibration to properly compact the mix. Excess vibration which may cause segregation shall be avoided. If over 75 mm in thickness, or if reinforcing steel is in the lift, the concrete shall be internally vibrated in advance of machine finishing.

(v) The temperature of the concrete shall not be less than 10ºC, nor more than 18ºC, at the time of placing, and shall be maintained below this maximum temperature by the inclusion of ice in the mix in place of a portion of the mix water, as approved by the Contract Administrator, taking care to maintain the design water/cementitious ratio.

(vi) The overall combination of labour and equipment for proportioning, mixing, placing, and finishing new concrete shall be of such minimum capability as to meet the following requirements, as shown on Table E26.2, "Minimum Requirement for Placing High Performance Concrete (HPC) Overlay", except when noted otherwise on the drawings.

TABLE E26.2
MINIMUM REQUIREMENT FOR PLACING
HIGH PERFORMANCE CONCRETE (HPC) OVERLAY

TOTAL CONCRETE AREA PER BRIDGE (Square Metre)	MINIMUM REQUIREMENTS (Cubic Metres/Hour)
0 - 275	1.0
276 - 410	1.5
411 - 550	2.0
Over 550	2.5

(vii) The finishing machine shall be so designed that, when concrete is mixed and placed at the specified minimum rate, under normal operating conditions, the elapsed time between depositing the concrete and final screeding shall not exceed 30 minutes. Similarly, the placing equipment and operations shall be such that in no case shall the elapsed time between batching of ready-mix concrete and final screeding exceed 90 minutes.

(viii) Placement of the concrete shall be a continuous operation throughout the pour. In the event of equipment breakdown, such that concrete placement is stopped or delayed for a period of 60 minutes or more, further placement shall be discontinued and may resume only after a period of not less than 12 hours. This restriction does not prohibit continuation of placement provided that a gap is left in the lane or pour strip. The gap shall be sufficient in length for the finishing machine to clear the previously placed concrete. The fill-in section shall be placed after a period of not less than 12 hours. The edge of any discontinued overlay shall be saw cut full depth a minimum 50 mm horizontally back from the discontinued joint location, and then shall be chipped out and thoroughly cleaned before placing further HPC overlay concrete.

(ix) Screed guides shall be placed and fastened in position to ensure finishing of concrete to the required profile. Supporting rails upon which the finishing machine travels shall be placed outside the area to be concreted. Provisions for anchorage of supporting rails shall provide for horizontal and vertical stability; positive anchorage may be required by the Contract Administrator. A hold-down device shot into the lower lift deck concrete will not be permitted. Plans for anchoring support rails shall be submitted to the Contract Administrator for acceptance. The Contract Administrator's acceptance must be received in writing by the Contractor prior to the installation of any anchorage devices.

(x) The finished Bridge deck grades shown on the drawings are preliminary only and are subject to revision during construction by the Contract Administrator.

(xi) The HPC overlay shall have a minimum thickness of 50 mm. Actual HPC overlay thickness may be greater. This would be to accommodate field adjustments for camber and deflection, and to accommodate variances in grade of the underlying deck slab.

(xii) The vibratory screed of the finishing equipment shall be moved slowly and at a uniform rate, such that screeding shall be completed in no more than two passes. The screed vibrators shall not be allowed to run except when screeding is actually in progress. The screeded surface shall not be walked on or otherwise damaged.

(xiii) The HPC overlay concrete surface produced behind the finishing machine shall be magnesium floated the minimum amount necessary to ensure that the surface is free from open texturing, plucked aggregate or projecting polypropylene fibres and local projections or depressions, to meet the surface tolerance specified. The Contractor shall ensure that the concrete surface is not overworked, resulting in excessive loss of air entrainment.

(xiv) During the concrete finishing operations, the Contractor shall utilize a 3.05 m (10 ft.) straightedge with a 75 mm (3 inch) semicircular shape, as supplied by Bidwell Inc., and as accepted by the Contract Administrator. It shall be used both for flattening the plastic concrete surface and for checking and verifying the surface flatness before commencing curing of the surface. The entire surface shall be checked and any areas not within the surface flatness tolerances specified under the Quality Control section of this Specification shall be corrected using the straight edge. Care shall be taken to preserve the crown and cross section of the roadway.

(xv) Upon completion of the straight-edge checking and final floating the joint with any previous pour (or any transverse joints) shall be sealed by the application of the bonding grout.

(f) Curing of the HPC Overlay

(i) Immediately following finishing of the HPC overlay concrete surface, apply fog misting until the concrete has enough strength to support the placement of the predampened curing blankets. The misting device shall not be used to apply water to the concrete's surface for finishing purposes. The misting device shall not be directed towards the concrete surface. Only a fine coating or sheen should be applied by the misting device. There should be no standing water.

(ii) After the joint painting is completed, the surface shall be promptly covered with a single layer of clean, lightly pre-dampened, curing blanket.

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

(iv) The predampened curing blankets shall be a temperature of 20°C, ± 5ºC, when applied to the deck.

(v) Failure to apply wet curing blankets within 40 minutes after the deck concrete has been deposited shall be cause for rejecting the Works so affected. Concrete in the rejected area shall be removed and replaced at no additional cost to the City.

(vi) It is intended that the surface receive a wet curing blanket cure for at least seven (7) days. Water shall be applied as necessary to keep the concrete and

curing blankets saturated. The Contractor must ensure the concrete and curing blankets are kept saturated with water for the entire seven (7) days.

(vii) As soon as the HPC overlay surface can be walked on without damaging the surface, as approved by the Contract Administrator, the curing blankets shall be covered with a layer of minimum 4-mil polyethylene film and a layer of insulated tarps (during cold weather) in order to maintain the concrete temperature of 10°C.

(viii) If, in the opinion of the Contract Administrator, curing has not been maintained sufficiently, the curing period will be extended as directed with no additional payment made.

(g) Surface Texturing of the HPC Overlay Surface

(i) Grooves are to be parallel (within 2 mm) and cut perpendicular to traffic flow. Grooves shall only be cut into the HPC overlay surface following the curing.

(ii) Saw cuts shall be 2.5 mm wide, 6 ± 2 mm deep, and spaced 25 mm on centre.

(iii) The area 600 mm from the low side of traffic barriers, and the area 300 mm from the high side of traffic barriers is not to be grooved and the grooves shall all end in a straight line parallel to the face of the traffic barrier.

(iv) Saw cuts shall extend no closer than 150 mm to expansion joints and to any deck drains.

(v) The Contractor shall supply all water for surface texturing operations strictly in accordance with Section E26.4.7 of this Specification. All run-off from grooving operations and suspended solids shall be collected at either end of the Bridge off the Bridge approach slabs, in collection tanks, passed through several settling and filtration processes before it is discharged into the sewer system. The final effluent shall meet the requirements of the City of Winnipeg By-Law No. 7070/97 Part 5, Control of Discharge into Sewers, for water quality.

(vi) All Work associated with surface texturing shall be considered incidental to the HPC overlay Works specified herein, and no additional measurement or payment shall be made for this Work.

(h) Limitation of Operations

(i) Provisions shall be made to protect the concrete by only casting overlay concrete under good weather conditions. This means that the air temperatures shall be between 5°C and 25°C and the surface moisture evaporation rate is less than 0.75 kg/square metre per hour as determined by CSA A23.1-04, Appendix D, “Guidelines for Curing and Protection”. Also, it shall not be raining and no rain forecast for the duration of each pour. The Contract Administrator’s decision in this matter will be final.

E26.7 Concrete Quality

E26.7.1 Inspection

(a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final acceptance of the specified Work.

(b) The Contractor shall be wholly responsible for the control of all operations incidental thereto, notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.

(c) Quality Assurance testing shall be undertaken by the Contract Administrator. Quality Control testing shall be undertaken by the Contractor.

E26.7.2 Access

(a) The Contractor shall allow the Contract Administrator free access to all parts of the Work at all times. The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes as required. There will be no charge to the City for samples taken.

E26.7.3 Materials

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

(b) All materials shall conform to CSA Standard A23.1-04.

(c) All testing of materials shall conform to CSA Standard A23.2-04.

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

E26.7.4 Quality Assurance and Quality Control

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

(b) The Contract Administrator reserves the right to reject concrete in the field that does not meet the Specifications.

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

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

(e) The Contractor will be required to undertake Quality Control tests, of all concrete supplied. All test results are to be copied to the Contract Administrator immediately after the tests have been performed.

(f) The frequency and number of concrete Quality Control tests shall be in accordance with the requirements of CSA Standard A23.1-04. An outline of the quality tests is indicated below.

E26.7.5 Concrete Testing

(a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C-04, "Slump of Concrete". If the measured slump falls outside the limits in E26.3.2 of this Specification, a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.

(b) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C-04, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E26.3.2 of this Specification, a second test shall be made at any time within the specified discharge time limit for the mix. In the event of a second failure, the Contract Administrator reserves the right to reject the batch of concrete represented.

(c) The air-void system shall be proven satisfactory by data from tests performed in accordance with the test method of ASTM C457. The spacing factor, as determined

on concrete cylinders moulded in accordance with CSA Standard Test Method A23.2-3C-04, 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) Rapid chloride permeability testing shall be performed in accordance with ASTM C 1202.

(e) Testing for post-cracking residual strength index of FRC shall be tested as follows. One set of five concrete beam specimens, 100 mm by 100 mm by 350 mm long, shall be tested to failure using the same test set up in ASTM C 1399-04 without the steel plate. The average of the peak loads is the cracking load of the concrete (Pcr), and shall be provided to the Contract Administrator. A second set of five concrete beam specimens shall be tested to failure in accordance with ASTM C 1399-04. The average of the peak loads is the post cracking load of the concrete (Ppcr). The Contractor shall submit a summary of the results of all post-cracking residual strength index tests specimens shall be sampled in accordance with E26.7.5(g).

(f) Testing for shrinkage strain shall take place for HPC overlay in accordance with ASTM C 157.

(g) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C-04, "Sampling Plastic Concrete".

(h) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C-04, "Making and Curing Concrete Compression and Flexure Test Specimens".

(i) Compressive strength tests at fifty-six (56) days shall be the basis for acceptance of all concrete supplied by the Contractor. For each fifty-six (56) day strength test, the strength of two companion standard-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C-04, "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.

(j) Compressive strength tests on specimens cured under the same conditions as the concrete Works shall be made to check the strength of the in-place concrete so as to determine if the concrete has reached the minimum allowable working compressive strength as specified in Table E30.1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field-cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C-04, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

(k) Notwithstanding CSA A23.2-04, cores taken from HPC overlay must achieve at a minimum 85% of the specified concrete design strength.

E26.7.6 Corrective Action

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

E26.7.7 Surface Flatness Requirements

(a) The surface of the HPC overlay shall be finished to a flatness tolerance as specified herein. The surface flatness of the finished concrete shall be determined by measuring the elevation difference between equidistant points spaced 305 mm apart, along straight or curved lines running parallel or perpendicular (radial) to the direction of travel on the Bridge deck. An acceptable surface flatness, as measured along any such line on the finished surface, shall have the absolute difference between any two consecutive readings (a reading being the difference in elevation between two consecutive points) not exceeding 5 mm.

(b) At each location(s) where the absolute difference of 5 mm is exceeded, further detailed contour survey(s) shall be conducted by and at the discretion of the Contract Administrator to determine the extent of the area requiring corrective action, all at the Contractor's expense. Corrective measures shall involve immediate removal of the surface in the areas not meeting the specified surface flatness tolerance and/or acceptable rideability, in the judgement of the Contract Administrator, and replacement of same to a minimum depth of 50 mm, with the perimeter of the area saw-cut to a depth of 25 mm (the cut face to be sloped to key-in the replacement concrete), as directed by the Contract Administrator. If more than 20 percent of the surface is rejected by the Contract Administrator based on the flatness tolerance and/or any other defect, the Contractor shall immediately remove and replace the entire area of the applicable pour.

(c) This criterion will not apply across the crown or at any deck drains, which must be constructed to meet design grades as shown on the drawings or as directed by the Contract Administrator.

(d) The Contract Administrator shall take readings and determine the acceptability for the surface flatness prior to the opening of the Bridge. The Contractor shall remove and replace the curing blankets, if required by the Contract Administrator, to undertake the necessary flatness testing and shall restore same immediately upon completion of the testing in each area, so as not to significantly disturb concrete curing, to the satisfaction of the Contract Administrator. The Contractor shall clear all materials and equipment from the deck surface during the testing.

E26.8 Measurement and Payment

E26.8.1 Supplying and placing the High Performance Concrete (HPC) Overlay shall not be measured. The Work shall be paid for at the Contract Lump Sum Price for “Supply and Place High Performance Concrete (HPC) Overlay”, performed in accordance with this Specification and accepted by the Contract Administrator, which price shall be paid in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work.

E27. SUPPLYING AND PLACING REINFORCING STEEL

E27.1 Description

E27.1.1 This Specification shall cover the supply, fabrication, and placement of plain and hot-dipped galvanized reinforcing steel.

E27.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E27.2 Materials

E27.2.1 General

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

E27.2.2 Handling and Storage of Materials

(a) All materials shall be handled in a careful and workmanshiplike manner, to the satisfaction of the Contract Administrator. Storage of materials shall be in accordance with the requirements of CSA Standard CAN/CSA-A23.1-00, Storage of Materials, except as otherwise specified herein.

E27.2.3 Reinforcing Steel

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

(b) All reinforcing steel shall conform to the requirements of CSA Standard CAN/CSA G30.18-M92, Grade 400W, 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 manufacture or fabrication, such material shall be immediately removed from the site and replaced with acceptable reinforcing steel.

(c) All reinforcing steel shall be straight and free from paint, oil, millscale, and injurious defects. Rust, surface seams, or surface irregularities will not be cause for rejection, provided that the minimum dimensions, cross-sectional area, and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA Standard CAN/CSA G30.18-M92.

E27.2.4 Galvanizing

(a) Shop Applied

(i) The galvanizing shall be shop applied and strictly in accordance with ASTM A767M-00a to a retention equal to a Class II level (610 gm/m^2), except as otherwise specified herein.

(ii) Submit an original and three (3) copies of the coating applicator's notarized Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements.

(iii) Preclean reinforcing steel using acceptable methods to produce an acceptable surface for quality hot-dip galvanizing.

(iv) Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

(v) The surface finish shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect detrimental to the stated end use of the coated article.

(vi) Coating adhesion shall withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

(vii) Sheared ends of bars shall be coated with a zinc-rich formulation before rusting occurs and before shipment to the job site.

(viii) Furthermore, all field welds, as well as cracking and other visible damage or deterioration of the hot-dip galvanizing as a result of handling or bending operations, or any other causes, shall be galvanize-coated with field applied galvanizing touch-up material as specified hereinafter.

(b) Field Applied

(i) Field applied galvanized coating shall be brush applied:

- Zinga, as supplied by Pacific Evergreen Industries Ltd., West Vancouver, BC, Canada (604) 926-5564
- ZRC Cold Galvanizing Compound, as supplied by ZRC Worldwide, 145 Enterprise Drive, Marshfield, MA 02050 USA (781) 319-0400
- Or equal as acceptable by the Contract Administrator.

(ii) All field applied galvanized coatings shall be applied in accordance with the manufacturer's recommendations and as directed by the Contract Administrator.

(iii) The maximum area to be repaired in the field shall be 5,000 mm^2. Any damaged article with a damaged area greater shall be rejected, removed, and replaced at the Contractor's expense.

E27.2.5 Bar Accessories

(a) Bar accessories shall be of a type acceptable to the Contract Administrator. They shall be made from a nonrusting material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.

(b) Bar chairs, bolsters, and bar supports shall be cementitious material. No plastic, PVC, or galvanized bar chairs will be used.

(c) Approved products are as supplied by Con Sys Inc., Box 341, Pinawa, Manitoba, Canada R0E 1L0 (204) 753-2404, or equal as accepted by the Contract Administrator in accordance with B7.

(d) Bar accessories are not included in the drawings and shall include bar chairs, spacers, clips, wire ties, wire (16 gauge minimum), or other similar devices and are to be acceptable to the Contract Administrator. Wire for tying galvanized bars shall be annealed wire. The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

E27.3 Construction Methods

E27.3.1 Fabrication of Reinforcing Steel

(a) General

(i) Reinforcing steel shall be fabricated in accordance with CSA Standard CAN/CSA G30.18-M92 to the lengths and shapes as shown on the drawings.

(b) Submissions

(i) At least twenty-one (21) days prior to the scheduled commencement of any fabrication, the qualifications of the Contractor, the qualifications of operators, the shop drawings including bar lists, and the mill certificates shall be submitted to the Contract Administrator for his review.

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

E27.3.2 Preparation of Galvanized Reinforcing Steel

(a) The fabricator shall consult with the Contract Administrator and hot-dip galvanizer regarding potential problems or potential handling problems during the galvanizing process which may require modification of design prior to proceeding with fabrication.

(b) Remove all welding slag, splatter, antisplatter compounds, and burrs prior to delivery for galvanizing.

(c) Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil, paint, and other deleterious material prior to fabrication.

(d) Remove by blast cleaning or other methods surface contaminants and coatings which would not be removable by the normal chemical cleaning process in the galvanizing operation.

(e) Hooks or bends should be smooth and not sharp. Bars are to be bent prior to galvanizing. They shall be fabricated to a bend diameter equal to or greater than indicated in the following table:

Minimum Finished Bend Diameters	
Bar No.	**Bend Diameters (mm)**
10M	60
15M	90
20M	120
25M	200
30M	240
35M	280

E27.4 Placing of Reinforcing Steel

E27.4.1 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.

E27.4.2 Reinforcing steel shall be free of all foreign material in order to ensure a positive bond between the concrete and steel. The Contractor shall also remove any dry concrete which has been deposited on the steel from previous pouring operations before additional concrete may be placed. Intersecting bars shall be tied positively at each intersection.

E27.4.3 Splices in reinforcing steel shall be made only where indicated on the drawings. Prior acceptance by the Contract Administrator shall be obtained where other splices must be made. Welded splices will not be permitted.

E27.4.4 Place reinforcing bars to provide a clear space between the reinforcing bars as shown on the drawings to accurately place preformed holes where necessary.

E27.4.5 Reinforcing steel shall not be straightened or rebent in a manner that will injure the metal or create excess damage to the galvanized coating. Bars with bends not shown on the drawings shall not be used. Heating of reinforcing steel will not be permitted without prior acceptance by 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.

E27.4.6 Following placement of galvanized-coated bars, all areas of damaged coating shall be repaired using approved touch-up coating material specified in Clause E27.2.4.

E27.5 Reinforcement System

E27.5.1 All reinforcing steel for the caissons, abutments, retaining walls, slope pavement, shall be plain reinforcing steel.

E27.5.2 All the remaining reinforcing steel, including, but not limited to, the deck, barriers, curbs, medians, sidewalks, approach slab, sleeper slabs, expansion slab, shall be galvanized.

E27.6 Quality Control

E27.6.1 Inspection

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

E27.6.2 Access

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

E27.6.3 Quality Testing

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

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

E27.7 Measurement and Payment

E27.7.1 Supplying and Placing Reinforcing Steel Bars shall be paid for at the Contract Lump Sum for the "Items of Work" listed here below, measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

(a) Items of Work:

(i) Supplying and Placing Reinforcing Steel Bars

- Plain
- Galvanized

E28. STRUCTURAL STEEL

E28.1 Description

E28.1.1 This Specification shall cover the supply, fabrication, transportation, handling and erection of structural steel girders, stiffeners, diaphragms, splice plates, bearing shoe plates, bearing anchor rods, and all incidental structural steel elements, components and fasteners, including hot-dip galvanizing, as specified herein.

E28.1.2 The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as herein specified and as indicated on the drawings.

E28.2 Materials

E28.2.1 General

(a) All materials supplied under this Specification shall be of a type acceptable to 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.

E28.2.2 Structural Steel

(a) All structural steel (excluding shear connector studs) for the girder, flanges, webs, stiffeners, splice plates, sole plates, and any detail material welded to the girders shall conform to the requirements of CSA Standard CAN/CSA - G40.21-04, Grade 350WT, Category 3.

(b) Rolled steel sections and all other steel not included above shall conform to the requirements of CSA Standard CAN/CSA-G40.21-04, Grade 350W.

(c) The structural steel shall be impact tested at the steel manufacturer's plant in accordance with the requirements of ASTM Standard A370 to meet the requirements of CSA Standard CAN/CSA-G40.21-04.

(d) Prior to fabrication, the Contractor shall supply to the Contract Administrator the manufacturer's mill certificates giving details of all chemical, physical, and impact properties of the CSA Standard CAN/CSA G40.21-04, Grade 350WT steel to be used in the Work.

(e) Plate steel from coils will not be permitted.

(f) Edges of all plates shall be subject to visual inspection, and any plates found to include laminations shall not be used on the Work.

E28.2.3 Galvanizing

(a) Shop Applied:

(i) The galvanizing shall be shop applied and strictly in accordance with CSA Standard G164 to a minimum net retention of 610 g/$m^{2.}$

(ii) Submit an original and three (3) copies of the coating applicator's notarized Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements.

(iii) Preclean structural steel using acceptable methods to produce an acceptable surface for quality hot-dip galvanizing.

(iv) Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

(v) The surface finish shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect detrimental to the stated end use of the coated article.

(vi) Coating adhesion shall withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

(vii) Furthermore, no underlying cracking and other visible damage or deterioration of the hot-dip galvanizing as a result of handling or bending operations, or any other cause, shall be galvanize-coated with field applied galvanizing touch-up material as specified hereinafter.

(b) Field Applied Touch-up Galvanizing:

(i) Any areas of damaged galvanizing on the sign structures shall receive field applied touch-up galvanizing.

(ii) Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose scale, rust, paint, grease, dirt, or other contaminants.

(iii) for self fluxing, low temperature, zinc based alloy rods, preheat the surface to 315°C and wire brush the surface during preheating. Rub the cleaned preheated area with the repair stick to deposit an evenly distributed layer of zinc alloy. Spread the alloy with a wire brush, spatula, or similar tool. Field applied galvanizing shall be blended into existing galvanizing of surrounding surfaces. Care shall be taken to not overheat surfaces beyond 400°C and to not apply direct flame to the alloy rods.

(iv) For pure zinc paint on systems, the approved product Zinga shall be applied by either a brush or roller. The Zinga shall be applied in 3 coats, with each coat having a dry film thickness of 60 µm (2.36 mils). Each coat shall be left to dry for a minimum of one (1) hour before the application of the next coat.

(v) The maximum area to be repaired in the field on a single repair shall be 5,000 mm^2. Any damaged article with a damaged area greater shall be rejected, removed, and replaced at the Contractor's expense.

E28.2.4 Welding Consumables

(a) Welding consumables for all processes shall be certified by the manufacturer as complying with the requirements of CSA Standard W59-03 and the following Specifications:

(i) Manual, Shielded Metal Arc Welding (SMAW):

All electrodes for manual, shielded metal arc welding shall conform to CSA W48.1-91, CSA W48.3-93 classification E480XX or imperial equivalent.

(ii) Gas, Metal Arc Welding (GMAW):

All electrodes used in the gas, metal arc-welding process shall be composite electrodes conforming to CSA W48.4-06 classification ER480S-X or imperial equivalent.

(iii) Shielding gas shall be welding grade carbon dioxide with a guaranteed dew point of 46°C.

(iv) Submerged Arc Welding (SAW):

Welding electrodes and fluxes used in the submerged arc welding process shall conform to CSA W48.6-96 classification F480X-EXXX or imperial equivalent.

(v) All electrodes, wires and fluxes used shall be of a classification requiring a minimum impact of 27 joules at 30°C as outlined in the various codes mentioned above.

(b) The proposed welding procedures and welding consumable certificates shall be submitted to the Contract Administrator for his acceptance at least twenty one (21) days prior to the scheduled commencement of any fabrication.

(c) In multiple pass welds, the weld may be deposited such that at least two layers on all surfaces and edges are deposited with one of the filler metals listed above for each particular welding process, provided the underlying layers are deposited with one of the filler metals specified in CSA Standard W59.

E28.2.5 High-Strength Bolts, Nuts and Washers

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

(b) Galvanized fastener nuts shall be over-tapped by the minimum amount required for assembly and shall be lubricated with a lubricant containing a visible dye.

E28.2.6 Shear Connector Studs

(a) Unless otherwise specified on the drawings, shear connector studs shall be 22-mm diameter, 106-mm long Nelson type S3L Studs, made from cold-drawn steel grades C-1010 through C-1020 in accordance with ASTM A-108, Grade 1020, and shall be welded in accordance with the manufacturer's recommendation.

E28.3 Equipment

E28.3.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E28.4 Construction Methods

E28.4.1 Fabrication

(a) General

(i) Except as otherwise specified herein, steelwork shall be fabricated in accordance with the latest A.W.S. Specification D1.1 and subsequent revisions. Fabrication shall be in accordance with the latest CHBDC S6-06 Canadian Highway Bridge Design Code and S16.1 Limit States Design of Steel Structures.

(ii) No fabrication or welding of steelwork shall commence until permission to do so has been received from the Contract Administrator.

(iii) The procedure for the repair of any members damaged during fabrication shall be accepted by the Contract Administrator prior to any Work taking place.

(b) Submissions

(i) At least twenty one (21) working days prior to the scheduled commencement of any fabrication, the qualifications of Contractor, the qualifications or operators, the shop drawings, mill certificates shall be submitted to the Contract Administrator for his acceptance.

(ii) At least twenty-one (21) working days prior to the scheduled installation of structural steel, the installation methods and equipment shall be submitted to the Contract Administrator for his acceptance.

(c) Shop Drawings

(i) The shop drawings shall consist of three (3) sets of prints, one (1) reproducible sepia set and an electronic copy.

(ii) The shop drawings shall clearly show shapes, weights, dimensions, details, connections (including proper AWS welding identification), bolt holes, accessories and erection procedures.

(iii) The Contractor shall field measure all dimensions as required prior to submission of the structural steel shop drawings.

(iv) Calculated mass of structural steel for each shop drawing following shop drawing final acceptance shall be submitted.

(d) Preparation of Material

(i) Straightening Material:

- Prior to being used in fabrication, all structural steel shall be straight and free from kinks or bends. The flatness tolerance of plate in excess of 1 m wide shall be in accordance with the tolerance of the finished product as stated in E28.4.1(q). If straightening is necessary, it shall be done by methods that will not injure the metal. The steel shall not be heated unless permission is given by the Contract Administrator. Sharp kinks and bends will be cause for rejection of the steel.

(ii) Camber:

- Girders shall be cambered as indicated on the drawings, with suitable allowance for shrinkage due to cutting and subsequent welding.
- The required camber shall be produced within the tolerances as set out in CSA Standard W59-03. The fabricator shall record measurements of the actual camber of each girder, at the points indicated on the drawings.
- If the shop-measured actual camber of a fabricated girder is not within the tolerances as set out in CSA Standard W59-03, the Contract Administrator shall be so informed immediately, the fabricator shall submit a record of the actual camber of any such girder and a proposal as to possible corrective measures. No remedial measures shall be undertaken by the fabricator until his proposal has been given due consideration and has been accepted in writing by the Contract Administrator.

(iii) Edge Preparation for Welding:

- 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 fins, 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, except that all mill scale shall be removed from the surfaces on which flange to web welds are to be made by submerged arc welding or by shielded metal arc welding with low hydrogen electrodes. 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.

- All flange plates shall be cut so that the direction of applied stress is parallel to the direction of plate rolling.
- 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:
  - Sheared edges of material thicker than 12 mm
  - Rolled edges of plates (other than Universal Mill Plates) thicker than 9 mm
  - Toes of angles or rolled shapes (other than wide flange sections) thicker than 16 mm
  - Universal Mill Plates or edges of flanges of wide flange section thicker than 25 mm
- Edges may be prepared by oxygen cutting, providing a smooth and regular surface free from cracks and notches is secured, and providing that an accurate profile is secured by the use of a mechanical guide. Freehand cutting shall be done only where acceptable to the Contract Administrator.
- All flange plates prepared by flame cutting shall be preheated in accordance with E28.4.1(j).
- In all oxygen cutting, the cutting flame shall be so adjusted and manipulated as to avoid cutting beyond (inside) the prescribed lines. Roughness of cut surfaces shall not be greater than that defined by the United States Standards Institute surface roughness value of 1,000 (USAI B46.1, Surface Texture). Roughness exceeding this value shall be removed by machining or grinding. Occasional gouges will be tolerated only at the discretion of the Contract Administrator and shall be repaired in accordance with his instruction.

(iv) Edge Preparation (Non-welded Edges):

- Steel may be cut to size by sawing, shearing, flame cutting or machining. All steel after cutting shall be marked by a method agreed to by the Contract Administrator so that its Specification may be immediately identified.
- Sheared edges of plates more than 16 mm in thickness shall be planed to a depth of 6 mm.
- Any flame cutting of steel shall be in accordance with E28.4.1(d)(iii).
- Special attention shall be given to the cutting of coverplates or flange plates. Occasional gouges not in excess of 6 mm deep will be accepted in areas of low stress at the discretion of the Contract Administrator. The repair or removal of such gouges shall be to the Contract Administrator's instructions.
- 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.

(e) Bolt Holes

(i) Except otherwise specified on the Drawing, all holes for high strength bolts shall be either subpunched to a maximum of 22 mm and reamed, or drilled, and shall be of a nominal diameter not more than 2 mm in excess of the nominal bolt diameter.

(ii) Reamed holes shall be cylindrical and perpendicular to the member. Where practicable reamers shall be directed by mechanical means. Reaming shall be done with twist drills.

(iii) Drilling shall be done with twist drills. Burrs on the outside surfaces shall be removed.

(iv) Poor matching of holes will be cause for rejection.

(f) Shear Connector Studs

(i) Welding of shear connector studs shall conform to the requirements of CSA Standard W59-03, Section 3.1.2.2 and 5.5.6.

(g) Assembly and Welding Sequences

(i) If requested by the Contract Administrator, the Fabricator shall supply full details of the proposed assembly and welding sequence of any particular weldment.

(h) Marking

(i) Prior to fabrication, all steel shall be marked for identification by heat number and Specification by a marking system acceptable to the Contract Administrator.

(i) Assembly

(i) The shop assembly of the various components of the weldments shall be executed in accordance with A.W.S. D1.1 Subsections 3.3 and 3.4.

(ii) 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.

(iii) Tack welds shall be made with 4 mm maximum size electrodes and shall be subject to the preheat requirements of E28.4.1(j).

(j) Preheat and Interpass Temperatures

(i) No welding shall be done when the ambient temperature is lower than 20°C.

(ii) 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 E28.1.

(iii) Preheat shall be applied to all steel to be welded so that the steel within 80 mm of the weld is heated to the temperature shown in Table 28.1.

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

(v) For all welding processes, preheat and interpass temperatures shall be maintained during welding, at temperatures not less than stated in Table E28.1.

TABLE E28.1
Minimum Preheat and Interpass Temperatures

Thickness of Thickest Part at Point of Welding	CSA Standard W59-03 Grade 350WT
Less than 19 mm	10°C
19 mm to 38 mm	10°C
38 mm to 64 mm	65°C
Over 64 mm	107°C

(vi) Preheat temperatures above the minimum shown in Table E28.1 may be required for highly restrained joints if designated by the Contract Administrator.

(vii) Preheat temperature shall in no case exceed 200°C but there shall be no limit on interpass temperature.

(viii) Preheat requirements for tack welds shall be as in the above table except that 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.

(k) Welding

(i) Welding shall be done by the manual, shielded metal arc, gas shielded metal arc or submerged arc processes in accordance with the approved procedures and A.W.S. D1.1 Section 4, Technique.

(ii) All welding shall be done under cover and, in the case of gas metal arc welding, shall be done in an area free from wind or draft.

(iii) Where the submerged arc or gas metal arc processes are to be used, the Contract Administrator may order that:

- A preliminary test run of the accepted procedure be made over the length of the joint to prove that the disposition of the equipment, the handling of hoses, and the method and accuracy of travel are satisfactory.
- Each operator makes a weld specimen not less than 1.2 m in length for fillet welds and 150 mm in length for butt welds. Steel of the same Specification and thickness as that to be used in the Work shall be used in the specimen welds. No welding shall be done on the Work until such a specimen is satisfactory to the Contract Administrator.

(iv) Materials to be used for backing strips and runoff tabs shall conform to the same Specifications as the base material.

(v) Butt welds shall be extended beyond the edges of the parts to be joined by means of start and runoff tabs providing sufficient thickness to avoid the weld burning through and with a joint preparation similar to that on the main material. For manual shielded metal arc welding, the width of the tabs shall be not less than the thickness of the thicker part being joined or 75 mm, whichever is greater. For submerged arc welding, the width of the tabs shall be not less than 75 mm. Each weld pass shall be carried far enough beyond the edge of the parts being joined to ensure sound welds in the joint. Tabs shall be removed upon completion and cooling of the weld without damage to the parent plate and the end of the weld made smooth and flush with the edges of the abutting parts.

(vi) In gas metal arc welding, the equipment shall be capable of sustaining a gas flow rate of from 0.85 to 1.27 m^3 per hour (30 to 45 ft^3 per hour).

(vii) Mechanical scaling tools shall not be used on any weld surface that is a final weld surface. Scaling tools may be used on welded passes provided their use does not crack or injure the first pass of a multipass weld.

(viii) Semiautomatic machines may be used only when they are equipped with a mechanical control of travel speed.

(ix) Repairs to welds of base metal shall be made by grinding or arc air-gouging followed by grinding. The use of flame gouging or oxygen gouging will not be permitted.

(l) Weld Profiles

(i) Weld profiles shall meet the requirements of CSA Standard W59-03 Clause 5.9

(m) High-Strength Bolt Installation

(i) Installation of high-strength bolts shall be in accordance with “AASHTO Standard Specifications for Highway Bridges - 2002, Division II, Clause 11.5 - Assembly” turn of the nut method.

(ii) Sufficient bolts, nuts and washers shall be furnished to complete the entire structure with an ample surplus to replace all bolts damaged or lost.

(n) Bent Plates

(i) 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.

(ii) Before bending, the corners of the plate shall be rounded to a radius of 2 mm throughout that portion of the plate at which bending is to occur.

(o) Machined Surface

(i) Machine finished surfaces, as designated on the drawings, shall be coated with an accepted protective compound.

(p) Shop Assembly

(i) Holes in girder field splices shall be subpunched and, unless otherwise specified, reamed while assembled in the shop. A shop trial assembly of field

splice bolted connections is to be done. The assembly, including camber, alignment, and accuracy of holes shall be accepted by the Contract Administrator before reaming is recommended.

(q) Dimensional Tolerances

(i) Members and parts of members shall be straight, true to line, and free from twists and bends. In determining acceptability under these general requirements, the tolerances stated herein after shall be applied.

(ii) Deviation from specified camber at centre of girder: in accordance with CSA Standard W59-03, Clause 5.8 (c).

(iii) Deviation from flatness of girder webs measured between flanges or between stiffeners: As per CSA Standard W59-03, Clause 12.5.3.

(iv) Combined warpage and tilt of flanges of girders, determined by measuring the offset between the end of the flange plate and the flange plate at the centre of the web plate: As per CSA Standard W59-03, Clause 5.8 (f).

(v) This tolerance does not apply to the following cases:

- Abutting parts of flanges to be butt welded, which shall meet the requirements of CSA Standard W59.1-03, Clause 5.4.4.
- Flange plates at bearings shall meet the requirements of the following clause:

(vi) Deviation from specified depth: As per CSA Standard W59-03, Clause 5.8 (j).

(vii) Intermediate Stiffeners: As per CSA Standard W59.1-03, Clause 5.8 (k).

(viii) Bearing Stiffeners: As per CSA Standard W59.1-03, Clause 5.8 (l).

(ix) The maximum deviation from the specified length measured on centreline of web: ± 6 mm.

(r) Surface Preparation and Cleaning

(i) Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with CSA G164 and SSPC Specification SP:10, “Near White Metal Blast Cleaning”, unless otherwise specified herein. The Contractor shall ensure that all exterior surfaces of structural steel are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 600 g/m^2. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the drawings.

(ii) The sandblasting and cleaning of structural steel members shall be done in the shop.

(iii) After the structural steel members have been sandblasted and cleaned, the Contract Administrator will carry out a visual inspection of the structures in the shop before they are shipped to the galvanizing plant.

(s) Shipping

(i) 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.

(ii) All necessary haulage permits shall be obtained by the Contractor from the proper authorities prior to transportation by vehicles of any structural members.

(t) Delivery

(i) The Contractor shall be responsible for arranging directly, with the appropriate authorities, a route and schedule acceptable to them; the Contractor shall keep the authorities and Contract Administrator advised and obtain the authorities' approval on any changes as the project proceeds.

(ii) Railway cars or vehicles containing materials shall be promptly unloaded by the Contractor upon delivery and, in case of failure to do so, the Contractor shall be liable to any demurrage charge.

E28.4.2 Erection

(a) Erection of Structural Steel

(i) The Contractor shall obtain the Contract Administrator's acceptance on erection procedures and scheduling prior to the commencement of erection of structural steel girders.

(ii) The Contractor shall furnish, construct and subsequently dismantle and remove off-site, all falsework including working bridge required for the erection of the steelwork. Falsework shall be designed by the Professional Engineer registered in the Province of Manitoba and employed by the Contractor.

(iii) Any variations in construction sequences indicated on the drawings must be submitted to the Contract Administrator at least twenty-one (21) days prior to fabrication of the girders. Any such variations could affect cambers and may require modifications which must be reviewed and accepted by the Contract Administrator.

(iv) Minimum vertical clearance of 4.3 m must be maintained. The Contractor shall not project anything below bottom girder flanges without Contract Administrator's approval. This can be accomplished by laying down plywood between girder flanges immediately after or during girders' erections.

(b) Erection Methods and Equipment

(i) The Contractor shall submit to the Contract Administrator at least three (3) weeks prior to installation, drawings which shall consist of three (3) sets of prints, one (1) reproducible sepia set and an electronic copy, showing complete details of the method of erection he proposes to follow and the number and character of the equipment he proposes to use. Where practicable, this submission shall be made prior to submission of shop drawings. Erection will not be allowed to proceed without the Contract Administrator's review of the method proposed. The review shall not relieve the Contractor of any responsibility for the safety of the proposed method of erection or of the equipment or from carrying out the Work in full accordance with the drawings and these Specifications.

(ii) Tack welding for the purpose of falsework attachments or any other temporary attachment will not be permitted.

(c) Handling and Storing Materials

(i) The Contractor shall design whatever special handling requirements there may be for transporting and erecting the girders. This design must be submitted with the falsework submission and be designed by a Professional Engineer registered in the Province of Manitoba and employed by the Contractor. The Contractor shall ensure the stability of all components and provide temporary structural steel bracing, when required, during: handling, transportation, and erection and until the structural steel is in its final location with all permanent bracing, connections, and supports in place and when the concrete in the deck has reached 75 percent of its specified strength.

(ii) Material to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. Caution shall be exercised when storing structural steel which is exposed to weather or condensation to prevent local corrosion which may develop in areas where water is trapped. Coating with a water soluble oil after fabrication may be used to avoid this problem. Long members shall be supported on skids placed near enough to prevent injury from deflection. The Contractor shall be responsible for the loss of any material while in his care, or for any damage to it.

(d) Field Assembly

(i) The parts shall be accurately assembled as shown on the drawings and any match marks shall be followed. Hammering which will injure or distort the members shall not be done. Bearing surfaces and faying surfaces to be in permanent contact shall be cleaned before the members are assembled.

(ii) Field connections shall have one half of the holes filled with bolts and cylindrical erection pins (half bolts and half pins) before final bolting. Fitting up bolts shall be the same nominal diameter as the high strength bolts, and cylindrical erection pins shall be 1 mm larger.

(e) Straightening Bent Material

(i) The straightening of plates and angles or other shapes shall be done by methods that will not produce 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.

(ii) 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.

(f) Bolting

(i) All field connections shall be bolted with high-strength bolts with the head side of the bolt on the exterior side of the girders in the splices, and facing the closest riverbank in all other connections. Bolting with high-strength bolts shall be carried out in accordance with “AASHTO Standard Specifications for Highway Bridges - 2002, Division II, Clause 11.5 - Assembly” turn of the nut method.

(g) Splice Connections

(i) Galvanized surfaces at splice connection locations shall be hand-wire brushed prior to installing bolted splices, as directed by the Contract Administrator.

(h) Misfits

(i) The correction of minor misfits involving harmless amounts of reaming, cutting and chipping as determined by the Contract Administrator will be considered a legitimate part of erection. However, any error in shop fabrication which prevents the proper assembling and fitting up of parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be the responsibility of the Contractor.

(i) Damage to Substructure

(i) The substructure shall be carefully protected during erection of the structural steel by the Contractor. All concrete surfaces and corners liable to damage shall be protected with wood blocking, sacking, or other means, to prevent damage and chipping of concrete due to wire ropes, swing loads, or other activities. The Contractor shall repair any such damage to the satisfaction of the Contract Administrator at his own cost.

(ii) The erection of structural steel shall be done so that there shall be no forces applied to cause overstressing of the piers and abutments.

(j) Welding to Galvanized Metal

(i) All galvanizing should be removed from prepared surfaces to be field welded.

(ii) After field welding the metal shall be touched up by the Galvanizing Touch-up Process in accordance with E28.4.2(k) of these Specifications. All Galvalloy repairs shall be made flush with adjacent metal.

(k) Galvanizing Touch-up Procedure

(i) Any areas of damaged galvanizing, and all field welds, are to receive field applied galvanizing, in accordance with ASTM A780-09.

E28.5 Quality Control

E28.5.1 Inspection

(a) All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials through to final

acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or acceptance that may have been previously given. The Contract Administrator reserves the right to reject any materials or works which are not in accordance with the requirements of this Specification.

E28.5.2 Access

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

E28.5.3 Qualifications of Contractor

(a) The Contractor shall produce evidence that his plant is recently fully approved by the C.W.B. to the requirements of CSA Specification W47.1-09, Division 1.

(b) The Contractor shall also produce evidence of satisfactory experience in the fabrication of heavy structural steelwork. The requirements of five (5) years of C.W.B. approval and/or experience in heavy structural steelwork may be waived by the Contract Administrator provided the Contractor's plant has been accepted by the Contract Administrator prior to bidding. Acceptance of a plant will be at the discretion of the Contract Administrator based upon his assessment of the Contractor's organization, personnel, equipment and past performance.

(c) The Contractor shall employ or retain throughout the fabrication of the Work, a welding engineer who shall be a Professional Engineer registered in the Province of Manitoba. This engineer shall be responsible for the design, preparation, and control of welded fabrication, and continuous supervision of all welding procedures and operations in the Work.

(d) When a welding engineer is retained, the fabricator shall appoint, subject to the Contract Administrator's acceptance, an employee who shall assist and be responsible to the welding engineer.

(e) Prior to commencement of any fabrication, the Contractor shall submit to the Contract Administrator the names of the welding engineer, welding supervisors and shop inspectors who are to be employed on the Work.

E28.5.4 Qualifications of Operators

(a) 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 (2) years of the commencement of fabrication.

(b) 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.

E28.5.5 Welding Procedures

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

(b) Such procedures shall be accompanied by documentary proof that they have been qualified previously by the Canadian Welding Bureau at the plant where the Work is to be carried out.

(c) The procedures shall include the following information: joint type, welding process, welding position, base metal Specification, welding consumable Specification and size, preheat requirements, amperage and voltage requirements, speed, polarity, and welding equipment, including a description of travel for automatic welding

(d) The use of gas welding will be limited to light structural elements.

E28.5.6 Quality and Details of Welds

(a) The quality and details of welds shall be in accordance with CSA Standard W59-03, Clause 12.5.4.

(b) Welds shall have no cracks, inadequate penetration or lack of fusion, and shall have no other defects exceeding the limits in size and frequency of occurrence as specified in CSA Standard W59-03, Clause 12.5.4. Fusion type defects referred to in the Clause shall be interpreted as slag inclusions and similar generally elongated defects.

(c) Undercut at the toe of the flange-to-web fillet weld will not be allowed, except in regions of low stress at the discretion of the Contract Administrator.

E28.5.7 Material Storage and Care

(a) Steel

(i) Structural material, either plain or fabricated, shall be stored above the ground upon platforms, skids or other supports. It shall be kept free from dirt and other foreign matter, and shall be protected, as far as practical, from corrosion. Long members shall be supported on skids placed near enough together to prevent injury from deflection.

(ii) Prior to fabrication, all steel shall be marked for identification by heat number and Specification by a marking system acceptable to the Contract Administrator.

(b) Welding Consumables

(i) All electrodes having low hydrogen coverings shall be dried for at least 2 hours between 230°C and 260°C, before they are used. Electrodes shall be stored immediately after drying in storage ovens held at a temperature of at least 120°C. Electrodes that are not used within 4 hours after removal from a drying or storage oven shall be redried before use. Electrodes that have been wet shall not be used.

(ii) Electrode wire used in submerged arc welding and gas metal arc welding shall be stored in the original container at room temperature and kept free of moisture, oil, dirt or other contaminators.

(iii) Flux used for submerged arc welding shall be dry and free of contamination from dirt, mill scale, oil, or other foreign material. Fused flux shall not be used on the Work.

(iv) Gas for gas metal arc welding shall be stored in marked steel bottles and shall not be subjected to temperatures in excess of 50°C nor temperatures of less than 0°C.

(c) Testing

(i) In addition to the Contractor's own quality control testing, all materials, welding procedures, shop drawings, and steelwork fabrication will be inspected by the Contract Administrator to ascertain compliance with the Specifications and drawings.

(ii) A testing agency will work with the Contract Administrator to carry out all shop fabrication inspection and testing until the girders are accepted ready for shipment. The Contractor shall cooperate fully with the testing firm.

(iii) The minimum extent and frequency of weld inspection shall be as follows:

- Radiographic Inspection:
  - 100% of all flange butt welds
  - 100% of all web butt welds
- Magnetic Particle Inspection:
  - 50% of web-to-flange welds
  - 10% of web-to-stiffener welds
  - 100% of stiffener-to-tension flange welds

(iv) All welds will be visually inspected.

(v) The inspector shall have access to all of the fabricator' normal quality control records for this Contract specified herein.

(vi) Weld inspection will be carried out in accordance with the requirements of CSA Standard W59-03.

(vii) Welds that are found to be inadequate and unsatisfactory shall be repaired in accordance with CSA Standard W59-03, retested and paid for by the Contractor. All initial testing will be paid for by the City.

(viii) No repair shall be made until agreed to by the Contract Administrator.

E28.5.8 Unacceptable Work

(a) Any Work found to be unacceptable shall be corrected in accordance with CSA Standard W59-03, Clause 5.10.

(b) No repair shall be made until agreed to by the Contract Administrator.

E28.6 Measurement and Payment

E28.6.1 The supply and erection of Structural Steel, including all incidental structural steel elements, components and fasteners, will not be measured. The supply and erection of Structural Steel, including all incidental structural steel elements, components and fasteners, will be paid for at the Contract Lump Sum price for "Supply and Installation of Structural Steel", 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.

E29. BRIDGE BEARINGS

E29.1 Description

E29.1.1 This Specification shall cover the supply and installation of the expansion and fixed bearings.

E29.1.2 The Work to be done under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E29.2 Materials

E29.2.1 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.

E29.2.2 Material

(a) Bearing Pads

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

(i) Expansion Bearings

Bearing pads shall be "Wercho" Moulded Steel Reinforced Eleastomeric Bearings or Goodco Laminated Elastomeric pads as shown on the drawings or approved equivalent. Bearing pads shall have Shore A hardness of 55 Durometer.

(ii) Fixed Bearings

Bearing pads shall be "Fabreeka" Cotton Duck Bearing Pad (CDP) Bearings as shown on the drawings or approved equivalent. Bearing pads shall have Shore A hardness of 90±5 Durometer.

(b) Grout

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

E29.3 Equipment

E29.3.1 All equipment shall be of a type approved by the Contract Administrator and shall be kept in good working order.

E29.4 Fabrication

E29.4.1 Shop drawings showing details of bearings, completed with laminated and non-laminated bearing pads 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.

E29.5 Guarantee

E29.5.1 Fabrication Guarantee

(a) 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 do not perform satisfactorily within the design range of movement and under the design loads.

E29.5.2 Installation Guarantee

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

(b) 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.

E29.6 Construction Methods

E29.6.1 Bearings

(a) The bearing pads shall be installed by the Contractor prior to placing the girders.

(b) 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.

(c) 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.

E29.7 Quality Control

E29.7.1 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.

E29.8 Measurement and Payment

E29.8.1 Supply and Install Girder Expansion Bearing

(a) Supply and installation of girder expansion bearing will be measured and paid for at the per unit price for "Supply and Install Girder Expansion Bearing", measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the Work included in this Specification. The number of each item to be paid for will be the total number supplied and placed in accordance with this Specification and accepted by the Contract Administrator, as measured by the Contract Administrator.

E29.8.2 Supply and Install Girder Fixed Bearing

(a) Supply and installation of girder fixed bearing shall be measured and paid for at the per unit price for "Supply and Install Girder Fixed Bearing", measured as specified herein, which price shall be payment in full for supplying all materials and performing all operations herein described and all other items incidental to the Work included in this Specification. The number of each item to be paid for will be the total number supplied and placed in accordance with this Specification and accepted by the Contract Administrator, as measured by the Contract Administrator.

E30. EXPANSION JOINTS

E30.1 Description

E30.1.1 This Specification shall cover the supply and installation of expansion joints, as specified herein.

E30.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all other things necessary for and incidental to the satisfactory performance and completion of all Work hereinafter specified.

E30.2 Materials

E30.2.1 General

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

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

E30.2.2 Epoxy Adhesive

(a) Epoxy adhesive shall be ST 431, Dural Duralbond, Copper Capbound E, Sikadur 32 Hi-bond, Concresive 1001 LPL, or equal as accepted by the Contract Administrator in accordance with B7.

E30.2.3 Epoxy Adhesive Strip

(a) Epoxy adhesive strip shall be 50 mm wide Flex-Tred nonslip adhesive strip or equal as accepted by the Contract Administrator in accordance with B7.

E30.2.4 Epoxy Grout

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

E30.2.5 Grout

(a) Grout shall be nonmetallic and nonshrink grout. Acceptable grouts are: Master Builders Set Nonshrink Grout, Sika Grout 212, Sternson M-Bed Standard Grout, CPD Nonhrink Grout, or equal as accepted by the Contract Administrator in accordance with B7.

E30.2.6 Expansion Joints

(a) Expansion joints shall be modular expansion joint at SU4 and single cell expansion at SU1.

(b) The modular expansion joints shall be a Mauer Box Seal Modular Joint System, as specified in the drawings, and supplied by D.S. Brown, Goodco, or Watson Bowman Acme Corp., or equal as accepted by the Contract Administrator in accordance with B7.

(c) Modular expansion joints shall have fabricated cover plates and slider plates as shown on the drawings.

(d) The seals at each joint shall be made out of neoprene, as accepted by the Contract Administrator and shall be supplied in one continuous piece, separate from the steel extrusions or joint. No shop or field splicing will be allowed in the seals.

(e) All fasteners and hardware of the modular bridge deck expansion joints shall be galvanized in accordance with CSA Standard CAN/CSA C1164-92 to a minimum net retention of 610 gm/m^2.

E30.2.7 Steel

(a) Steel supplied for the fabrication of the bridge deck expansion joints shall conform to CSA Standard CAN/CSA-G40.21-04, Grade 300W, or equal as accepted by the Contract Administrator in accordance with B7. They shall be galvanized after shop fabrication in accordance with CSA Standard CAN/CSA-G164-92 to a minimum net retention of 610 gm/m^2.

E30.2.8 Steel Extrusions

(a) Steel for the extrusions shall conform to CSA Standard CAN/CSA-G40.21-04, Grade 230G minimum.

E30.2.9 Anchor Studs

(a) Anchor studs shall conform to the requirements of ASTM Specification A108-07, Grade Designation 1020 and shall be galvanized.

E30.2.10 Miscellaneous Steel Items

(a) Rods, cover plates, brackets and washer plates, slider plates, and all other associated steel items shown on the drawings shall be fabricated from steel conforming to CSA Standard CAN/CSA-G40.21-04, Grade 300W and shall be galvanized in accordance with CSA Standard CAN/CSA-G164-92 to a minimum net retention of 600 gm/m^2.

E30.2.11 Galvalloy

(a) Galvalloy shall be as supplied by Metalloy Products Company, P.O. Box #3093, Terminal Annex, Los Angeles, California. Locally, this is available from Welders supplies Ltd., 25 McPhillips Street.

E30.2.12 Welding

(a) Welding shall be of a low oxygen classification. Manual electrodes shall be E7016 or E7018. All welding shall be in accordance with CSA Standard W59-03.

E30.2.13 Preformed Neoprene Joint Seals

(a) General

Preformed joint seal shall be manufactured from a vulcanized elastomeric compound using crystallization resistant polychoroprene (neoprene) as the only polymer.

The preformed neoprene joint seal shall meet the requirements of Ontario Provincial Standard Specification (OPSS) 1210 "Material Specification for Preformed Neoprene Joint Seals", latest edition, and as amended herein; and of Table E30.1 of this Specification. All tests will be made on specimens prepared from the extruded seals.

E30.3 Equipment

E30.3.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E30.4 Fabrication

E30.4.1 Shop drawings consisting of five (5) prints and one (1) reproducible sepia showing the fabrication details and proposed field splice details of the steel components of the bridge deck expansion joints shall be provided to the Contract Administrator for acceptance at least twenty-one (21) days prior to scheduled commencement of fabrication. No fabrication shall commence until acceptance of the shop drawings from the Contract Administrator has been obtained. The complete expansion joint shop fabrication and installation shall be done by or under the direct supervision of a trained factory representative, who shall be responsible for the joint installation procedure.

E30.4.2 Care shall be taken to ensure that all members are straight and flat and free from twists, bends, and distortions due to welding. The units shall be shop assembled and checked for matching of sliding surfaces, correct cross-fall and skew, as well as accurate positioning and alignment of supporting brackets. The Contractor shall exercise care in the handling of all units to prevent twists, bends, and warping.

E30.4.3 Matching expansion joints shall be assembled and bolted together for shipping.

E30.4.4 Expansion joint assemblies shall be shop checked for fit and match marked.

E30.4.5 All metal surfaces to be galvanized shall be cleaned thoroughly of rust, rust scale, mill scale, dirt, paint, and other foreign material by commercial sand, grit or shop blasting, and pickling prior to galvanizing. Heavy deposits or oil and grease shall be removed with solvents prior to blasting and pickling.

E30.4.6 In no case shall weldments be substituted for extrusion shapes.

E30.5 Construction Methods

E30.5.1 Installation

(a) The Contractor shall install expansion joints as shown on the Contract drawings and shall be responsible for the correct matching and seating of parts. The expansion joints shall be checked for accurate matching of sliding plates with the bridge deck expansion joints installed at the specified skews and crossfalls.

E30.5.2 Galvanizing Touch-up Prior to Placement of Concrete

(a) Any areas of damaged galvanizing and field welds are to receive field applied galvanizing.

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

(c) The process is to be repeated as required to achieve a thickness comparable to original galvanizing.

E30.5.3 Placement of Concrete at Expansion Joints

(a) The assemblies shall be set in position such that they will remain true to line and elevation during and after concreting.

(b) Care shall be taken during compaction of the concrete to ensure that there are no voids in the concrete under and around the structural steel components.

(c) Before concreting, the expansion joint opening shall be set to give the correct width for the mean concrete temperature of the deck. The width shall be obtained from the installation temperature table given on the accepted shop drawings.

(d) Immediately prior to placement of concrete at the expansion joints, all metal contact surfaces between the expansion joint and concrete shall be coated with epoxy adhesive.

(e) Epoxy grout shall be used to fill any bolt holes left after the removal of manufacturer's clamping channels.

E30.5.4 Installation of Seal

(a) The seal at each expansion joint unit shall be installed as one continuous piece after completion of all concreting operations, to the satisfaction of the Contract Administrator, and shall **not** be installed prior to casting of the expansion joints into the concrete.

E30.5.5 Watertight Verification of Joint Seal

(a) Prior to installing the expansion joint and walkway cover plates, the Contractor shall dyke off the bridge deck expansion joints and maintain a minimum of 75 mm of water over all areas of the seal for a period of not less than four (4) hours, with no leakage. Any and all leaks shall be corrected, using mechanical or other adjustment of the bridge deck expansion joints to the satisfaction of the Contract Administrator. In no case shall caulk or other temporary devices or materials be used to seal leaks in the expansion joints. The Contract Administrator's decision in this regard shall be final.

(b) Prior to commencing the test, the Contractor shall remove all expansion joints forming materials and debris from the deck and from the substructure units below. The Contractor shall provide safe access, acceptable to the Contract Administrator, to the pier tops for inspection of the expansion joints during the testing.

E30.6 Fabrication Guarantee

E30.6.1 Before final acceptance of the expansion joints by the Contract Administrator, the bridge deck expansion joints supplier shall provide the City with 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 Certificate of Acceptance, provided that the expansion joints have been properly installed. The supplier shall state that they have reviewed the installation procedures and find them in accordance with their recommendations. The supplier shall guarantee the replacement of the expansion joints, including removal of the defective expansion joints assembly and supply and installation of the replacement expansion joint, at no cost to the City, in the event that the joint does not 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 Certificate of Acceptance.

E30.7 Installation Guarantee

E30.7.1 The General Contractor shall ensure that the expansion joints are installed in such a manner that will not void the fabrication guarantee.

E30.7.2 Similar to the expansion joint supplier, and before final acceptance by the Contract Administrator, the General Contractor shall guarantee, in writing, the performance of the expansion joints for a period of five (5) years from the date of issuance of the Certificate of Acceptance. Provide in the guarantee for the replacement of the expansion joints at no cost to the City, including all direct and indirect costs in the event that the expansion joints do not perform satisfactorily in the range of design movement and under the design loads for a period of five (5) years from the date of issuance of the Certificate of Acceptance.

E30.8 Quality Control

E30.8.1 General

(a) All workmanship and all materials furnished and supplied under this Specification are subject to the 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.

E30.8.2 Markings

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

(b) The Contractor shall supply to the Contract Administrator a summary of the seals identifying the data of manufacture, the batch/lot, and the proposed installation location.

E30.8.3 Samples and Testing Procedures

(a) The Contractor shall supply sample material at no charge to the Owner for quality control testing purposes. The samples will each be 12 m long. Each sample will represent not more than three expansion joint seals of the same size, lot, and make and shall be continuous with same until sampled by the Contract Administrator. As soon as the seals to be used in the joint assemblies have been manufactured, they shall be available to the Contract Administrator for sampling.

(b) Testing procedures will be in accordance with the latest revisions of the methods indicated on Table E30.1.

(c) All materials failing to meet the Specification requirements will be rejected.

(d) Lots rejected may be culled by the supplier and, upon satisfactory evidence of compliance with the Specifications, will be accepted.

Table E30.1 Physical Requirements

PROPERTY	PHYSICAL REQUIREMENTS	TEST PROCEDURE*
1.Tensile Strength	Minimum 13.5 MPa	ASTM D412 OPSS 1210.07.03.01.02
2.Elongation at Break	Minimum 250 Percent	ASTM D412 OPSS 1210.07.03.01.02
3.Hardness, Type A Durometer	55, +7, -5	ASTM D2240 OPSS 120.07.03.01.03
4. Oven Aging Test 70 Hour at 100°C Reduction in Tensile Strength Reduction in Elongation Increase in Hardness	 Maximum 20 Percent Maximum 20 Percent Maximum 10 Points	ASTM D573
5. Permanent Set at Break	Maximum 10 Percent	ASTM D412

Table E30.1 Physical Requirements		
PROPERTY	**PHYSICAL REQUIREMENTS**	**TEST PROCEDURE***
6. Low Temperature Stiffening Hardness, Type A Durometer	Maximum 15 Points	ASTM D2240 OPSS 1210.07.03.01.03
7. Oil Swell, ASTM Oil No. 3 70 H at 40°C (wipe with toluene to remove surface contamination)	No Cracks	ASTM D1149
9.**Safe Compressibility Test (Z min.) Bridge Seal - # 63.5 mm > 63.5 mm	 Min. 50% Min. 55%	 OPSS 1210.07.03.01.04
10.**Pressure Generation at 15 Percent Deflection	Min. 20 kPa	OPSS 1210.07.03.01.04
11.**Recovery 22 h at –28°C 70 h at –10°C 70 h at +100°C	 Min. 80% No Cracking Min. 88% Splitting or Min. 85% Sticking	 OPSS 1210.07.03.01.05

* ASTM - American Society for Testing and Materials
OPSS - Ontario Provincial Standard Specification

** This physical requirement not applicable to lock-in type joint seals

E30.9 Measurement and Payment

E30.9.1 The Supply and Installation of Expansion Joints will be paid for at the Contract Lump Sum Price for the "Supply and Installation of Expansion Joints", 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.

E31. CHAIN LINK FENCING (TYPE 2)

E31.1 Description

E31.1.1 The Work covered under this item shall include all operations relating to supply and installation of new chain link fencing (Type 2) including cast-in-place concrete piles and the supply and placing of reinforcing steel as specified herein.

E31.1.2 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 the Work as hereinafter specified.

E31.2 Materials

E31.2.1 Base Plate and Anchors

(a) The base plate shall be fabricated and installed in accordance with the details provided on the drawings. The base plate shall be hot-dip galvanized.

(b) Either cast-in-place anchor bolts or drilled anchors may be used.

(c) Anchor bolts shall be fabricated from steel with a minimum yield stress of 350 MPa. Bolts shall be galvanized in accordance with CSA Standard G164. Supply anchor bolts complete with nuts and washers.

(d) Anchors shall be Hilti HVU adhesive anchors c/w stainless steel threaded HAS rods, nuts and washers.

E31.2.2 Chain Link Fence

(a) Chain link fencing to be supplied in accordance with CW 3550-R2

(b) Further to CW 3550-R2, 43 O.D. bottom rails shall be used.

(c) Further to CW 3550-R2, 43 O.D. mid rails shall be required if Chain Link Fence is 2.1 m or taller.

E31.3 Construction Methods

E31.3.1 Shop Drawings

(a) Submit shop drawings showing the arrangement and details of all fencing. Posts shall be spaced uniformly at spacing as required by design, but not to exceed 2.4 m.

E31.3.2 Base Plates and Anchors

(a) Install anchors in accordance with Manufacturer's Specifications.

(b) Mount fence posts on shims and ensure correct vertical alignment.

(c) Grout below base plates as shown on the drawings.

E31.3.3 Chain Link Fence

(a) Install new chain link fence to the limits shown on the drawings in accordance with CW 3550-R2.

E31.4 Measurement and Payment

E31.4.1 Chain Link Fencing

(a) The Chain Link Fencing will not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for "Chain Link Fencing (Type 2)", performed in accordance with this Specification and accepted by the Contract Administrator.

E32. NON-CONDUCTIVE FENCE PANEL SYSTEM (TYPES 3 AND 4)

E32.1 Description

E32.1.1 The Work covered under this item shall include all operations relating to supply and installation of temporary non-conductive fence panel system (Type 3) and permanent non-conductive fence panel system (Type 4), including the supply and installation of cast-in-place concrete piles and the supply and placing of reinforcing steel, on the west side and in the vicinity of the Manitoba Hydro Sub-station property line. The Contractor shall remove, salvage Type 3 fencing material and deliver to Manitoba Hydro at the completion of the project as directed by the Contract Administrator.

E32.1.2 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 the Work as hereinafter specified.

E32.2 Materials

E32.2.1 Posts

(a) The posts shall be steel and Fibre Reinforced Polymer (FRP) for sizes and details as shown on the drawings.

(b) Approved products are supplied by:

(i) Structural Composite Technologies Ltd., 200-100 Hoka Street, Winnipeg, Manitoba, R2V 3N2, (204) 668-9320.

(ii) Canadian Composite Structures Inc., P.O. Box 20085, Woodstock, Ontario, N4S 8X8, (519) 488-1402.

(iii) Or equal as approved by the Contract Administrator.

E32.2.2 Non-conductive fence panels and rails

(a) Non-conductive fence panels and rails shall be FRP as shown on the drawings.

(b) Approved products are supplied by:

(i) Structural Composite Technologies Ltd., 200-100 Hoka Street, Winnipeg, Manitoba, R2V 3N2, (204) 668-9320.

(ii) Canadian Composite Structures Inc., P.O. Box 20085, Woodstock, Ontario, N4S 8X8, (519) 488-1402.

(iii) Or equal as approved by the Contract Administrator.

E32.2.3 Fasteners and Accessories

(a) Fasteners and accessories shall be FRP and stainless steel as shown on the drawings and as per Manitoba Hydro Standard Drawing No. 1-01000-DE-15100-0010.

(b) Approved products are supplied by:

(i) Structural Composite Technologies Ltd., 200-100 Hoka Street, Winnipeg, Manitoba, R2V 3N2, (204) 668-9320.

(ii) Canadian Composite Structures Inc., P.O. Box 20085, Woodstock, Ontario, N4S 8X8, (519) 488-1402.

(iii) Or equal as approved by the Contract Administrator.

E32.3 Construction Methods

E32.3.1 Shop Drawings

(a) Submit shop drawings showing the arrangement and details of all fencing. Posts shall be spaced uniformly at spacing as required by design and as shown on the drawings.

E32.3.2 Cast-in-Place Concrete Piles

(a) Cast-in-place concrete piles shall be installed to the sizes and lengths shown on the drawings.

E32.3.3 Posts and Fence Panels

(a) Install posts and fence panels in accordance with Manufacturer's Specifications.

(b) Posts should be temporary supported and ensure correct vertical alignment.

E32.3.4 Type 3 Non-Conductive Fence Panel System

(a) Type 3 non-conductive fence panels are installed on a temporary basis. This temporary fence will be removed upon completion of the project and delivery to Manitoba Hydro as directed by the Contract Administrator.

E32.3.5 Coordination with Manitoba Hydro

(a) The Contractor must coordinate the installation of Types 3 and 4 non-conductive fence panel systems with Manitoba Hydro. The contacts at Manitoba Hydro are listed in Specification E14.

E32.4 Measurement and Payment

E32.4.1 Non-Conductive Fence Panel System

(a) The supply and installation of Non-Conductive Fence Panel System will not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for "Non-Conductive Fence Panel System (Types 3 and 4)", performed in accordance with this Specification and accepted by the Contract Administrator.

E33. ZINC METALLIZING OF STRUCTURAL MEMBERS AND COATING

E33.1 Description

E33.1.1 This Specification shall cover the surface preparation, zinc metallizing, and surface sealing of structural steel members of the Transit Station Building including the wind baffle buildings, as specified herein.

E33.1.2 The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all other things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E33.2 Materials

E33.2.1 General

(a) The Contractor shall be responsible for the supply, safe storage, and handling of all materials as set forth in this Specification. All materials shall be subject to inspection and approval of the Contract Administrator. There shall be no charge to the City for any materials taken by the Contract Administrator for testing purposes.

E33.2.2 Zinc Metallizing

(a) The zinc metallizing shall consist of 99.9% zinc wire 3 mm in diameter, as approved by the Contract Administrator.

(b) All zinc metallizing material shall be delivered in the original unopened spools with manufacturer's labels intact. Any material that has been damaged, livered, jelled, or otherwise deteriorated shall not be used. The Contractor shall provide, if and when requested by the Contract Administrator, a listing, updated weekly, of the weight and number of spools and the type of zinc metallizing material (as identified by a mill test report and corresponding heat number for each spool) received from the zinc metallizing manufacturer on this project.

(c) All material shall be stored under cover in a secured place as approved by the Contract Administrator, and shall be kept within storage temperature limitations recommended by the manufacturer.

E33.2.3 Seal Coat

(a) Clear polyurethane seal coat shall be at least 60% solids, shall be compatible with the zinc metallizing, as accepted by the Contract Administrator. The Contractor shall provide a written statement clearly identifying that the proposed product is suitable for its intended use and is being applied in an acceptable manner prior to undertaking the work.

E33.2.4 Abrasive for Blast Cleaning

(a) The blast cleaning abrasive shall be free of corrosion-producing contaminants. Sand abrasive shall be oil free. Slag abrasive shall contain no more than 0.1% oil by weight. The blast cleaning abrasive and grit size employed shall be capable of achieving an average profile peak-to-valley height not exceeding 3.0 mils.

E33.2.5 Incidental and Miscellaneous Materials

(a) Incidental and miscellaneous materials utilized in undertaking the surface preparation, zinc metallizing, and surface sealing works shall be supplied strictly in accordance with the manufacturer's guidelines, as approved in advance by the Contract Administrator, and in accordance with these Specifications.

(b) The use of all such materials shall be reviewed with the Contract Administrator to ensure conformance with the Specification, prior to the use of same in the works. The Contract Administrator's decision in these matters shall be final.

E33.3 Equipment

E33.3.1 Surface Preparation Equipment

(a) All equipment shall be of a type approved by the Contract Administrator and capable of preparing the steel surfaces in accordance with these Specifications.

(b) All compressed air services shall have oil and moisture separators, attached and functional, properly designed and sized to allow delivered air at the blasting or coating nozzle to be free of oil and moisture, and of sufficient pressure to accomplish the associated work efficiently and effectively. The tanks on the air compressors and the moisture separators shall be drained at the end of each working shift. Prior to abrasive blast cleaning, the Contractor shall demonstrate to the Contract Administrator that the air is moisture free. Air-driven power tools shall be properly lubricated in accordance with the respective manufacturer's instructions, but in such a manner that lubrication is not deposited onto the surface being prepared.

E33.3.2 Zinc Metallizing Equipment

(a) The zinc metallizing coating equipment shall be designed such that the coating material will be applied uniformly to all surfaces in the locations required, as shown on the drawings and approved by the Contract Administrator, and shall be kept in good working order.

E33.4 Construction Methods

E33.4.1 Scope of Work

(a) The works include surface preparation, application of zinc metallizing, and surface sealing of all surfaces of the structural steel truss as shown on the drawings and described in this Specification.

E33.4.2 Surface Preparation

(a) General

(i) Prior to actual work commencement, representative trial areas shall be cleaned in accordance with SSPC Specifications SP:10.

(ii) The degree of cleaning and surface profile (where required) achieved, once accepted by the Contract Administrator, will become the standard for all subsequent surface preparations. Furthermore, the Contractor shall prepare and maintain blasted reference panels for the purpose of calibrating magnetic dry film thickness gauges as specified in SSPC Specification PA2.

(b) Surface Cleaning

(i) All oil and grease shall be removed manually with solvent cleaning in accordance with SSPC Specification SP:1, "Solvent Cleaning," before any blast cleaning operations or any zinc metallizing application.

(c) Blast Cleaning Operation

(i) The Contractor shall prepare the structural steel immediately prior to zinc metallizing by blast cleaning, in accordance with current SSPC Specifications SP:10. The prepared surface shall have a 2.0 to 3.0 mil profile.

(ii) No rust scale shall remain within the designated areas.

(iii) Use dry abrasive blasting only in accordance with all applicable regulations.

(iv) Wet blasting will not be permitted.

(v) Any areas shielded or hidden from the effects of sandblasting shall be cleaned manually or by other means to the satisfaction of the Contract Administrator, and must meet SSPC SP:11.

(vi) The blasting shall be performed so as not to damage or contaminate any previously coated areas.

(vii) Freshly prepared steel shall be zinc metallized as quickly as practical thereafter. However, if the freshly prepared steel begins to rust prior to application of the zinc metallizing, the steel must be reblasted to meet the specified SSPC Specification.

(viii) Where the zinc metallized surface has been damaged or rejected, remove loose or nonadherent coating by hand cleaning or other approved techniques. Cleaning shall be performed approximately 20 mm beyond the damaged areas in all directions or until a soundly adhered zinc metallizing coating is obtained.

(ix) The Contractor shall prepare only as much surface as can be zinc metallized the same day. If unusual circumstances occur which prevent all prepared surfaces from being zinc metallized the same day, a light sandblast will be required over all nonzinc metallized surfaces to achieve specified surface preparation.

(d) Blast Cleanup Operations

(i) Following all blast cleaning operations and prior to the Contract Administrator's inspection, all surfaces involved shall be blown off with compressed air or cleaned by vacuum for the purpose of removing any and all traces of blast products from the surface, and for the removal of abrasive from all pockets and corners.

(ii) Following surface preparation cleanup operations, the Contractor shall immediately notify the Contract Administrator so that an inspection can be made prior to the application of any zinc metallizing material.

(iii) The zinc metallizing material shall be applied as soon as possible after the surface preparation cleanup operation as approved by the Contract Administrator.

(e) Surface Testing and Inspection

(i) The Contractor shall provide the Contract Administrator with a minimum of four hours notice prior to zinc metallizing to allow for testing and inspection of prepared surfaces.

(ii) Immediately following blast cleaning and cleanup operations, the Contractor shall notify the Contract Administrator in order that a chemical analysis of the blasted steel and that a surface profile inspection be carried out. No zinc metallizing shall be applied to any prepared surface until written acceptance of complete surface preparation of any area has been given by the Contract Administrator.

(f) Application of Zinc Metallizing

(i) The zinc metallizing coating is to be applied to all structural steel to a minimum thickness of 12 mils for all components of the steel truss. The full coating thickness shall be achieved in two or more applications.

(ii) Absolutely no zinc metallizing shall be applied until the prepared surface has been inspected by the Contract Administrator and approved. Failure to follow this requirement will necessitate the complete removal, by blast cleaning, of all coating placed over surfaces not inspected and approved.

(iii) No deviation from this requirement will be tolerated.

(iv) Zinc metallizing shall be applied as soon as possible after the surface preparation cleanup operation, as approved by the Contract Administrator, and the system manufacturer's representative.

(v) Zinc metallizing shall be applied in accordance with the manufacturer's instructions. The zinc metallizing manufacturer's representative shall be available at the site to provide guidance and solve problems as required. The manufacturer's representative is to certify in writing that prepared surfaces meet their requirements and are suitable for application of their product before zinc metallizing is to proceed. The specified zinc metallizing system shall be applied as soon as possible after the surface preparation cleanup operation and the manufacturer's representative has approved the surface.

(vi) No zinc metallizing shall be applied when the air and/or steel temperatures are at or below 4°C or when the metal has absorbed sufficient heat (above 50°C) to cause the zinc metallizing to blister and produce a porous film or when it is

possible the air temperature may drop below 0°C before the zinc metallizing is dry.

(vii) Zinc metallizing shall not be applied to damp or frosty surfaces, nor when there is a risk of dew on the surfaces to be coated. Using a sling powdered wet and dry bulb psychrometer at the site, zinc metallizing shall not commence unless the dry bulb temperature exceeds the wet bulb temperature by more than 3°C (5°F) and the ambient temperature is rising.

(viii) Zinc metallizing that becomes oxidized, thickened, ropy, lumpy, or dirty shall be discarded.

(ix) The zinc metallizing thickness specified herein shall be the thickness over the peaks of the blast profile. To ensure this thickness is being measured, dry film thickness measurements and gauge calibration methods shall be as described in SSPC Specification PA2.

(x) Electrical arc equipment is the zinc metallizing coating equipment preference for this work. The steel shall not be heated to a temperature exceeding 350°C. The zinc metallizing shall be applied at a minimum thickness of 12 mils. The zinc metallizing thickness specified herein shall be the thickness over the peaks of the blast profile. To ensure this thickness is measured, thickness measurements and gauge calibration methods shall be as described in SSPC Specification PA2. Additional layers of zinc metallizing material shall be applied until the minimum specified thickness is attained. After zinc metallizing is completed and approved by the Contract Administrator, a clear seal coat shall be applied to the surface as specified hereinafter.

(g) Application of Seal Coat

(i) All structural steel truss members will receive seal coat. The clear seal coat shall be applied in two coats to fill in and seal off all the natural pores of the zinc metallizing coated surface. The first coat shall be reduced down to 25% solids to allow the coating to penetrate into the zinc metallized steel. The first coat shall be allowed to dry for a minimum of one hour. The full coat shall be applied at a maximum rate of 2 to 3 mil dry film thickness equivalent to 5 mil wet.

(ii) Seal coat coating shall not be applied over previous coat which is not dry.

E33.5 Repair and Field Touch-up

E33.5.1 General

(a) Repair and field touch-up areas, including truss splices shall be cleaned of all damaged zinc metallizing and the system reapplied using all zinc metallizing material similar to the original materials. Each coat shall be dry before applying subsequent coats.

(b) All repairs and field touch-ups shall be carried out at the Contractor's expense.

E33.6 Quality Control

E33.6.1 General

(a) The Contractor shall supply samples to the Contract Administrator or his inspector for testing purposes, from time to time as required. There shall be no charge to the City for samples taken.

(b) The Contractor shall arrange for regular site visits by a representative of the thermal spray coating material manufacturer who shall ensure that the thermal spray coating is being applied in accordance with the manufacturer's recommendations. The Contract Administrator shall be notified of each such visit and may request additional visits. The Contract Administrator shall be immediately advised of any proposed deviation from this Specification or the manufacturer's requirements.

(c) 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 approval that may have been previously given.

E33.7 Measurement and Payment

E33.7.1 The supply, surface preparation, and application of zinc metallizing, including seal coat will be paid for at the Contract Lump Sum Price for "Zinc Metallizing of Structural Steel Members and Coating", which price shall be payment in full for supplying, applying, and performing all operations herein described and all other items incidental to this Specification.

E34. PRECAST CONCRETE MEDIAN

E34.1 Description

E34.1.1 The Work shall consist of:

(a) The supply of materials and the fabrication of precast concrete median and removable trench covers, as shown and described on the drawings and in this Specification.

(b) The supply of all materials embedded in the precast concrete median and their anchorage/fasteners.

(c) The handling, storage and loading of the precast concrete median.

(d) The quality control testing of all materials.

(e) The supply and installation of Bituthane waterproofing membrane under the precast concrete medians as described on the drawings.

(f) The supply and installation of joint sealant as described on the drawings.

E34.2 References and Related Specifications

E34.2.1 All reference standards shall be current issue or latest revision at the first date of tender advertisement.

(a) CSA-A23.1, Concrete Materials and Methods of Concrete Construction

(b) CSA-A23.2, Methods of Test and Standard Practices for Concrete

(c) CSA-A23.4/CSA-A251, Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products

(d) CSA-A3001, Cementitious Materials for Use in Concrete

(e) CSA – G30.18, Billet-Steel Bars for Concrete Reinforcement

(f) CAN/CSA G 164, Hot Dip Galvanizing of Irregularly Shaped Articles

(g) ASTM C 260, Standard Specification for Air-Entraining Admixtures for Concrete

(h) ASTM C 494, Standard Specification for Chemical Admixtures for Concrete

(i) ASTM C 1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

E34.3 Supply of Materials

E34.3.1 Concrete

(a) The concrete shall conform to Specification E25.

E34.3.2 Reinforcing Steel

(a) The reinforcing steel shall be galvanized and conform to Specification E27.

E34.3.3 Embedded Materials

(a) Embedded materials shall be galvanized and conform to the requirements shown on the drawings and are subject to the approval of the Contract Administrator.

E34.4 Replacement of Damaged Materials

E34.4.1 All material supplied by the Fabricator that in the opinion of the Contract Administrator has been damaged or otherwise rendered unusable by improper storage or handling by the Fabricator shall be replaced by the Fabricator at his expense.

E34.5 Construction Methods

E34.5.1 General

(a) The Fabricator shall ensure that the concrete is properly batched, mixed, placed and cured.

(i) The precast concrete median shall be constructed as shown on the drawings

E34.5.2 Tolerances

(a) Cross-sectional dimensions throughout the entire length of the barrier shall not vary from those shown on the drawings by more than 5 mm.

(b) The locations of the reinforcing steel shall not vary from those shown on the drawings by more than 5 mm.

(c) For the horizontal alignment, the maximum deviation from a straight line parallel to the centreline of a median shall be 5 mm.

(d) The bottom surface of median at the bearing areas shall be in a true level plane, which does not vary by more than 5 mm from a true straight edge placed in any direction across the bearing area.

E34.5.3 Forms

(a) Steel forms shall be used. The faces of the forms shall be smooth so as to impart a good finish to the concrete. Forms shall produce precast concrete median that conform to the shape, lines and dimensions as shown on the drawings and within the tolerances described in this Specification.

(b) Forms shall be designed for the rate and method of concrete placement.

(c) 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 prevent the release agent from coming in contact with any reinforcing steel or embedded materials.

(d) Forms shall include temporary openings to facilitate the removal of all foreign substances prior to placing the concrete.

E34.5.4 Installation of Embedded Materials

(a) Embedded materials shall be placed in the positions as indicated on the drawings and fixed securely to the forms to ensure that there is no displacement during the placing or vibrating of concrete.

E34.5.5 Reinforcing Steel

(a) Reinforcing steel shall be placed accurately in the positions shown on the drawings, 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 depositing of concrete. Bar accessories shall be galvanized or shall be made from non-rusting material.

(b) Reinforcing steel shall be kept free of all foreign materials in order to ensure a positive bond between the concrete and steel. The Fabricator shall remove any material that has been deposited on the reinforcing steel before concrete is placed.

(c) Intersecting bars shall be tied positively at each intersection.

E34.5.6 Depositing of Concrete

(a) Concrete shall be deposited carefully and vibrated so that it fills the forms completely and makes complete contact with all reinforcing bars and embedded materials.

(b) The Fabricator shall provide sufficient personnel to deposit and vibrate the concrete and shall ensure that each batch of concrete is vibrated properly into place as it is deposited.

(c) Buckets, chutes and other equipment used to deposit concrete in the forms shall be positioned as close to the top of the forms as possible to minimize the free fall of the concrete.

(d) Depositing of concrete shall be a single continuous complete operation so that each barrier shall be monolithic without joints.

(e) Before any concrete shall be deposited, the interior of the forms shall be cleaned of all chips, earth, shavings, sawdust, rubbish or other foreign substances.

E34.5.7 Vibrating Concrete

(a) 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 a 25 mm slump.

(b) 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 barrier. At least one extra vibrator shall be on hand for emergency use.

(c) Internal vibrators shall be constantly moving vertically in the concrete and shall be applied at points uniformly spaced that are not farther apart than the radius over which the vibrator is visibly effective. Internal vibrators shall be applied close enough to the forms to vibrate the surface concrete effectively but care shall be taken to avoid displacing or damaging the forms.

(d) The vibration shall be of sufficient duration and intensity to thoroughly consolidate the concrete but shall not be continued so as to cause segregation or draw a pool of grout from the surrounding area.

E34.5.8 Concrete Finish

(a) Immediately after the removal of the forms, all defects in the concrete shall be repaired as directed by the Contract Administrator, provided the defects are not extensive enough to cause rejection of the barrier.

(b) Honeycomb, if any, shall be repaired as soon as the forms are taken off. When approved by the Contract Administrator, repairs shall be accomplished by: removing all aggregate that is loose or that is not bonded thoroughly to the surrounding concrete, washing the sound concrete with clean water, using a wire brush to remove any loose particles, applying an approved epoxy resin to the dried areas, and applying a cementitious mortar. The cementitious mortar shall have the same quality and mix as that used for the concrete. Patched areas shall be rubbed flush with the surrounding surface after the cementitious mortar has hardened.

(c) All objectionable fins, projections, offsets, streaks, and other surface imperfections shall be removed totally to the Contract Administrator's satisfaction by approved means.

(d) Finally, the concrete surface shall be wetted down thoroughly and all air pockets larger than 6 mm in diameter and other surface cavities shall be filled carefully with the approved cementitious 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.

(e) If, in the Contract Administrator's opinion, repairs to the concrete are not satisfactory or will be detrimental to the strength or long-term durability of the barrier, the

Fabricator shall, at his own expense and as directed by the Contract Administrator replace the barrier.

E34.5.9 Curing

(a) The median shall be steam cured. Steam shall not be applied until after the initial set has taken place. Initial set will be considered to have taken place 4 hours after the completion of concrete placing.

(b) During steam curing, the rise in the ambient air temperature shall not exceed 20° C per hour to a maximum temperature of 60° C.

(c) A thermocouple approved by the Contract Administrator shall be placed within the barrier after placing of concrete is completed and the thermocouple shall not be removed until after steam curing has been completed. A graph showing the internal temperature plotted against the time of day shall be submitted to the Contract Administrator by the Fabricator upon completion of the steam curing for each barrier. 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.

(d) Once curing has been completed, the temperature of the concrete shall not be allowed to fall at a rate exceeding 20°C per hour.

(e) The median shall not be subjected to freezing temperatures before reaching the design strength of 35 MPa.

E34.5.10 Handling, Storage and Loading

(a) The Fabricator shall be responsible for storage of the median from the completion of their fabrication until they are required by the Bridge Contractor. The Fabricator may have to store, free of charge, all or portions of the fabricated material past the delivery date specified in the Contract documents, depending on the actual progress of the Bridge Contractor, for a period of up to one year.

(b) During storage and hauling, the median shall be maintained in an upright position and shall be supported at the bearing areas. Care shall be exercised during the handling, transportation and storage of the precast concrete median to avoid twisting, cracking or other distortion that may result in damage to the barrier.

(c) Should the Fabricator choose to transport the median to a storage location, the Fabricator shall be responsible for protecting the median at restraint points. Any damaged corners or surfaces of the median are to be regarded as honeycomb and repaired in accordance with E34.5 of this Specification. Extensive cracking of the median during transportation will be basis for rejection by the Contract Administrator.

(d) The Bridge Contractor will give the Fabricator 48 hours notice of his intention to pick up the median.

(e) The Fabricator shall load the median onto the Bridge Contractor's hauling equipment and shall co-operate with the Bridge Contractor as to the loading procedures. The point of loading shall be in the City of Winnipeg.

E34.6 Quality Control/Quality Assurance

E34.6.1 Test Cylinders

(a) The Fabricator shall mold a sufficient number of cylinders for every 5 m^3 of concrete to be placed in a barrier in order to establish that the concrete has achieved the minimum compressive strength of 35 MPa. The minimum compressive strength will be deemed to have been obtained when the average compressive strength of three cylinders from an individual batch equals or exceeds 35 MPa.

(b) The compressive strength of the concrete shall be determined from standard 100 mm diameter x 200 mm test cylinders or 150 mm x 300 mm test cylinders that have been molded, cured and tested in accordance with CSA-A23.2.

E34.6.2 Concrete Batches

(a) In addition to the molding of test cylinders, the Fabricator shall perform and record the results of the following tests for every 5 m^3 of concrete to be placed in a barrier:

(i) slump,

(ii) air, and

(iii) temperature

(b) The Fabricator 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 shall be prepared for each barrier and the strengths of the test cylinders as well as the pertinent data shall be listed in the same order as the batches of concrete were placed in the forms. A complete set of test results shall be submitted to the Contract Administrator within 7 days after the date that the final cylinder from the last barrier was tested.

E34.6.3 Quality Assurance

(a) The Contract Administrator, at his discretion and City of Winnipeg's, may complete other tests deemed necessary on: a) the concrete, b) the concrete constituent materials or c) any finished or partially finished barrier. The Fabricator shall allow the Contract Administrator unhindered access to the concrete, concrete constituent materials and median and shall assist the Contract Administrator in carrying out any test.

(b) During fabrication of the precast concrete median, the Fabricator shall weigh completed median to verify the mass when requested by the Contract Administrator.

E34.7 Measurement and Payment

E34.7.1 The supply and installation of precast concrete median will not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for "Supply and Installation of Precast Concrete Median and Trench Covers", performed in accordance with this Specification, and as described on the drawings accepted by the Contract Administrator, measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the Work.

E35. MISCELLANEOUS SITE WORKS

E35.1 Description

E35.1.1 The Work required under this section shall include, but not limited to the following:

(a) Fence removal adjacent to Manitoba Hydro Substation to be coordinated with Manitoba Hydro;

(b) Removal and disposal of shrubs and trees;

(c) Removal of underpass sump well to 1.0 m below underside of SU.2 pier cap;

(d) Removal and disposal of billboard and demolish foundation to 1.0 m below finished grade;

(e) Demolish concrete foundation to 1.0 m below finished grade, as shown on drawing;

(f) Saw cut and remove retaining wall, as shown on drawing;

(g) Remove existing aluminum guardrail, adjust existing post height to match new sidewalk grade and reinstall guardrail; and

(h) Manhole adjustment to include risers and reducers as required.

(i) Planing of asphalt pavement on Jessie Avenue and Osborne Street and placing a minimum 50 mm Type 1 asphalt pavement overlay;

(j) Removal of existing concrete sidewalks, curbs, and approach removal at Jessie Avenue and Osborne Street;

(k) Removal of existing sidewalk retaining walls at Jessie and Osborne intersection;

(l) Construction of 200 reinforced concrete pavement complete with units pavers at base of west side ramp;

(m) Construction of monolithic sidewalk on Jessie Street complete including base course;

(n) Construction of 100 concrete sidewalk with units pavers complete with base course on east side of Osborne Street;

(o) Construction of 150 barrier curb east side of Osborne Street;

(p) Construction of temporary asphalt pavement widening on Warsaw including removal of bollards, sidewalks, excavation, geotextile fabric and base materials; and

(q) Supply and installation of Quadquard II TL3 crash attenuation systems at east and west end of station, including mounting pad, backup system, transition system and nose assembly.

E35.1.2 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 Works as described hereinafter.

E35.2 References

E35.2.1 Miscellaneous Site Works are in accordance with Standard Construction Specifications:

(a) CW 1110 – General Instructions

(b) CW 1120 – Existing Services, Utilities, and Structures.

(c) CW 3110 – Sub-grade, Sub-Base, and Base Course Construction

(d) CW 3130 – Supply and Installation of Geotextile Fabrics

(e) CW 3220 – Adjustment of Pavement and Boulevard Structures

(f) CW3235 – Renewal of Existing Miscellaneous Concrete Slabs

(g) CW 3240 – Renewal of Existing Curbs

(h) CW 3250 – Joint and Crack Maintenance

(i) CW 3325 – Portland Cement Concrete Sidewalk

(j) CW 3410 – Asphaltic Concrete Pavement Works

(k) CW 3450 – Planing of Pavement

(l) CW 3550 – Chain Link Fencing

(m) CW 3615 – Riprap

(n) CW 3650 – Installation of Aluminum Balanced Barrier

E35.2.2 CSA S350-M1980, Code of Practice for Safety in Demolition of Structures.

E35.2.3 Manitoba Workplace Safety and Health Act, and all applicable National, Provincial, and Municipal regulations.

E35.2.4 Energy Absorbtion Systems Inc. Product Manual for Quad Guard II System Attenuators. Contact information: Jeff Keates – Guardian Traffic Services Ltd., 982 Powell Avenue, Winnipeg, MB, R3H 0H6. Ph. (204) 233-1600.

E35.3 Protection

E35.3.1 Prevent movement, settlement or damage of adjacent structures. Make good damage caused by demolition.

E35.4 Execution

E35.4.1 Inspection

(a) Inspect Site with Contract Administrator and verify extent and location of items designated for removal, disposal, salvage and items to remain.

(b) Locate and protect utilities.

(c) Notify and obtain approval of Contract Administrator before starting demolition.

E35.4.2 Preparation

(a) Do not disrupt active or energized utilities.

E35.4.3 Safety Code and Requirements

(a) Unless otherwise specified, carry out demolition Work in accordance with the City of Winnipeg Safety Directives and Guidelines.

(b) Blasting operations shall not be permitted during demolition unless reviewed and approved by the Contract Administrator.

E35.4.4 Demolition

(a) Demolition structures to permit construction of new Work as indicated.

(b) At end of each day's Work, leave Work in safe condition so that no part is in danger of toppling or failing.

(c) Do not sell or burn materials on Site.

E35.4.5 Disposal of Demolished Material

(a) The Contractor shall be responsible for removal of debris and waste from the Work area to the location to an appropriate solid waste disposal area approved by the Contract Administrator.

(b) Metal debris, which may include structural steel, miscellaneous inserts, and reinforcing steel, shall be removed from the Site and Disposed of by the Contractor.

E35.5 Measurement of Payment

E35.5.1 Miscellaneous Site Works

(a) The Miscellaneous Site Works will not be measured. This Item of Work will be paid for in the Contract Lump Sum Price for "Miscellaneous Site Works", performed in accordance with this Specification and accepted by the Contract Administrator.

(b) No payment shall be made for Works beyond the limits specified, or those otherwise approved by the Contract Administrator.

E36. PARTIAL SLAB PATCHES

E36.1 Construct partial slab patches in accordance with CW 3230. Partial Slab Patches shall be measured on an area basis and paid for at the Contract Unit Price per square metre for "Partial Slab Patches" in Form B of the Bid Submission.

E36.2 No separate measurement or payment will be made for Drilled Dowels or Tie Bars, the cost for which shall be included in the prices bid for Partial Slab Patches.

E37. DITCH INLET GRATES

E37.1 Description

E37.1.1 General

(a) This Specification covers the supply and installation of "beehive" manhole covers, typically used in open swales or ditches as an alternative to City of Winnipeg Approved Product grated manhole cover AP-006.

E37.2 Materials and Equipment

E37.2.1 As per Contract drawings.

E37.2.2 All steel shall be supplied in accordance with details on the Contract drawings. All steel shall be hot dip galvanized after fabrication and all hardware shall be stainless steel.

E37.2.3 Cover to be Shopost Iron Works MK-A1 or approved equal in accordance with B7.

E37.3 Construction Methods

E37.3.1 General

(a) Contractor to securely affix “beehive” cover to manhole reducer or riser utilizing stainless steel hardware.

(b) Any galvanized surfaces that are damaged shall be coated with a galvanizing compound approved by the Contract Administrator.

E37.4 Measurement and Payment

E37.4.1 “Beehive” Manhole Covers will be measured on a unit basis and paid for at the Contract Unit Price per cover as “Beehive Manhole Covers”. The number to be paid for will be the total number of ’Beehive’ Manhole Covers installed in accordance with this Specification and accepted by the Contract Administrator.

E38. SUMP MANHOLES

E38.1 This Specification is supplemental to CW 2130 and SD-010. The Work in this section comprises the furnishing of all labour, equipment and materials required to complete the installation of the sump manholes.

E38.2 Materials

E38.2.1 All materials used shall conform to CW 2130 and SD-010.

E38.3 Construction Methods

E38.3.1 Supply and install manholes similar to SD-010 with a 1200 mm diameter base, with the exception that the inlet/outlet inverts shall allow for a 600 mm sump at the bottom of the manhole, similar to that of a catchbasin as detailed in SD-025. No benching of the manhole will be required.

E38.4 Measurement and Payment

E38.4.1 Supply and installation of the sump manholes will be paid for on a per vertical metre basis, similar to that of a regular SD-010 manhole as per CW 2130.

E39. EARTHWORK AND ROUGH GRADING

E39.1 This Specification is supplemental to CW 3110 and CW 3170. The Work of this section comprises the furnishing of all labour, equipment and materials required to complete the excavation and related Work including, but not necessarily confined to, the following:

(a) Excavation, removals, disposal, subgrade compaction and rough grading of the existing Site for the construction sodded and seeded areas, planting beds, mulch beds, swales, etc. to the design requirements noted on the drawings, approved on Site by the Contract Administrator, less the appropriate surface finish allowance.

(b) Stockpile suitable, approved material on Site for reuse (clean topsoil, clean earth fill and gravel fill). Remove and dispose of unsuitable material.

(c) Earthwork and Grading of the existing Site to the design elevations shown on the drawings, less the appropriate surface finish allowance.

(d) Earthwork and Grading of the existing Site (cut and fill including compaction of subgrade and fill material) to ensure positive drainage in all swales and adjacent sodded/seeded areas and planting beds.

E39.2 Materials

E39.2.1 All fill materials shall conform to CW 3170.

E39.3 Construction Methods

E39.3.1 The Contractor shall construct the Site within the limits indicated to the design elevations and gradients noted on the drawings, less the appropriate surface treatment depths specified and shall excavate, remove and dispose of all unsuitable materials of whatever nature encountered.

E39.3.2 The Contractor shall construct all sub-grades in accordance with Specification CW 3110, including removal of unsuitable excavated material and surplus materials.

E39.3.3 The Contractor shall restrict his activities strictly to within the limits of the Work, unless receiving prior written approval from the Contract Administrator. The Contractor shall take all precautions to prevent damage to traffic structures, pole lines, existing trees, Site services and adjacent property and he shall be liable for any damages occurring in the performance of this Work.

E39.3.4 The Contractor shall examine the Site and make themselves familiar with the existing conditions and the nature of the Work to be done.

E39.3.5 Prevent damage to surface or underground utility lines which are to remain. Make good any damage.

E39.3.6 The Contractor shall excavate to the design grades shown less the appropriate allowance for surface treatment and shall excavate, remove and dispose of all unsuitable materials of whatever nature encountered.

E39.3.7 Excavated or graded materials to be approved before use as fill for grading Work. Protect such approved material from contamination. Stockpile in approved locations on Site. Protection and stockpiling are incidental to unit prices bid for excavation, removals and rough grading.

E39.3.8 The Contractor shall ensure that upon completion of the earthwork and grading operations the Site is left in a neat condition free from debris, etc. for approval by the Contract Administrator prior to placing base courses and clean fill.

E39.3.9 Except for drainage swales and embankments indicated, the design gradient for all other areas shall be considered to be straight grade between the design elevations shown. Changes in grade at swales, and embankments shall be gently contoured as directed by the Contract Administrator to provide future ease of grass mowing operation.

E39.3.10 Construction to the new design grades shall be accomplished by the placement of clean fill in areas as indicated on the drawings.

E39.3.11 Areas of Fill

(a) Fill low areas in sodded/planting bed areas with imported clean earth fill suitable for plant growth free from roots, muskeg, organic or cohesive matter, building debris, waste materials, rubble, rubbish, frozen portions, soluble materials and rocks larger than 25mm (1”) in diameter and capable of sustaining plant and seed growth. Compact to 95% S. P. D. in 150mm (6”) lifts to 1000mm below finish grade for all planting beds and 900mm below finish grade for sodded and seeded areas noted on the drawings. Where depth of planting soil is not noted on drawings for sodded and seeded areas place earth fill to 150mm below finish grade.

(b) Prior to placing fill over existing ground, scarify surface to depth of 150mm. Maintain fill and existing surface at approximately the same moisture content to facilitate bonding.

E39.3.12 Compaction shall include the use of sheep's foot or other suitable compaction equipment as approved by the Contract Administrator to achieve a minimum compaction of 98% Standard Proctor Density below all paved areas and rock areas, and 95% Standard Proctor Density in all other areas disturbed under this Contract.

E39.3.13 The Contractor shall construct the sub-grade surface to the following depths below the grades shown on the drawings for each area:

(a)	Planting bed	1150 mm
(b)	Mulch bed with existing trees	100 mm
(c)	Sodded and seeded areas with trees	1050 mm
(d)	Sodded areas	150 mm
(e)	Seeded areas	300 mm

E39.3.14 Following earth moving, rough grading and compaction the Work areas shall be fine graded to provide a maximum deviation of 50 mm in 10 metres from the design grade with no low areas to hold water. The finished surface of all disturbed areas shall be dragged and smoothed in such a manner that there are no loose soil particles greater than 50mm in maximum dimensions. Fine grading is incidental to the unit prices bid for each item listed in the schedule of prices.

E39.3.15 If required and at locations directed by the Contract Administrator, the Contractor shall excavate and remove unsuitable subgrade material and replace it with compacted granular material in accordance with Specification CW3110.

E39.4 Measurement and Payment

E39.4.1 Earthwork and grading for landscape areas will be incidental to the lump sum price for soft landscaping for all Work as described herein and as accepted by the Contract Administrator.

E40. PLANTING BED PREPARATION

E40.1 Description

E40.1.1 The following list generally describes the scope of this Section:

(a) Cultivate subsoil;

(b) Supply and install rigid insulation and geotextile;

(c) Supply and install drainage course and drainage pipe;

(d) Supply and install planting soil mixture in planting beds;

(e) Supply and install wood chip mulch and filter fabric.

E40.1.2 Submit to the Contract Administrator samples of the following materials:

(a) Planting Soil Mixture: 1 kg

(b) Wood chip mulch: 500g

(c) Geotextile

E40.2 Delivery and Storage

E40.2.1 Deliver and store fertilizer in waterproof bags showing weight, analysis and name of manufacturer.

E40.3 Materials

E40.3.1 Planting Soil: For mix imported topsoil with 20% peatmoss loose by volume, and 5% sand loose by volume. Incorporate bonemeal into planting soil at rate of 5 lbs /cu.yd. of soil mixture. Planting soil items to be comprised as follows:

E40.3.2 Peatmoss: horticultural grade Class "A" decomposed plant material, fairly elastic and homogeneous. Free of decomposed colloidal residue, weed, sulphur and iron. To have pH value of 5.9 to 7.0, 60% organic matter by weight, moisture content not exceeding 15% and water absorption capacity of not less than 300% by weight on oven dry basis.

E40.3.3 Bonemeal: shall be raw bonemeal, finely ground with a minimum analysis of 3% nitrogen and 20% phosphoric acid.

E40.3.4 Imported topsoil: natural, fertile, agricultural soil typical of locality, capable of sustaining vigorous plant growth, from well drained Site that is free of flooding, not in frozen or muddy condition, not less than 6% organic matter to a maximum 25% organic matter by volume, and pH value of 5.9 to 7.0. Free from subsoil, slag or clay, stones, lumps, live plants and their roots, sticks, crabgrass, couchgrass, noxious weeds and foreign matter.

E40.3.5 Sand: hard, granular natural beach sand, washed free of impurities, chemical or organic matter.

E40.3.6 Fertilizer: commercial type with 50% of the elements derived from organic sources.

E40.3.7 Rigid insulation to be 50mm thick closed cell high density rigid board.

E40.3.8 Drainage fabric and geotextile as per CW 3120.

E40.3.9 Drainage material as per CW 3120.

E40.3.10 Drainage pipe as per CW 3120.

E40.3.11 Wood chip mulch: varying in size from 15-25 mm and 5-20 mm thick, from coniferous trees.

E40.4 Construction Methods

E40.4.1 Remove debris, broken roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove subsoil that has been contaminated with oil, gasoline or calcium chloride. Dispose of removed materials as directed.

E40.4.2 Excavate bed and planters to a depth of 1150 mm as per details on the drawings.

E40.4.3 Place drainage pipe, drainage fabric and drainage material as per the drawings. Connect subdrain to catchbasins as shown on the drawings. All work related to subdrain for planting beds is incidental to the unit prices bid for shrub bed preparation.

E40.4.4 Install rigid insulation against all concrete surfaces as per the drawings. Ensure no gaps in insulation and that the surfaces are flush to the concrete. Two layers of insulation to be installed.

E40.4.5 Geotextile to be run continuous along all insulation surfaces and drainage course. Wrap geotextile over top edge of insulation to secure with filter fabric under mulch.

E40.4.6 Do not spread planting soil mixture until Contract Administrator has inspected drainage course, insulation and geotextile.

E40.4.7 Spread planting soil mixture with adequate moisture in uniform layers during dry weather over approved, dry, unfrozen sub-grade, where planting is indicated.

E40.4.8 Bring planting soil mixture up to 100 mm below finished grade in beds.

E40.4.9 Remove stones, roots, grass, weeds, construction materials, debris and foreign non-organic objects from soil mixture.

E40.4.10 Spread fertilizer at manufacturer's recommended rate of application. Mix fertilizer thoroughly into upper 50mm of planting soil.

E40.4.11 Fine grade entire planting soil area. Eliminate rough spots.

E40.4.12 Compact planting soil to leave surface smooth, uniform, firm against deep foot printing, with a fine, loose texture. Tolerance: plus or minus 15mm of design grade.

E40.4.13 Supply and install 100mm wood chip mulch in beds.

E40.4.14 Mulch beds around existing trees and between proposed trees are to be constructed by stripping the existing sod from the site and preparing the ground as per items 20 through 27 above.

E40.5 Measurement and Payment

E40.5.1 Planting bed preparation will be incidental to the lump sum price for soft landscaping for all work as described herein and as accepted by the Contract Administrator.

E41. PLANT MATERIAL

E41.1 Description

E41.1.1 The following list generally describes the scope of this section:

(a) Supply and planting of trees, shrubs and vines;

(b) Maintenance to date of substantial performance;

(c) Warranty for two full years.

E41.2 General

E41.2.1 Obtain approval of plant material at source.

E41.2.2 Notify Contract Administrator of source of material at least 7 days in advance of shipment. No Work under this Section is to proceed without approval.

E41.2.3 Acceptance of plant material at source does not prevent rejection at Site prior to or after planting operations.

E41.2.4 Source of all plant material to be from an area within the same hardiness zone and soil conditions as Winnipeg.

E41.3 Shipment and Pre-Planting Care

E41.3.1 Co-ordinate shipping of plants and excavation of holes to ensure minimum time lapse between digging and planting. Tie branches of trees and shrubs securely and protect plant material against abrasion, exposure and extreme temperature change during transit. Avoid binding of planting stock with rope or wire which would damage bark, break branches or destroy natural shape of plant. Give full support to root ball of large trees during lifting.

E41.3.2 Cover plant foliage with tarpaulin, and protect bare roots by means of dampened straw, peatmoss, sawdust or other acceptable material to prevent loss of moisture during transit and storage.

E41.3.3 Remove broken and damaged roots with sharp pruning shears. Make clean cut and cover cuts over 50 mm diameter with wound dressing.

E41.3.4 Keep roots moist and protected from sun and wind. Heel-in shrubs, which cannot be planted immediately, in shaded areas, and water well.

E41.4 Materials

E41.4.1 Water

(a) Water should be potable and free of minerals, which may be detrimental to plant growth.

E41.4.2 Anti-Desiccant

(a) Anti-desiccant should be wax-like emulsion to provide film over plant surface reducing evaporation but permeable enough to permit transpiration.

E41.4.3 Wound Dressing

(a) Wound dressing should be horticulturally accepted non-toxic, non-hardening emulsion.

E41.4.4 Plant Material

(a) Quality and Source: Comply with City of Winnipeg tree planting guidelines, referring to size and development of plant material and root ball. All plant material to be approved by City and Contract Administrator at source.

(b) Measure plants when branches are in their natural position. Height and spread dimensions refer to main body of plant and not from branch tip to branch tip. Use trees of No. 1 grade.

(c) Additional plant material qualifications:

(i) Use plants with strong fibrous root system free of disease, insects, defects or injuries and structurally sound. Plant must have been root pruned regularly, but not later than one growing season prior to arrival on Site.

E41.4.5 Cold Storage

(a) Approval required for plant material, which has been held in cold storage.

E41.4.6 Container – Grown Stock

(a) Acceptable if containers large enough for root development. Shrubs and vines must have grown in container for minimum of one growing season but not longer than two. Root system must be able to "hold" soil when removed from container. Plants that have become root bound are not acceptable. Container stock must have been fertilized with slow releasing fertilizer.

E41.4.7 Substitutions

(a) Substitutions to plant material as indicated on plantings plan are not permitted unless written approval has been obtained as to type, variety and size prior to award of Contract. Plant substitutions must be similar species and of equal size to those originally specified.

E41.4.8 Root balls

(a) Deciduous trees in excess of 3 m height must have been dug with large firm ball. Root balls must include 75% of fibrous and feeder root system. This excludes use of native trees grown in light sandy or rocky soil. Lift root ball from hole, place in wire basket designed for purpose and line with burlap. Secure root balls with burlap, heavy twine and wire basket. Protect root balls against sudden changes in temperature and exposure to heavy rainfall. Take care not to injure trunk of tree with wire basket ties or rope.

(b) Tree spade material shall not be accepted. Unless dug in field and secured as above.

E41.5 Construction Methods

E41.5.1 Workmanship

(a) Stake out location of trees and shrubs as per the Construction drawings. Obtain approval by City and Contract Administrator prior to excavating.

(b) Apply anti-desiccant in accordance with material manufacturer's instructions only as required.

(c) Co-ordinate operations. Keep Site clean and planting holes drained. Immediately remove soil or debris spilled onto pavement.

E41.5.2 Planting Time

(a) Plant deciduous plant material during dormant period, before buds have broken. Plant material noted for spring planting only, must be planted in dormant period.

(b) When permission has been obtained to plant materials after buds have broken, spray plants with anti-desiccant to slow down transpiration prior to transplanting.

(c) When permission has been obtained, shrubs and perennials growing in containers may be planted throughout growing season.

(d) Plant only under conditions that are conducive to health and physical conditions of plants.

(e) Provide planting schedule. Executing planting operations over long period using limited crew will not be accepted.

E41.5.3 Excavations

(a) Prepare planting areas as shown on the drawings.

(b) Provide drainage for planting holes in heavy soil if natural drainage does not exist. Have method approved.

(c) Protect bottom of excavations against freezing.

(d) Remove water, which enters excavations prior to planting. Ensure source of water is not ground water.

E41.5.4 Planting

(a) Scarify sides of planting hole to depth of 150 mm where tree is planted in isolated tree pit.

(b) Plant trees, shrubs and perennials vertically with roots placed straight out in hole. Orient plant material to give best appearance in relation to structure, roads and walks.

(c) Place plant material to depth equal to depth they were originally growing in nursery. Allow for soil settlement in planting.

(d) With balled and burlapped roots balls, loosen burlap and cut away minimum top 1/2 without disturbing root ball. Cut vertical slits in remaining burlap around root ball at 250mm intervals. Remove all rope, string, or other ties from around trunk. Do not pull burlap or rope from under root ball. With container stock, remove entire container without disturbing root ball. Non bio-degradable wrappings must be removed including wire baskets.

(e) Tamp planting soil around root system in layers of 150mm eliminating air voids. Frozen or saturated planting soil is unacceptable. When 2/3 of planting soil has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling.

(f) Build 100 mm deep saucer around outer edge of hole to assist with maintenance watering. Install 100mm depth wood chip mulch in saucer as shown on drawings.

(g) When planting is completed, give surface of planting saucer dressing of organic 10-6-4 fertilizer at rate of 12 kg/100 m for shrub beds or 40 to 50 g/mm of calliper for trees. Mix fertilizer thoroughly with top layer of planting soil and water in well.

E41.5.5 Pruning

(a) Prune trees and shrubs after planting only as required to remove broken diseased or dead branches. Employ clean sharp tools and make cuts flush with main branch, smooth and sloping as to prevent accumulation of water.

E41.5.6 Maintenance

(a) After completion of planting operation to the satisfaction of the Contract Administrator and City of Winnipeg, the Contractor shall be responsible for the maintenance of the plant material until date of Substantial Performance and commencement of two year warranty.

(b) Replace any dead or damaged plant material during the maintenance period, including replacement of vandalized material.

(c) Water sufficiently to maintain optimum growing conditions. Ensure adequate moisture in root zone at freeze-up.

(d) The Contractor shall provide all necessary equipment, including: tractors, mowers, hand mowers, trimmers, fertilizer spreaders, pruning tools, hoses, water meters, and

any other items necessary for the maintenance of the plant material indicated in this Specification.

(e) Remove all weeds and debris from mulch beds, planting beds and tree wells on a weekly basis.

(f) Turn and top up mulch in beds and tree wells each spring and piror to start of extended maintenance.

E41.5.7 Personnel

(a) The Contractor shall provide all necessary personnel for the ongoing maintenance operations.

(b) Personnel should have at least one year of experience in landscape maintenance and should be under the direction of a foreman, in all cases, with not less than five years of experience with similar maintenance operations.

E41.6 Maintenance Methods

E41.6.1 Watering

(a) Trees shall be watered twice weekly, or during the summer, if temperatures are fairly high and there has been no rainfall, water approximately once a week.

(b) To determine the need for watering, make a soil test weekly with a one-inch auger. Take a test sample from both the planting soil and from the root ball by drilling to a minimum depth of 600 mm. The soil shall contain enough moisture to hold together when compressed in the hand, but not be muddy.

E41.6.2 Fertilizing

(a) Because of the specialized nature of such operations, fertilizing is to be done by a qualified local arborist.

(b) Fertilize in the fall over the surface of the ground surrounding the plants, then soak the area thoroughly, use 10-6-4 analysis fertilizer spreading a maximum of 0.13 kg per square metre.

E41.6.3 Spraying

(a) Spray trees to control insect pests and diseases. Use horticulturally recommended compounds specific for the problem to be contained.

E41.6.4 Insects and Diseases

(a) Spray plants to combat pests and diseases. Do not use DDT or sprays prohibited by Agriculture Canada.

E41.7 Measurement and Payment

(a) Supply and installation of plant material will be incidental to the lump sum price for soft landscaping for all Work as described herein and as accepted by the Contract Administrator.

E42. EXTENDED MAINTENANCE

E42.1 Description

E42.1.1 This Specification shall deal with the maintenance of the trees, shrubs, mulch beds, and sod for Two (2) calendar years after the date of the Substantial Performance

E42.2 Materials and Personnel

E42.2.1 The Contractor shall provide all necessary equipment, including: tractors, trimmers, fertilizer spreaders, pruning tools, water trucks, hoses, water meters, and any other items necessary for the maintenance of the area indicated in this Specification.

E42.2.2 The Contractor shall provide all necessary personnel for the ongoing maintenance operations

E42.3 Work Included

E42.3.1 The following areas shall be part of the maintenance jurisdiction:

(a) The trees, shrubs and vines as indicated on the drawings

(b) Mulch beds as indicated on the drawings.

(c) All sodded areas as indicated on the drawings.

E42.4 Maintenance of Trees, Shrubs and Vines

E42.4.1 Watering

(a) All plant material shall be watered bi-weekly, or during the summer, if temperatures are fairly high and there has been no rainfall, water approximately once a week. Where irrigation is not available this should be executed by leaving a hose, with a gentle rate of flow, running into the saucer of the root ball for about one hour

(b) To determine the need for watering, make a soil test weekly with a one-inch auger. Take a test sample from both the planting soil and from the root ball by drilling to a minimum depth of 600 mm. The soil shall contain enough moisture to hold together when compressed in the hand, but shall not be muddy.

E42.4.2 Fertilizing and Pest Control

(a) Fertilizing, Pruning and Spraying Deciduous Trees and Shrubs. Because of the specialized nature of such operations, this should be done by a qualified local arborist

(b) Fertilize in the fall over the surface of the ground surrounding the plants, then soak the area thoroughly. Use 10-6-4 analysis fertilizer spreading a maximum of 0.13 kg per square meter.

(c) Spray to control insect pests and diseases. Use horticulturally recommended compounds specific for the problem to be contained.

E42.4.3 Weeding

(a) Remove all weeds in tree wells planting beds and mulch beds by hand on a weekly basis. Do not use chemical weed killer.

(b) Remove all debris from beds, including weeds, and dispose of off Site in a legal manor.

E42.4.4 Other Maintenance

(a) Tighten, or remove, turnbuckles or guy wires for trees as required or directed by the Contract Administrator.

(b) Straighten trees as required and directed by the Contract Administrator.

(c) Vines are to be trained up trellises and over walls. Prune out dead material as required and train new leaders to fill in open areas.

E42.4.5 The Contractor shall agree and guarantee to replace and replant any nursery stock found dead or in poor condition during and at the completion of the maintenance period. All plant material to be replaced and maintained for a minimum of 30 days prior to end of maintenance period. "Poor Condition" shall be interpreted as meaning nursery stock in which branches are dead or dying, or have not shown satisfactory growth of leaves. All replacements shall be of same size and species, as specified.

E42.4.6 Upon the end of the required maintenance period, a Site inspection shall be held. If at this time, all material and Works is satisfactory the Contract for maintenance and warranty shall be terminated. If materials and Works are found unacceptable the warranty shall be extended by 30 days for a follow up inspection. Extension of warranty will continue in 30 day increments for inspection until all Work and material are satisfactory.

E42.5 Measurement and Payment

E42.5.1 Extended maintenance will be incidental to the lump sum price for soft landscaping for all Work as described herein and as accepted by the Contract Administrator.

E43. TOPSOIL AND FINISH GRADING

E43.1 Description

E43.1.1 Further to CW3540 this section shall cover the supply and placement of topsoil for areas of sodding and seeding.

E43.2 Materials

E43.2.1 Topsoil for sod as per CW3540.

E43.2.2 Soil in areas of sod and seed with trees to be planting soil to minimum 900mm depth. Soil to be as per Planting Bed Preparation.

E43.2.3 Topsoil for top 300mm of seed areas to be weed free topsoil as supplied and installed by Native Plant Solutions. Contact Glen Koblun 953-8206

E43.3 Installation

E43.3.1 Installation of topsoil for sod as per CW3540.

E43.3.2 Installation of to 300mm of weed free topsoil for seed areas to be by Native Plant Solutions.

E43.4 Measurement and Payment

E43.4.1 Supply and placing of topsoil will be incidental to the lump sum price for soft landscaping for all Work as described herein and as accepted by the Contract Administrator.

E44. ESTABLISHMENT OF SEEDED AREAS

E44.1 Description

E44.1.1 This Specification will cover all Work and materials required to establish seeded areas.

E44.1.2 Native seed areas to be constructed using Native Plant solutions for all materials and labour required for the establishment of native turf grass and native tall grass prairie. Contact: Glen Koblun 953-8206.

E44.1.3 Plant plugs to be used in beds and tight location to provide fuller coverage. Quantity of plugs for project expected to be 3000 of mixed species. Species mix to be determined by Native Plant Solutions to coordinate with seeding operations.

E44.2 Measurement and Payment

E44.2.1 Establishment of seeded areas will be incidental to the lump sum price for soft landscaping for all Work as described herein and as accepted by the Contract Administrator.

E45. LANDSCAPE ROCK AND ROCK MULCH

E45.1 Scope of Work

E45.1.1 The following list generally describes the scope of this Section:

(a) Supply and install rough field stone rock on geotextile fabric with limestone fines infill.

(b) Supply and install rock mulch on geotextile fabric.

E45.2 Samples

E45.2.1 Submit to the Contract Administrator samples of the following materials:

(a) Rock: 1 -350 mm-450 mm O.D.

(b) Rock Mulch

(c) Geotextile: 1 sq.m

E45.3 Products

E45.3.1 Limestone and granite rock to be from a Manitoba quarry, colour to be approved by Contract Administrator. Size range to be:

(a) 300mm-450mm O.D. – 50%

(b) 550mm-600mm O.D. – 40%

(c) 650mm-800mm O.D. – 10%

E45.3.2 Rock mulch to be 19mm river washed stone mulch.

E45.3.3 Geotextile to be fabric suitable to application as per approved product as per City of Winnipeg Approved Products for Surface Works.

E45.4 Installation

E45.4.1 Verify grades of compacted subgrade (to 95% SPD) and adjacent features for conformity with existing grades before placing boulder.

E45.4.2 Remove and dispose of unsuitable subgrade material as directed by Contact Administrator.

E45.4.3 Supply and installation of geotextile as per the drawings. The cost to supply and install geotextile is incidental to the Work in this section.

E45.4.4 Place landscape rock in locations as shown on the drawings and directed on site by project landscape architect.

E45.4.5 Place rock mulch in areas as shown on the drawings.

E45.4.6 Backfill around landscape rock with limestone fines.

E45.5 Measurement and Payment

E45.5.1 Landscape rock and rock mulch will be incidental to the lump sum price for soft landscaping for all Work as described herein and as accepted by the Contract Administrator.

E46. SITE FURNITURE

E46.1 Description

E46.1.1 This Specification covers the supply and installation of benches, ash urns and waste receptacles.

E46.1.2 Store units in a protected location, immediately upon arrival on the Site.

E46.1.3 Remove from Site any units which have been damaged during transportation and replace.

E46.2 Products

E46.2.1 Benches with backs to be cast aluminium bench with concrete seats product number CTRA-BB as supplied by:

Urban Park,
49 Life Sciences Parkway
Steinbach, Manitoba, R5G 2G7
Ph: 1.800.775.0018

E46.2.2 Attn. Myron KrentzBenches without backs to be cast aluminium bench with concrete seats product number CTRA-BLB as supplied by:

Urban Park,
49 Life Sciences Parkway
Steinbach, Manitoba, R5G 2G7
Ph: 1.800.775.0018
Attn. Myron Krentz

E46.2.3 Bicycle loops to be U shaped A-coated bicycle rack as supplied by:

Urban Park,
49 Life Sciences Parkway
Steinbach, Manitoba, R5G 2G7
Ph: 1.800.775.0018
Attn. Myron Krentz

E46.2.4 Ash urn to be stainless steel cigarette disposal column as supplied by:

Urban Park,
49 Life Sciences Parkway
Steinbach, Manitoba, R5G 2G7
Ph: 1.800.775.0018
Attn. Myron Krentz

E46.2.5 Recycling/waste container to be stainless steel three bin containers to match existing City of Winnipeg on street systems. Contractor to provide product information for approval prior to purchase.

E46.2.6 Bicycle lockers to be steel pie shaped Duralocker DL100-1-P-F as supplied by:

Hannan Specialties, Inc.
4019 Leos Lane unit #3
Carmichael, CA 95608
ph: 800-722-2453
fax: 916-488-7256

(a) With padlock style handle and perforated floor and door. Door to have bicycle symbol outline incorporated into the perforations. Lockers to be powder coated silver, colour to be PM211S11 (sparkle silver) by Protech.

(b) Twenty lockers to be provided.

E46.3 Installation

E46.3.1 Install benches on concrete paving as shown on the drawings.

E46.3.2 Where benches are to be located in unit paver the Contractor is to supply and install extensions on the legs to meet the depth of the pavers and provide a solid base for mounting. Cost of extensions is incidental to the unit price for benches.

E46.4 Drill holes and install stainless steel threaded insert to fit bolts. Epoxy in place.

E46.4.1 Set benches level and plumb. Dry fit bench with bolts.

E46.4.2 Fill under bench legs with non-shrinking grout where legs do not fit flush to sidewalk, maximum 15mm depth. Finish exposed edges with smooth trowel finish with consistent slope to sidewalk surface. Install grout as per manufacturer's Specifications. Notify Contract Administrator of grout requirements prior to placing bench.

E46.4.3 Fasten benches with stainless steel, tamper proof bolts. Surface of bolt head to be flush or slightly recessed from base plate of legs..

E46.4.4 All other site furniture to be installed as per manufacturers details.

E46.4.5 Bicycle lockers to be installed in connected banks of lockers. Locker configuration as follows:

(a) Four of the lockers are to be installed as per the drawings;

(b) Two to be installed at Osborne Junction;

(c) Two to be installed at St. Vital Centre Bus Terminal;

(d) Four to be installed at Harkness Station;

(e) Eight to be installed at Fort Rouge Station;

(f) Contractor to confirm locations with Contract Administrator.

E46.5 Measurement and Payment

E46.5.1 Exterior site furniture will be incidental to the lump sum price for hard landscaping for all Work as described herein and as accepted by the Contract Administrator.

E46.5.2 Interior site furniture will be incidental to the lump sum price for Architectural Work for all Work as described herein and as accepted by the Contract Administrator.

E47. FENCING

E47.1 Description

E47.1.1 This Specification shall cover the supply and installation of 1200 mm height aluminum fencing.

E47.2 Materials

E47.2.1 1.2 m height aluminum fencing to be custom curved picket aluminum fencing as supplied by:

Wallace and Wallace
Lowson Crescent
Wallace and Wallace Fencing
Winnipeg MB, R3P 2H8
Ph: 204-452-2700
Attn. Kori Buhler

(b) Aluminum fence to be painted black. All paint to be powder paint.

(c) Fence to include one person gate for each area of installation.

E47.3 Installation

E47.3.1 Measure length of fencing to be installed prior to construction. Install posts as per detail and adjust post spacing at ends of fencing runs to provide minimum 1.5m length panels at ends. Post spacing maybe adjusted for up to 5 panels.

E47.3.2 Supply and install concrete bases for posts as required.

E47.3.3 Bolt fence to top of existing wall where possible. Remaining posts to be mounted to cast in place concrete bases.

E47.3.4 Construct fence as per manufacturers' Specifications and details.

E47.4 Measurement and Payment

E47.4.1 Fencing will be incidental to the lump sum price for hard landscaping for all Work as described herein and as accepted by the Contract Administrator.

E48. GUARDRAILS AND HANDRAILS

E48.1 Description

E48.1.1 This Specification shall cover the supply and installation of custom guardrails and handrails for plaza ramps and stairs.

E48.2 Materials

E48.2.1 Guardrails to be stainless steel custom posts with tempered glass panels as per the drawings.

E48.2.2 Handrails to be custom stainless steel with mounting on walls, guardrail posts and free standing as per details.

E48.2.3 Panels as part of custom posts to be formed with stamped aluminum in custom RT design. Panels to be painted blue.

E48.2.4 Tubular and plate aluminium shall be 6061-T6.

E48.2.5 All stainless steel components and fastenings shall be 304 or better. Provide plastic spacers and inserts as required to ensure galvanic corrosion does not occur with aluminium components.

E48.2.6 All paint to be powder paint. Silver colour to be PM211S11 (sparkle silver) by Protech. Blue colour to be 5005 38/40010 by Tiger Drylac.

E48.2.7 Posts to have lighting fit into post in locations as shown on the drawings. Light to be fit into stamped panel pattern and supported on backside of post with stainless steel housing. Wiring to be on be within housing.

E48.2.8 Glazing is to be tempered clear glass, minimum 3/8" (in) thickness, designed for outdoor glazing use.

E48.2.9 All fasteners and all mounting hardware use to fasten the shelter to the concrete base at ground level must be stainless steel or approved equal in accordance with B7.

E48.2.10 The post legs must include a stainless steel base plate with adjustable stainless steel bolts and rods for levelling to accommodate installations on poured concrete with imperfections or the slope of the surface. Adjustment capabilities must be a minimum of 2" (in). Design of plates and internal post to allow for slope of ramp and stair walls. Manufacturer to site measure all areas to confirm dimensions.

E48.3 Detailed Design and Shop Drawings

E48.3.1 The Contractor shall submit dimensioned, detailed design drawings within five (5) working days when contacted by the Contract Administrator. The drawings shall show all details of construction, fastenings, materials and colours.

E48.3.2 The Contractor shall submit stamped engineer’s drawings for review and approval within five (5) Working Days of Contract Award and prior to commencement of work. Engineer’s drawings shall show all details of construction and fastenings for erections and shall be as specified or approved. Engineer shall be a structural engineer licensed to practice in Manitoba with extensive experience in the design and manufacturing of aluminium and stainless steel benches for public transit. Drawings to include concrete base requirements.

E48.3.3 Autocad files of the drawings are available to be emailed upon written request to the Contract Administrator identified in E3.

E48.4 Workmanship

E48.4.1 Proportion items to meet the National Building Code, the Manitoba Building Code and local conditions specifically relating to wind and snow loading. Items shall support loads recommended by the Code unless specific loads are indicated on the drawings.

E48.4.2 Fabricate all Work to shape and size with sharp lines, angles and smooth surfaces as defined in the drawings. Connections shall be securely welded, bolted or riveted. Welds shall be dressed smooth on exposed surfaces. Rabbets, lugs and brackets shall be provided so that the Work can be assembled in a neat substantial manner. Thickness of metal and design of assembly and support shall give ample strength and stiffness.

E48.4.3 All portions of the Work shall be neatly finished. Exposed ends and edges of metal shall be smooth. The shelters wall, roof and joints exposed to the weather shall be formed to exclude water or to drain.

E48.4.4 Insofar as possible, the Work is to be fitted and assembled in the Contractor's shop and delivered to the Site in largest practical sections.

E48.4.5 Fabricate Work in strict accordance with shop drawings. Shop drawings are to be based on details, sizes, materials shown on drawings and specified herein.

E48.4.6 Welding: All welding shall conform to the requirements of the current CSA Standard W.59 and the fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with the requirements of the current CSA Standard W.47. Welding shall be done by currently licensed welders only and certified to design welds.

E48.4.7 Manufacturer shall be a member of the Canadian Welding Bureau, or governing body where manufacture is in another country, and certified to design welds

E48.4.8 Welding splatter and other fabrication burrs where exposed shall be ground or filed smooth and left ready for subsequent operations.

E48.4.9 Assembly: Material intended for use in the various assemblies shall be straight, clean, sharply defined profiles, assembled in such a way that no disfigurements will show in the finished work, or impair the strength.

E48.4.10 Finish: Fabricated material Work shall be delivered with shop coat primer paint or E coated and other paint finish as specified. Following installation, apply a touch up coat of shop primer or galvanizing and paint to match finish to all surfaces where finish has been removed and to installation devices such as bolts, screws, welds and the like.

E48.5 Quality Control

E48.5.1 All workmanship and all material furnished and supplied under this Section 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 any materials or Works which are not in accordance with the requirements of this Section.

E48.6 Fabrication

E48.6.1 Fabrication shall be carried out in accordance with these Specifications and drawings which form a part of this Contract.

E48.6.2 The guardrail posts must be designed to stand without any glazing.

E48.6.3 The railings must be constructed to resist damage from vandalism and must be simple to maintain and clean.

E48.6.4 The posts must be designed for easy assembly and must not require any drilling, thread tapping, welding, or painting of structural members or glazing support fixtures.

E48.6.5 Fasteners used in accessible locations must be of tamper proof design.

E48.7 Painting

E48.7.1 Clean all metal thoroughly and apply recommended primer.

E48.7.2 All aluminium shall be sanded prior to powder painting.

E48.7.3 Apply all materials under adequate illumination, spread evenly and flow on smoothly without runs or sags.

E48.7.4 All coats must be thoroughly dry before applying succeeding coats.

E48.7.5 All Work where a coat of material has been applied must be inspected and approved by the Contract Administrator before the application of the succeeding specified coat, otherwise no credit for the coat applied will be given, and the Contractor shall then assume the responsibility and recoat the Work in question. Report each coat applied to the

Contract Administrator when completed for inspection and approved to comply with the above. Where manufacture is not in Winnipeg the Contractor is to supply digital photos via email of each step for review and approval prior to proceeding to next step.

E48.8 Samples / Prototypes

E48.8.1 A prototype is to be manufactured and installed for the custom posts January 15, 2011. The prototypes are to be installed for review and approval at Winnipeg Transit yards, 421 Osborne, prior to manufacture of all posts. Cost of prototype is to be incidental to the prices bid on this project. The prototype shall be the minimum acceptable standard for all materials, workmanship and finishes. If prototype is approved it may be used as a unit to fulfil the Contract quantities.

E48.9 Installation

E48.9.1 Freestanding railings to be mounted to concrete sidewalk with base plates.

E48.9.2 Railings mounted to walls to be installed with brackets flush to walls.

E48.9.3 Guardrails to be mounted to concrete curbs/walls for ramps.

E48.9.4 Handrails mounted to guardrails to be installed following guardrail installation.

E48.10 Measurement and Payment

E48.10.1 Guardrails and handrails will be incidental to the lump sum price for hard landscaping for all Work as described herein and as accepted by the Contract Administrator.

E49. METAL LATTICE SCREEN

E49.1 Description

E49.1.1 This Specification shall cover the supply and installation of custom metal lattice screen.

E49.2 Materials

E49.2.1 Panels to be formed with stamped aluminum in custom RT design. Panels to be painted silver.

E49.2.2 Tubular and plate aluminium shall be 6061-T6.

E49.2.3 All stainless steel components and fastenings shall be 304 or better. Provide plastic spacers and inserts as required to ensure galvanic corrosion does not occur with aluminium components.

E49.2.4 Posts to be composed of two tubular members with a cross piece of solid aluminum. Posts to be painted blue.

E49.2.5 All paint to be powder paint. Silver colour to be PM211S11 (sparkle silver) by Protech. Blue colour to be 5005 38/40010 by Tiger Drylac.

E49.2.6 All fasteners and all mounting hardware use to fasten the shelter to the concrete base at ground level must be stainless steel or approved equal in accordance with B7.

E49.3 Detailed Design and Shop Drawings

E49.3.1 The Contractor shall submit dimensioned, detailed design drawings within five (5) working days when contacted by the Contract Administrator. The drawings shall show all details of construction, fastenings, materials and colours.

E49.3.2 The Contractor shall submit stamped engineer's drawings for review and approval within five (5) Working Days of Contract Award and prior to commencement of work. Engineer's drawings shall show all details of construction and fastenings for erections and shall be as specified or approved. Engineer shall be a structural engineer licensed to practice in Manitoba with extensive experience in the design and manufacturing of aluminium and stainless steel benches for public transit. Drawings to include concrete base requirements.

E49.3.3 Autocad files of the drawings are available to be emailed upon written request to the Contract Administrator identified in E3.

E49.4 Workmanship

E49.4.1 Proportion items to meet the National Building Code, the Manitoba Building Code and local conditions specifically relating to wind and snow loading. Items shall support loads recommended by the Code unless specific loads are indicated on the drawings.

E49.4.2 Fabricate all Work to shape and size with sharp lines, angles and smooth surfaces as defined in the drawings. Connections shall be securely welded, bolted or riveted. Welds shall be dressed smooth on exposed surfaces. Rabbets, lugs and brackets shall be provided so that the Work can be assembled in a neat substantial manner. Thickness of metal and design of assembly and support shall give ample strength and stiffness.

E49.4.3 All portions of the Work shall be neatly finished. Exposed ends and edges of metal shall be smooth. The shelters wall, roof and joints exposed to the weather shall be formed to exclude water or to drain.

E49.4.4 Insofar as possible, the Work is to be fitted and assembled in the Contractor's shop and delivered to the Site in largest practical sections.

E49.4.5 Fabricate Work in strict accordance with shop drawings. Shop drawings are to be based on details, sizes, materials shown on drawings and specified herein.

E49.4.6 Welding: All welding shall conform to the requirements of the current CSA Standard W.59 and the fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with the requirements of the current CSA Standard W.47. Welding shall be done by currently licensed welders only and certified to design welds.

E49.4.7 Manufacturer shall be a member of the Canadian Welding Bureau, or governing body where manufacture is in another country, and certified to design welds

E49.4.8 Welding splatter and other fabrication burrs where exposed shall be ground or filed smooth and left ready for subsequent operations.

E49.4.9 Assembly: Material intended for use in the various assemblies shall be straight, clean, sharply defined profiles, assembled in such a way that no disfigurements will show in the finished work, or impair the strength.

E49.4.10 Finish: Fabricated material Work shall be delivered with shop coat primer paint or E coated and other paint finish as specified. Following installation, apply a touch up coat of shop primer or galvanizing and paint to match finish to all surfaces where finish has been removed and to installation devices such as bolts, screws, welds and the like.

E49.5 Quality Control

E49.5.1 All workmanship and all material furnished and supplied under this Section 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 any materials or Works which are not in accordance with the requirements of this Section.

E49.6 Fabrication

E49.6.1 Fabrication shall be carried out in accordance with these Specifications and drawings which form a part of this Contract.

E49.6.2 The lattice screen must be constructed to resist damage from vandalism and must be simple to maintain and clean.

E49.6.3 Fasteners used in accessible locations must be of tamper proof design.

E49.7 Painting

E49.7.1 Clean all metal thoroughly and apply recommended primer.

E49.7.2 All aluminium shall be sanded prior to powder painting.

E49.7.3 Apply all materials under adequate illumination, spread evenly and flow on smoothly without runs or sags.

E49.7.4 All coats must be thoroughly dry before applying succeeding coats.

E49.7.5 Metal lattice to be painted silver.

E49.7.6 Posts to be painted blue.

E49.7.7 All Work where a coat of material has been applied must be inspected and approved by the Contract Administrator before the application of the succeeding specified coat, otherwise no credit for the coat applied will be given, and the Contractor shall then assume the responsibility and recoat the Work in question. Report each coat applied to the Contract Administrator when completed for inspection and approved to comply with the above. Where manufacture is not in Winnipeg the Contractor is to supply digital photos via email of each step for review and approval prior to proceeding to next step.

E49.8 Samples / Prototypes

E49.8.1 A prototype is to be manufactured and installed for the custom posts January 15, 2011. The prototypes are to be installed for review and approval at Winnipeg Transit yards, 421 Osborne, prior to manufacture of all posts. Cost of prototype is to be incidental to the prices bid on this project. The prototype shall be the minimum acceptable standard for all materials, workmanship and finishes. If prototype is approved it may be used as a unit to fulfil the Contract quantities.

E49.9 Installation

E49.9.1 Lattice to be installed flush to ramp structure as per details. Fastening points to be limited to post locations and are to be inconspicuous on face of lattice.

E49.9.2 Connect to concrete structure with mechanical anchors.

E49.9.3 Ensure lattice extends to finish grade of planting bed.

E49.10 Measurement and Payment

(a) Metal lattice screen will be incidental to the lump sum price for hard landscaping for all Work as described herein and as accepted by the Contract Administrator.

E50. CONCRETE SIDEWALK

E50.1 All Work in this section shall be to City of Winnipeg Specification CW 3325 for Supply and Installation of Concrete Sidewalk.

E50.2 Blockouts for all paving bands in sidewalk to be constructed as per the drawings. All forming is incidental to the unit price bid for concrete sidewalk.

E50.3 Thickened edge of sidewalk will be incidental to the unit prices bid for concrete sidewalk.

E50.4 Where concrete sidewalk is to be installed as an overlay over existing concrete a bonding agent is to be used to ensure adhesion of concrete overlay to substrate. Concrete overlay is to be a minimum of 73mm thick and the surface elevation is to match the existing adjacent paving.

E51. INTERLOCKING PAVING STONES

E51.1 Description

E51.1.1 Further to CW 3335 this Specification shall cover the:

(a) Supply and installation of interlocking paving stones (unit pavers),

(b) Supply and installation of sand setting bed,

(c) Supply and installation of grout,

E51.1.2 The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E51.2 Materials

E51.2.1 Concrete interlocking paving stones (unit pavers) shall be Holland Stone Pavers, supplied by Barkman Concrete, contact Wayne Wiebe, phone 667-3310, as shown on the drawings and as follows:

(a) Custom colour Intense Blue Holland Stone 105x210x60mm

(b) Custom colour Intense Red Holland Stone 105x210x60mm

E51.2.2 Sand:

(a) Clean brick sand as joint filler.

(b) Clean brick sand as minimum 13mm depth setting bed

E51.2.3 Grout:

(a) Grout as specified hereinafter shall be used for grouting paving stone and brick in areas indicated on the drawings. The grout shall have a compressive strength of 25 MPA at 28 days, determined on 50 mm cubes stored and tested in accordance with ASTM C109, and shall consist of normal Portland cement, sand and water.

(b) The water-cement ratio shall be kept in the range of 0.45 to 0.55.

(c) The grout shall have between 3% and 5% entrained air.

(d) Acryl-Stik or approved equal to be used in grout at approximately 4 litres Acryl-Stik to 3 litres water.

(e) Admixtures to be used in the grout shall be supplied in accordance with the requirements of the City of Winnipeg Standard CW 3310.

(f) The grout shall be of a consistency suitable for the application intended as approved by the Contract Administrator.

(g) 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 grout for approval prior to construction.

E51.3 Construction Methods

E51.3.1 Interlocking paving stones shall be installed in block out in concrete sidewalk as per the drawings.

E51.4 Installation

E51.4.1 Install sand setting bed for pavers on granular base as shown on the drawings.

E51.4.2 Contractor to verify the exact dimensions of pavers and panels prior to construction of block outs in concrete sidewalk.

(a) Install concrete sidewalk as specified on drawings.

(b) Install sand bed to minimum 13mm depth as specified on drawings. Adjust depth of pavers under areas to be relevelled to ensure surface of pavers is flush with adjacent paving.

(c) Do not compact setting bed prior to installation of pavers.

(d) Spread only sufficient area which can be covered with pavers same day.

(e) Lay pavers on sand bed hand tight.

(f) For pavers in station where depth of blockout is restricted the pavers are to be cut down in depth to match block out. All pavers that are less than 60mm thick to be grouted in place.

(g) In areas where pavers are to be grouted in place clean existing concrete, install grout bed and then place pavers on grout.

(h) Grout between pavers as required to ensure stability.

(i) Remove adjacent pavers in bands as required to ensure that bricks do not require cutting on straight bands.

(j) Where paving pattern is interrupted by vertical structural elements pavers must be sawcut and fit true and hand tight.

(k) Commence installation of pavers against edge to obtain straightest possible course for installation.

(l) Pavers shall be cut with a saw only, to obtain true even undamaged edges. Chipped pavers are unacceptable.

(m) Crews shall Work on installed pavers, not on sand layer.

(n) Spread and fine grade brick sand over paving surface and sweep into joints, in several directions. Sand is incidental to the price for supply and installation of pavers.

(o) Compact pavers with vibratory plate compactor having mass of at least 113kg. Compaction is incidental to the price for supply and installation of paving stone.

(p) Sweep remaining sand over all paving areas and remove from Site.

(q) Replace at no extra cost all whole or cut stones marked as unacceptable.

(r) Remove cracked, chipped, broken or otherwise damaged paving materials from Site immediately.

(s) Upon completion, clean in accordance with manufacturer's recommendations.

E51.5 Measurement and Payment

E51.5.1 Interlocking paving stones in the sidewalk and plaza will be incidental to the lump sum price for hard landscaping for all Work as described herein and as accepted by the Contract Administrator.

E51.5.2 Interlocking paving stones inside the station building will be incidental to the lump sum price for Architectural Work for all Work as described herein and as accepted by the Contract Administrator.

E52. DETECTABLE PAVING

E52.1 Description

E52.1.1 This Specification shall cover the supply and installation of detectable paving in sidewalk.

E52.2 Materials

E52.2.1 Detectable paving in sidewalk ramps to be 2'x4' panels of cast in place system in federal yellow by Armor-Tile as supplied by:

Alsip's Industrial Products
1 Cole Ave
Winnipeg MB, R2L 1J3
Ph: 204-667-3330
Attn. Jason Alsip

E52.2.2 Detectable paving in sidewalk ramps to be 2'x4' panels of cast in place system in federal yellow by Armor-Tile as supplied by:

Alsip's Industrial Products
1 Cole Ave
Winnipeg MB, R2L 1J3
Ph: 204-667-3330
Attn. Jason Alsip

E52.2.3 Detectable paving in at top of stairs to be custom cut 12"x12" amd 24"x24" panels of cast in place system in federal yellow by Armor-Tile as supplied by:

Alsip's Industrial Products
1 Cole Ave
Winnipeg MB, R2L 1J3
Ph: 204-667-3330
Attn. Jason Alsip

E52.2.4 Detectable paving in sidewalk ramps in station to be 2'x4' panels of surface applied system in federal yellow by Armor-Tile as supplied by:

Alsip's Industrial Products
1 Cole Ave
Winnipeg MB, R2L 1J3
Ph: 204-667-3330
Attn. Jason Alsip

E52.2.5 Detectable paving for station platform to be 2'x5' panels of cast in place system in federal yellow by Armor-Tile as supplied by:

Alsip's Industrial Products
1 Cole Ave
Winnipeg MB, R2L 1J3
Ph: 204-667-3330
Attn. Jason Alsip

E52.3 Installation

E52.3.1 Install all materials to manufacturer's Specifications. Position and shape of materials as per drawings and as directed on site by Contract Administrator.

E52.3.2 Detectable paving at stairs to be custom fit to curves. Manufacturer to provide factory cut panels to fit radii.

E52.4 Measurement and Payment

E52.4.1 Detectable panels in the sidewalk and plaza will be incidental to the lump sum price for hard landscaping for all Work as described herein and as accepted by the Contract Administrator.

E52.4.2 Detectable panels inside the station building will be incidental to the lump sum price for Architectural Work for all Work as described herein and as accepted by the Contract Administrator.

E53. TILE

E53.1 Description

E53.1.1 This Specification covers the supply and installation of porcelain tile on concrete walls including custom water jet cut logos.

E53.2 Materials

E53.2.1 Porcelain tile to be Casalgrande Padana as supplied by Julian Tile in the following styles, colours and sizes:

(a) Unicolore, Granitogres -Nero 20x20

(b) Unicolore, Granitogres -Violet 20x20

(c) Unicolore, Granitogres - Blu Forte 20x20

(d) Unicolore, Granitogres - Bianco Assoluto 20x20

(e) Caleidoscopio, Monopadana - Rosso Selenio 20x20

E53.2.2 Tile setting mortar to be Keralastic System or Grani Rapid System by Mapei.

E53.2.3 Grout to be Kerapoxy in white.

E53.3 Construction Methods

E53.3.1 Concrete surface is to be lightly sandblasted to remove laitance and / or form release.

E53.3.2 Concrete is to be at least 28 days and have a moisture content of less than 5% (ideal is 2.5%)

E53.3.3 Prepare surface as per mortar manufacturer's Specifications.

E53.3.4 Layout tile from low point in tunnel and establish level lines across face of wall.

E53.3.5 Set out overall pattern of tile ensuring colour scheme is consistent with design drawings.

E53.3.6 Determine location of all water jet cut logos.

E53.3.7 In layout determine location of horizontal and vertical expansion joints.

E53.3.8 Mix and apply mortar as per manufacturer's Specifications to achieve 95% mortar contact. Do not spread more mortar than can be covered before the mortar begins to set up.

E53.3.9 Set tiles firmly into mortar to ensure good tile to mortar contact and a flush surface across tiles.

E53.3.10 Ensure tiles are square and plumb to layout.

E53.3.11 Cut tiles as required to fit pattern.

E53.3.12 Cut edges of tiles are not to be exposed on edges of tile area.

E53.3.13 Install expansion joints to meet the most current Terrazzo, Tile and Marble Association of Canada guide.

E53.3.14 Do not cover any substrate expansion or control joints with mortar or tiles.

E53.3.15 Protect tile work with metal edger along both edges of wall expansion joints.

E53.3.16 After allowing tiles to reach firm set apply grout

E53.3.17 Do not install in freezing temperatures. Cover and protect if temperatures drop to near freezing.

E53.3.18 Joint widths to be confirmed by tile manufacturer to allow for expansion, typically 12-16mm.

E53.3.19 Grout lines to be approximately 3mm (1/8") wide.

E53.3.20 Grout lines on the top of the retaining wall must be worked to slope down to the sides so that there will be no standing water on horizontal surfaces.

E53.3.21 Grout tiles as per grout manufacturer's Specification. Clean all tile surfaces after grouting.

E53.4 Measurement and Payment

E53.4.1 Supply and installation of tile will be incidental to the lump sum price for hard landscaping for all Work as described herein and as accepted by the Contract Administrator.

E54. PROTECTIVE GRAFFITI COATING

E54.1 General

E54.1.1 Scope of Work

(a) The work comprises the furnishings of all labour, equipment, services and materials required to complete the application of graffiti coating on all vertical concrete surfaces including but not limited to Decorative Planters and exposed portion of concrete foundation.

E54.1.2 Related Works

(a) Contractor shall visit the site and verify all data and dimensions and report any errors, omissions, or discrepancies to the Contract Administrator prior to any installation.

E54.2 Submittals

E54.2.1 Include sample of material.

(a) Provide product data on specified product, describing physical characteristics and maintenance instructions.

E54.3 Material

E54.3.1 Graffiti Coating: #M74-001/M75 Aliphatic Acrylic Urethane Gloss Clear Finish by Benjamin Moore and Co. Contact Portage Avenue Paints, Phone 788-0303.

E54.3.2 Accessories and Application Equipment: As per manufacturers Specifications.

E54.4 Execution

E54.4.1 Surface Preparation and application of graffiti coating to be executed as per manufacturers Specification.

E54.4.2 Surface Preparation: Remove all loose particles, laitance, oil, grease, form release agents and any other contaminants. New concrete and masonry must be allowed to cure for a minimum of 28 days. Before painting, roughen the surface by abrasive blasting, acid etching or scarifying.

E54.4.3 Due to the rapid dry of this coating only small areas may be coated by brush, applicator pad or roller. Care must be taken to achieve the specified wet and dry film thickness. Uniform even coats must be obtained. This paint is best applied by spray, however, this type of application may not be permitted on site and must be reviewed and approved by the City of Winnipeg Health Department prior to start of application.

E54.4.4 Contractor to install Graffiti Coating on cleaned concrete surface.

E54.4.5 Graffiti Coatings to be installed as per manufacturer's Specifications and as directed by Contract Administrator on site.

E54.4.6 Maintain graffiti coating on all vertical concrete surfaces for a period of five (5) years.

E54.5 Measurement and Payment

E54.5.1 Graffiti coating will be incidental to the lump sum price for hard landscaping for all Work as described herein and as accepted by the Contract Administrator.

E55. BUS STOP FLAG AND INFORMATION KIOSK BASE INSTALLATION

E55.1 General

E55.1.1 Scope of Work

(a) The work comprises the furnishings of all labour, equipment, services and materials required to install metal bases and anchor bolts within the station platform.

E55.1.2 Related Works

(a) The Contractor is to confirm location of bases prior to forming concrete. Blockouts in concrete to be provided as per the drawings.

E55.2 Materials

E55.2.1 Metal bases and anchor bolts for flags to be supplied by Winnipeg Transit.

E55.2.2 Metal bases and anchor bolts for information kiosks to be supplied by Winnipeg Transit.

E55.3 Execution

E55.3.1 Contractor to install metal anchor bolts into concrete platform. Bolts are to be installed using template provided. Ensure bolts are installed as per sign manufacturer's requirements.

E55.3.2 Contractor to install metal bases following curing of concrete. Metal bases are to be installed plumb and level, Contractor is to use stainless steel washers to level bases as required. Contractor to notify Contract Administrator immediately if any bases are delivered damaged. Damaged units are to be replaced by sign manufacturer at no cost to Contractor or City of Winnipeg. Installation of metal bases is incidental to the unit prices bid for concrete bases.

E55.4 Measurement and Payment

E55.4.1 Installation of bases for bus stop flags and information kiosks will be incidental to the lump sum price for Architectural Work for all Work as described herein and as accepted by the Contract Administrator.

E56. ILLUMINATED SIGNS AND SIGN BOXES

E56.1 Description

E56.1.1 The Work of this Specification comprises the furnishing of all labour, equipment and materials required to complete the supply, fabrication and erection of the illuminated signs and related Work as shown on the drawings and as hereinafter specified, including, but not necessarily confined to the following:

(a) Supply, fabrication and installation of single-sided illuminated station identification displays as per design drawings.

(b) Structure to mount signs.

(c) Electrical work to connect signs.

E56.2 Design / Shop Drawings

E56.2.1 The Contractor shall submit dimensioned detailed design drawings within five (5) Business Days when called by the Contract Administrator. The drawings shall show all details of construction, fastenings, lighting, materials and colours.

E56.2.2 The Contractor shall submit stamped structural engineer's drawings for review and approval within 5 Business Days of Contract Award. Structural engineer's drawings shall show all details of construction and fastenings for erections and shall be as specified or approved in accordance with B7.

E56.2.3 The Contractor shall submit full colour design drawings of sign faces and sign boxes including materials, lighting components, connections and fastenings for review and approval within 5 Business Days of Contract Award for review and approval by Winnipeg Transit prior to start of manufacture.

E56.3 Materials

E56.3.1 The structure to be aluminium 6061-T6 structural tubing.

E56.3.2 All fastenings and hardware to be stainless steel 304 or better non-rusting in winter corrosive environment, tamper-proof and flush to exposed surface

E56.3.3 All plates to be aluminum 6061-T6. All anchor bolts and breakaway base assemblies to be galvanized steel. Galvanizing to be a zinc coating with sufficient thickness to prevent galvanic corrosion between steel and aluminium.

E56.3.4 All paint to be powder paint. Silver colour to be PM211S11 (sparkle silver) by Protech. Blue colour to be 5005 38/40010 by Tiger Drylac.

E56.3.5 Provide a detailed parts list to Winnipeg Transit including product number, product description, colour and options for all components of the signs and structures.

E56.3.6 Illuminated sign boxes:

(a) Materials shall be free from defects impairing strength, durability or appearance, and be of best commercial quality for use intended.

(b) Materials and methods used to assemble Work of this section shall be of such properties and construction to safely sustain the loads normally imposed thereon, as would be required of this type of installation.

(c) All exposed fastenings shall be of the same material, colour and finish as the metals to which these are supplied, unless otherwise specified or called for on the drawings.

(ii) All metal shall be free from scale, buckles, pits and other defects.

(a) Sign components and construction shall be as shown on the drawings and as approved by the Contract Administrator.

(b) Identification sign cabinets to be constructed of 20 ga. sheet metal with 12.5 mm F-Section vinyl retainers. Cabinet to be painted to match sign structure. Paint – PM211S11 (sparkle silver) by Protech.

(c) Sign frame and backing to be constructed of aluminium. Corner pieces to be architectural 6063-T5 cast aluminium arc forms as per drawings. Sides of sign frame to extruded aluminium.

(d) Lamps to be white LED strips. Contractor to provide lighting schematic including ballast on shop drawings. Lamps and ballasts to be high output. Light levels to meet or exceed existing illuminated structures at Osborne Junction.

(e) Acrylic to be SG (sign grade).

(f) Polycarbonate face to be 4.6 mm (3/16") clear Lexan.

(g) Background to be blue to match Tiger Drylac 5005 38/40010 paint colour.

(h) Copy to be 50 - 125 mm high Frutiger Bold as per the design drawings.

(i) All graphics to be screen printed on 3M day/night film.

(j) All Work, materials and final sign box to be CSA compliant.

E56.4 Workmanship

E56.4.1 Proportion items to meet the National Building Code and Manitoba Building Code. Items shall support loads recommended by the Code and local standards for wind and snow loading unless specific loads are indicated on the drawings.

E56.4.2 Fabricate work to shape and size with sharp lines, even curves and smooth surfaces. Connections shall be securely welded, bolted or riveted. Bolted and riveted connections are not permitted in exposed areas of the sign. Welds shall be dressed smooth on exposed surfaces. Welds/joins shall not be visible upon completion of painting operations. Rabbets, lugs and brackets shall be provided so that the Work can be assembled in a neat substantial manner. Thickness of metal and design of assembly and support shall give ample strength and stiffness.

E56.4.3 Exposed ends and edges of metal shall be smooth. Joints exposed to the weather shall be formed to exclude water or to drain.

E56.4.4 Fit and shop assemble structure as one piece and deliver to the Site. Sign boxes can be delivered separately for installation on site.

E56.4.5 Prior to proceeding with shop fabrication, take all necessary field measurements to verify dimensions or calculations from drawings.

E56.4.6 Fabricate Work in strict accordance with shop drawings, and in general to details, sizes, materials shown on drawings and specified herein.

E56.4.7 Assembly: Material intended for use in the various assemblies shall be straight, clean, sharply defined profiles, assembled in such a way that no disfigurements will show in the finished work, or impair the strength.

E56.4.8 Welding: All welding shall conform to the requirements of the current CSA Standard W.59 and the fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with the requirements of the current CSA Standard W.47. Welding shall be done by currently licensed welders only and certified to design welds.

E56.4.9 Manufacturer shall be a member of the Canadian Welding Bureau, or governing body where manufacture is in another country, and certified to design welds

E56.4.10 Welding splatter and other fabrication burrs where exposed shall be ground or filed smooth and left ready for subsequent operations.

E56.4.11 Finish: Fabricated material Work shall be delivered with e-coating, shop coat primer and paint, or other finish as specified.

E56.4.12 Following installation, apply a touch up coat of shop primer and powder paint to match finish to all surfaces where finish has been removed and to installation devices such as bolts, screws, welds and the like. Application of touch up primer and paint must follow approved method of field repair acceptable to Contract Administrator.

E56.5 Quality Control

E56.5.1 All workmanship and all material furnished and supplied under this Section 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 any materials or Works which are not in accordance with the requirements of this Section.

E56.6 Fabrication

E56.6.1 Fabrication shall be carried out in accordance with these Specifications and drawings which form a part of this Contract.

E56.6.2 Curved angle portions of sign structure are to be one piece custom cast aluminium.

E56.6.3 All joints in structure are to be filled and sanded prior to cleaning for paint preparation.

E56.6.4 Vinyl graphics to be applied to second surface of Lexan background.

E56.6.5 The workmanship shall meet established practice in modern shops.

E56.6.6 If damage occurs during fabrication, the Contract Administrator shall be notified to facilitate the implementation of remedial measures. Remedial repair measures will be subject to the approval of the Contract Administrator. Their cost will be paid by the Contractor.

E56.6.7 Dimensions and fabrication which control the field matching of parts shall receive careful attention in order to avoid field adjustments.

E56.6.8 The material shall be clean, free from rust, mill scale, and other foreign matter before being worked in the shop.

E56.6.9 All portions of the Work shall be neatly finished. Shearing, cutting, chipping and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends open joints, sharp corners and edges.

E56.7 Painting

E56.7.1 Clean all metal thoroughly and apply recommended primer.

E56.7.2 All aluminium to be sanded prior to powder painting.

E56.7.3 Apply all materials under adequate illumination, spread evenly and flow on smoothly without runs or sags.

E56.7.4 All coats must be thoroughly dry before applying succeeding coats.

E56.7.5 All Work where a coat of material has been applied must be inspected and approved by the Contract Administrator before the application of the succeeding specified coat, otherwise no credit for the coat applied will be given, and the Contractor shall then assume the responsibility and recoat the Work in question. Report each coat applied to the Contract Administrator when completed for inspection and approved to comply with the above. Where manufacture is not in Winnipeg the Contractor is to supply digital photos via email of each step for review and approval prior to proceeding to next step.

E56.8 Samples / Prototypes

E56.8.1 A prototype is to be manufactured and installed for the sign structure and sign box by the date noted in Critical Stages. The prototype is to be installed for review and approval at Eastbound Grant, nearside Laxdal prior to manufacture of signs. Cost of prototype is to be incidental to the unit prices bid on this project. The prototype shall be the minimum acceptable standard for all materials, workmanship and finishes. If prototype is approved it may be used as a unit to fulfil the Contract quantities.

E56.9 Installation and Co-ordination with Others

E56.9.1 The Contractor is advised of the following:

(a) All signs to be installed on concrete pile and pile cap. Contractor to use existing bolt assemblies where possible. Where pile cap is new, the Contractor is to supply break away assembly, anchor bolts and template to site works Contractor. Where the anchor bolts have been damaged the Contractor is to breakout existing pile cap, and supply and install new pile cap with anchor bolts.

(b) Contractor to remove from Site and dispose of existing signs and structures in a legal manner as per E10.

(c) Contractor to ensure final electrical connections can be made by electrical Contractor to electrical source at sign base. All electrical work to be done by a certified journeyman electrician.

(d) The Contractor will notify the Contract Administrator of installation date with a minimum of three (3) working days notice. Contactor is to have a listing of all completed and pending work prepared for each site meeting.

(e) Any damage to the illuminated structure or signs, incurred during fabrication, delivery, installation etc., is to be repaired to the satisfaction of the Contract Administrator within three (3) working days of installation.

(f) Contractor to supply a field repair kit including primer, paint, custom fastenings and hardware for each sign to Winnipeg Transit at time of installation.

E56.10 Measurement and Payment

E56.10.1 Illuminated signage will be incidental to the lump sum price for Architectural Work for all Work as described herein and as accepted by the Contract Administrator.