



**THE CITY OF WINNIPEG**

# **BID OPPORTUNITY**

**BID OPPORTUNITY NO. 473-2016**

**WAVERLEY STREET UNDERPASS AT CN MILE 3.89 RIVERS SUB: CONTRACT 2 –  
UNDERPASS STRUCTURE, RAILWORKS, ROADWORKS, LAND DRAINAGE  
SEWER, PUMPING STATION AND LANDSCAPING WORKS**

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## **PART B - BIDDING PROCEDURES**

### **B1. CONTRACT TITLE**

- B1.1 WAVERLEY STREET UNDERPASS AT CN MILE 3.89 RIVERS SUB: CONTRACT 2 – UNDERPASS STRUCTURE, RAILWORKS, ROADWORKS, LAND DRAINAGE SEWER, PUMPING STATION AND LANDSCAPING WORKS

### **B2. SUBMISSION DEADLINE**

- B2.1 The Submission Deadline is 12:00 noon Winnipeg time, February 22, 2017.
- 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 public Site without making an appointment. The Bidder is advised that they can view all work on Public Right Of Way at any time.
- B3.2 The Bidder is advised that they are allowed to view private land owned by Grant Memorial Church/Linden Christian School that has been fenced off by Contract 1 fencing at any time, at no time can the Bidder access any other privately owned property that is beyond what is noted on the drawing as “proposed” property line.

### **B4. BIDDERS' CONFERENCE**

- B4.1 Further to C3.1, the Contract Administrator will hold two identical non-mandatory Bidders' conference at Dillon Consulting Ltd at 1558 Wilson Place at the following dates/times:
- (a) 9:00 am to 11:00 am on January 26, 2017; and
  - (b) 9:00 am to 11:00 am on February 2, 2017.
- B4.2 The Bidder is advised that, at the Bidders' Conference:
- (a) A presentation will be given at the non-mandatory Bidders' conferences related to the major project components;
    - (i) Road Reconstruction;
    - (ii) Underpass Structure;
    - (iii) Land Drainage Sewers and Watermains;
    - (iv) Pumping Station;
    - (v) Rail Construction;
    - (vi) Miscellaneous Underground Works;
    - (vii) Landscaping Works; and
    - (viii) CN and Third Party Utility Work
  - (b) No information provided at this meeting 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 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.

B4.4 Due to space limitations, Bidders are to limit their attendance to two persons maximum, including subcontractors for one conference. Bidders are discouraged from attending both conferences.

**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 B5 unless that response or interpretation is provided by the Contract Administrator in writing.

**B6. CONFIDENTIALITY**

B6.1 Information provided to a Bidder by the City or acquired by a Bidder by way of further enquiries or through investigation is confidential. Such information shall not be used or disclosed in any way without the prior written authorization of the Contract Administrator. The use and disclosure of the confidential information shall not apply to information which:

- (a) was known to the Bidder before receipt hereof; or
- (b) becomes publicly known other than through the Bidder; or
- (c) is disclosed pursuant to the requirements of a governmental authority or judicial order.

B6.2 The Bidder shall not make any statement of fact or opinion regarding any aspect of the Bid Opportunity to the media or any member of the public without the prior written authorization of the Contract Administrator.

**B7. ADDENDA**

B7.1 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.

B7.2 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.

B7.2.1 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>

B7.2.2 The Bidder is responsible for ensuring that he/she has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

B7.3 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.

## **B8. SUBSTITUTES**

- B8.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.
- B8.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.
- B8.3 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.
- B8.4 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.
- B8.5 The Contract Administrator, after assessing the request for approval of a substitute, may in their 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.
- B8.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, to the Bidder who requested approval of the substitute.
- B8.6.1 The Contract Administrator will issue an Addendum, disclosing the approved materials, equipment, methods and products to all potential Bidders. The Bidder requesting and obtaining the approval of a substitute shall be responsible for disseminating information regarding the approval to any person or persons he/she wishes to inform.
- B8.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.
- B8.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base their 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 B19.
- B8.9 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.

## **B9. BID COMPONENTS**

- B9.1 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;
- B9.2 Further to B9.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B8.
- B9.3 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.
- B9.4 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.
- B9.4.1 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.
- B9.4.2 A hard copy of Form B: Prices must be submitted with the Bid. If there is any discrepancy between the Adobe PDF version of Form B: Prices and the Microsoft Excel version of Form B: Prices, the PDF version shall take precedence.
- B9.5 Bidders are advised not to include any information/literature except as requested in accordance with B9.1.
- B9.6 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 B19.4(a). Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.
- B9.7 Bids shall be submitted to:  
The City of Winnipeg  
Corporate Finance Department  
Materials Management Division  
185 King Street, Main Floor  
Winnipeg, MB R3B 1J1
- B10. BID**
- B10.1 The Bidder shall complete Form A: Bid, making all required entries.
- B10.2 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 their own name, their 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 their own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.
- B10.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B10.2.
- B10.3 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.

- B10.4 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 their 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 their 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.
- B10.4.1 The name and official capacity of all individuals signing Form A: Bid should be printed below such signatures.
- B10.5 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.
- B11. PRICES**
- B11.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.
- B11.1.1 Notwithstanding C12.2.3(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.
- B11.1.2 For the convenience of Bidders, and pursuant to B9.4.2 and B19.5.2 an electronic spreadsheet Form B: Prices in Microsoft Excel (.xls) format is available along with the Adobe PDF documents for this Bid Opportunity on the Bid Opportunities page at the Materials Management Division website at <http://www.winnipeg.ca/matmgt/>
- B11.2 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.
- B11.3 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.
- B11.4 Payments to Non-Resident Contractors are subject to Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).
- B11.5 Form B: Prices is organized into Parts. Bidders shall provide a total price for each Part and, on the summary sheet, a Total Bid Price consisting of the sum of prices for Part A to Part P.
- B12. CASH ALLOWANCES**
- B12.1 The Contract Price includes cash allowances (if any) stated in the Contract Documents.
- B12.2 Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, Products, construction machinery and equipment, freight, unloading, handling, storage, installation and other authorized expenses incurred in performing the Work stipulated under the cash allowance.
- B12.3 The Contract Price, and not the cash allowance, shall include the Contractor's overhead and profit in connection with such cash allowance.

- B12.4 Expenditures under cash allowances shall be authorized by the Contract Administrator. Where the actual cost of the Work under the cash allowance exceeds the amount of the cash allowance, the Contractor shall be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess, provided that the Contractor has obtained prior written approval from the Contract Administrator for any excess costs. Where the actual cost of the Work under any cash allowance is less than the amount of the allowance, the City shall be credited for the unexpended portion of the cash allowance, but not the Contractor's overhead and profit on such amount.
- B12.5 The Contract Price shall be adjusted by change order to provide for any excess or deficit to each cash allowance.
- B12.6 Progress payments on account of authorized expenditures under cash allowances shall be certified on the monthly certificates for payment.

**B13. DISCLOSURE**

- B13.1 Various Persons provided information or services with respect to this Work. In the City's opinion, this relationship or association does not create a conflict of interest because of this full disclosure. Where applicable, additional material available as a result of contact with these Persons is listed below.
- B13.2 The Persons are:
- (a) Plenary Roads Winnipeg Transitway LP – information exchange regarding general schedule of Contract 1 and Contract 2 and adjacent Southwest Rapid Transitway (Stage 2) and Pembina Highway Underpass Project in order to co-ordinate projects;
  - (b) PCL Constructor Canada Inc. – Construction industry representative to Value Engineering session held on October 21, 2014 as part of preliminary design of Waverley Underpass Project; and
  - (c) Borland Construction Inc. - Construction industry representative to Value Engineering session held on October 21, 2014 as part of preliminary design of Waverley Underpass Project.
  - (d) Subterranean (Manitoba) Ltd. - Drilling for the test caisson was carried out by Subterranean (Manitoba) Ltd. on October 2016. Summary of the test caisson investigation is included in Appendix 'A'.

**B14. QUALIFICATION**

- B14.1 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.
- B14.2 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>
- B14.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:
- (a) have successfully carried out work similar in nature, scope and value to the Work; and

- (b) be fully capable of performing the Work required to be in strict accordance with the terms and provisions of the Contract; and
- (c) have a written workplace safety and health program if required pursuant to The Workplace Safety and Health Act (Manitoba);
- (d) have successfully carried out at least three (3) deep excavations to the level that groundwater pressures have to be mitigated with construction means, methods, techniques, and equipment that are consistent with the proposed method of excavation, shoring, and dewatering detailed in the Specifications.
- (e) employ key staff who have successfully carried out at least three (3) deep excavations with construction means, methods, techniques, and equipment that are consistent with the proposed method of excavation, shoring, and dewatering detailed in the Specifications.
- (f) upon request of the Contract Administrator, obtain Security Clearances in accordance with PART F - Security Clearance;

B14.4 Further to B14.3(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 copy of their valid Manitoba COR certificate and Letter of Good Standing (or Manitoba equivalency) as issued under the Certificate of Recognition (COR) Program administered by the Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association's WORKSAFELY™ COR™ Program; or
- (b) a copy of their valid Manitoba SECOR™ certificate and Letter of Good Standing (or Manitoba equivalency) as issued under the Small Employer Certificate of Recognition Program (SECOR™) administered by the Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association's WORKSAFELY™ COR™ Program; or
- (c) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/>).

B14.5 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator that the Shoring, Dewatering and Excavation approach is consistent with the specified technical requirements of the Specifications.

B14.6 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.

- (a) Further to B14.5, proof of compliance with the requirements of B14.3(d) and B14.3(e) shall include sufficient background experience of the organization and the specific personnel involved in completing the required shoring and dewatering works for construction of the Pumping Station. Experience shall be detailed in terms of a description of previous works, its relevance to the excavation, shoring and dewatering techniques being proposed for use on this Project and references (current name, phone number, and e-mail address) to confirm the details presented. Key personnel shall be detailed with supporting resume of experience and Project specific references for each relevant project. Key personnel shall include Site Superintendent, Dewatering, shoring and excavation specialists and the Engineer assuming responsibility for the Method Statement and Shop Drawing Submission

## B15. **BID SECURITY**

B15.1 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.

B15.1.1 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.

B15.1.2 All signatures on bid securities shall be original.

B15.1.3 The Bidder shall sign the Bid Bond.

B15.1.4 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.

B15.2 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.

B15.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B15.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B15.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B15.3 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.

## B16. **OPENING OF BIDS AND RELEASE OF INFORMATION**

B16.1 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.

B16.1.1 Bidders or their representatives may attend.

B16.1.2 Bids determined by the Manager of Materials, or their designate, to not include the bid security specified in B15 will not be read out.

B16.2 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/>

B16.3 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/>

B16.4 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.

**B17. IRREVOCABLE BID**

B17.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.

B17.2 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.

**B18. WITHDRAWAL OF BIDS**

B18.1 A Bidder may withdraw their Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B18.1.1 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.

B18.1.2 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.

B18.1.3 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 B18.1.3(b), declare the Bid withdrawn.

B18.2 A Bidder who withdraws their Bid after the Submission Deadline but before their Bid has been released or has lapsed as provided for in B17.2 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.

**B19. EVALUATION OF BIDS**

B19.4 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 B14 pass/fail);
- (c) Total Bid Price;
- (d) economic analysis of any approved alternative pursuant to B8.

B19.5 Further to B19.4(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.

B19.5.1 Further to B19.4(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.

B19.5.2 The electronic Form B: Prices and the formulas imbedded in that spreadsheet are only provided for the convenience of Bidders. The City makes no representation or warranties as to the correctness of the imbedded formulas. It is the Bidder's responsibility to ensure the extensions of the unit prices and the sum of Total Bid Price performed as a function of the formulas within the electronic Form B: Prices are correct.

**B20. AWARD OF CONTRACT**

B20.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B20.2 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.

B20.2.1 Without limiting the generality of B20.2, 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.

B20.3 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 B19. Following the award of contract, a Bidder will be provided with information related to the evaluation of their 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](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 the following major activities/tasks:

##### **D2.1.1 Part A – Wilkes Intersection – Surface Works**

- (a) pavement/curb/sidewalk/median removals;
- (b) roadworks excavation;
- (c) sub-grade compaction;
- (d) placement of separation geotextile fabric and geogrid where necessary
- (e) placement of sub base and base course materials;
- (f) construction of concrete pavements;
- (g) construction of concrete curbs, bullnoses and sidewalks;
- (h) construction of active transportation pathways;
- (i) removals, salvage and installation of fencing; and,
- (j) landscaping works.

##### **D2.1.2 Part B – BGSA – Surface Works**

- (a) pavement/curb/sidewalk/median removals;
- (b) roadworks excavation;
- (c) sub-grade compaction;
- (d) placement of separation geotextile fabric and geogrid where necessary
- (e) placement of sub base and base course materials;
- (f) construction of concrete curbs, bullnoses and sidewalks;
- (g) construction of concrete curbs and gutters;
- (h) construction of asphalt and concrete pavements;
- (i) construction of active transportation pathways;
- (j) removals, salvage and installation of fencing; and,
- (K) landscaping works.

##### **D2.1.3 Part C - Detour – Surface Works**

- (a) pavement/curb/sidewalk/median removals;
- (b) clearing and grubbing;
- (c) roadworks excavation;
- (d) sub-grade compaction;
- (e) placement of separation geotextile fabric;
- (f) placement of sub base and base course materials;
- (g) construction of asphalt pavements;
- (h) construction of active transportation pathways;

- (i) construction of asphalt curbs and medians;
- (j) removals, salvage and installation of fencing;
- (k) installation of temporary street lighting;
- (l) construction of railway crossings;
- (m) removal of detour road/sidewalk asphalt surface; and,
- (n) removal of detour road/sidewalk granular structure and replacement with suitable clay fill.

D2.1.4 Part D – 1360 Taylor Avenue - Surface Works

- (a) pavement/curb/sidewalk/median removals;
- (b) roadworks excavation;
- (c) sub-grade compaction;
- (d) placement of separation geotextile fabric;
- (e) construction of pinned concrete curbs, and sidewalks;
- (f) construction of asphalt pavements; and,
- (g) landscaping works.

D2.1.5 Part E – Grant Intersection – Surface Works

- (a) pavement/curb/sidewalk/median removals;
- (b) roadworks excavation;
- (c) sub-grade compaction;
- (d) placement of separation geotextile fabric and geogrid where necessary
- (e) placement of sub base and base course materials;
- (f) construction of concrete pavements;
- (g) construction of concrete curbs, bullnoses and sidewalks;
- (h) construction of active transportation pathways;
- (i) removals, salvage and installation of fencing; and,
- (j) landscaping works.

D2.1.6 Part F – Taylor Avenue West – Surface Works

- (a) pavement/curb/sidewalk/median removals;
- (b) roadworks excavation;
- (c) sub-grade compaction;
- (d) placement of separation geotextile fabric and geogrid where necessary
- (e) placement of sub base and base course materials;
- (f) construction of concrete curbs, bullnoses and sidewalks;
- (g) construction of concrete curbs and gutters;
- (h) construction of asphalt and concrete pavements;
- (i) construction of active transportation pathways; and,
- (J) landscaping works.

D2.1.7 Part G – Wilkes Intersection – Underground Works

- (a) installation and adjustment of drainage inlets and manholes;
- (b) new trenchless LDS, manholes, catchbasins and catch pits; and,
- (c) relocate, adjust plug drains for existing hydrants.

- D2.1.8 Part H – BGSA- Underground Works/Taylor Avenue East –Underground Works
- (a) installation and adjustment of drainage inlets and manholes;
  - (b) installation of CSP culverts; and,
  - (c) new trenchless LDS, manholes, catchbasins and catch pits.
- D2.1.9 Part I – Detour – Underground Works
- (a) new trenchless LDS, manholes, catchbasins and catch pits; and,
  - (b) new hydrants and watermain.
- D2.1.10 Part J – Midtown Feeder Main Protection
- (a) add a new steel casing to the existing feeder main in CN right-of-way while the feeder main is in service.
- D2.1.11 Part K – Grant Intersection – Underground Works
- (a) installation and adjustments of drainage inlets and manholes; and,
  - (b) new trenchless LDS, manholes, catchbasin and catch pits
- D2.1.12 Part L – Taylor Avenue West – Underground Works
- (a) installation and adjustment of drainage inlets and manholes;
  - (b) new trenchless LDS, manholes, catchbasin, and catch pits;
  - (c) relocate, adjust and plug drains for existing hydrants; and,
  - (d) new watermain.
- D2.1.13 Part M – Underpass Outlet – Underground Works
- (a) new trenchless LDS, manhole, catchbasin and catch pits.
- D2.1.14 Part N – Pumping Station
- (a) construction of cast-in-place concrete Pumping Station wet well/substructure;
  - (b) construction of masonry and wood superstructure;
  - (c) construction of mechanical heating and ventilation systems;
  - (d) supply and installation of five submersible land drainage pumps complete with associated piping, controls, and instrumentation; and,
  - (e) construction of electrical, control and instrumentation systems.
- D2.1.15 Part O – Railworks
- (a) construct shoofly embankment;
  - (b) reconstruct main track embankment;
  - (c) remove shoofly embankment and shape/reclaim material to form access roads;
  - (d) stockpile remaining embankment material;
  - (e) track Construction, Shoofly Removal (by Others):
    - (i) install turnouts;
    - (ii) construct track on bridge using previously built track panels; and,
    - (iii) complete cut-overs and re-establish service on main tracks.
- D2.1.16 Part P – Bridge and OHSS
- (a) installation of rock-socketed caissons;
  - (b) supply and installation of steel H-piles for abutment foundations;
  - (c) structural excavation;
  - (d) construction of concrete abutments and pier caps;

- (e) fabrication and installation of steel reinforced elastomeric bearings;
- (f) fabrication and installation of steel plate girder spans;
- (g) construction of cast-in-place concrete deck;
- (h) construction of trainman's walkways and handrail installation;
- (i) supply and installation of expansion joints;
- (j) supply and installation of waterproofing membrane;
- (k) supply and installation of deck drains, abutment subdrains, including leads and connection to catch basins;
- (l) reconstruction of main tracks on bridge (by Others);
- (m) installation of fiber optic cable (by Others);
- (n) relocation of rail traffic on bridge (by Others);
- (o) construction of median and shoulder traffic barriers and median slab;
- (p) construction of slope paving slabs;
- (q) supply and installation of bridge electrical work;
- (r) construction of cast-in-place concrete pile foundations for new steel overhead sign support structures;
- (s) supply and installation of new steel overhead sign support structures;
- (t) supply and installation of crash attenuation systems;
- (u) construction of median and shoulder traffic barriers and median slab;
- (v) construction of OHSS bases;
- (w) fabrication and installation of OHSS's; and,
- (x) installation of roadside barriers and end treatments for overhead sign structures and other appurtenances.

### D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

- (a) **"Agreement End Date"** is the end date of the Building Canada Fund funding agreement between the City and other levels of government. This date is March 31, 2024.
- (b) **"AREMA"** means American Railway Engineering and Maintenance of Way Association;
- (c) **"ASTM"** means American Society for Testing and Materials;
- (d) **"AWWA"** means American Waterworks Association;
- (e) **"BGSA"** means basic grade separation area. This generally corresponds to the work area within Contract 2 that is critical to the construction of the Underpass. That is, the existing road, sewer, etc. must be adjusted to facilitate the elevation drop in grade to fit under the underpass structure. It includes Waverley from just north of Wilkes to Mathers, and Taylor from approximately Station 2+600 to east of Cambridge;
- (f) **"CN"** means Canadian National Railway Company, their agents, or designated representatives;
- (g) **"Contract 1"** is defined as Bid Opportunity No. 472-2016 Waverley Street Underpass at CN Mile 3.89 Rivers Sub: Contract 1 - Preliminary Underground Works and Security Fencing. Issued for Tender drawings are available on the City of Winnipeg Materials Management website. Issued for Construction drawings are available by request through the Contract Administrator;
- (h) **"Contract 2"** is defined as Bid Opportunity No. 473-2016 Waverley Street Underpass at CN Mile 3.89 Rivers Sub: Contract 2 – Underpass Structure, Railworks, Roadworks, Land Drainage Sewer, Pumping Station and Landscaping Works;

- (i) **“CSA”** means Canadian Standard Association;
- (j) **“Linden”** means the property owned by Grant Memorial Baptist Church/Linden Christian School at 877 Wilkes Avenue;
- (k) **“NSF”** means National Sanitation Foundation;
- (l) **“Others”** means any person, firm, corporation, utility or other entity employed by or having a contract directly or indirectly with the City other than through the Contractor.
- (m) **“Project Closure Date”** means up to eighteen (18) months after Substantial Completion Date but no longer than three (3) months prior to the Agreement End Date;
- (n) **“Protecting Foreman** means the CN employee or Contractor employee qualified in the Canadian Rail Operation Rules (CROR) and CN requirements. Protecting Foremen are responsible for protecting employees against Railway traffic. Protecting Foremen are charged solely with the safe movement of trains and are not responsible for the safety of the Contractor, the Contractor’s personnel or the Contractor’s equipment;
- (o) **“Pumping Station”** means the proposed Waverley Underpass Land Drainage Pumping Station at 861 Waverley Street located immediately west of Waverley Street and south of the CN Mile 3.89 Rivers Sub.
- (p) **“RFI”** means Request for Information and means written documentation sent by the Contractor to the Contract Administrator requesting written clarification(s) and/or interpretation(s) of the Drawings, Specifications and/or Contract requirements and/or other pertinent information required to complete the Work;
- (q) **“Site”** In addition to the definition of Site in GC C1.1 bb), “Site” shall also refer to lands or areas delineated in the Drawings as being furnished by the City upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by the City which are designated for the use of the Contractor for the performance of the Work;
- (r) **“Submittal”** shall be a term synonymous with the term “Shop Drawings”;

D3.2 Within the text of the Specifications, reference may be made to the following acronyms in relation to codes, standards and organizations:

AABC	Associated Air Balance Council
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGMA	American Gear Manufacturers Association
AHRI	Air-Conditioning, Heating and Refrigeration Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
APHA	American Public Health Association
API	American Petroleum Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASA	Acoustical Society of America
ASCE	American Society of Civil Engineers

ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	ASTM International (formerly American Society for Testing and Materials)
ATP	Active Transportation Pathway
AWMAC	Architectural Woodwork Manufacturers Association of Canada
AWPA	American Wood Protection Association
AWS	American Welding Society
AWWA	American Water Works Association
CAN	National Standard of Canada
CBAC	Clay Brick Association of Canada
CBM	Certified Ballast Manufacturers
CCA	Canadian Construction Association
CCMC	Canadian Construction Materials Centre
CEA	Canadian Electricity Association
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CGA	Canadian Gas Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CISPI	Cast Iron Soil Pipe Institute
CITC	Canadian Institute of Timber Construction
CIU	Canadian Institute of Underwriters
CLA	Canadian Lumberman's Association
CLSAB	Canadian Lumber Standards Accreditation Board
CMAA	Crane Manufacturers Association of America
CMHC	Canada Mortgage and Housing Corporation
CPCA	Canadian Paint and Coatings Association
CPCI	Canadian Precast/Prestressed Concrete Institute
CRCA	Canadian Roofing Contractors' Association
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSDMA	Canadian Steel Door Manufacturers Association
CSPI	Corrugated Steel Pipe Institute
CSSBI	Canadian Sheet Steel Building Institute
CTI	Cooling Technology Institute
CWB	Canadian Welding Bureau

CWC	Canadian Wood Council
CWDMA	Canadian Window & Door Manufacturers Association
DIN	Deutsche Industries Norm
EEI	Edison Electric Institute
EEMAC	Electrical Equipment Manufacturers Association of Canada
EFC	Electro-Federation Canada
EIA	Electronic Industries Alliance
EJMA	Expansion Joint Manufacturers Association
ETL	Intertek Testing Services (formerly ETL Testing Laboratories)
FCC	Federal Communications Commission (USA)
FM	Factory Mutual Engineering Corporation
FSA	Fluid Sealing Association
GANNA	Glass Association of North America
IAO	Insurers' Advisory Organization
IAPMO	International Association of Plumbing and Mechanical Officials
IBC	International Building Code (published by ICC)
IBRM	Institute of Boiler and Radiator Manufacturers
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IGMAC	Insulating Glass Manufacturers Association of Canada
ISA	International Society of Automation
ISO	International Organization for Standardization
LDS	Land Drainage System
LTIC	Laminated Timber Institute of Canada
MCAC	Mechanical Contractors Association of Canada
MFMA	Metal Framing Manufacturers Association
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NAAMM	National Association of Architectural Metal Manufacturers (USA)
NABA	National Air Barrier Association
NACE	NACE International (formerly National Association of Corrosion Engineers)
NAIMA	North American Insulation Manufacturers Association
NBC	National Building Code of Canada
NEBB	National Environmental Balancing Bureau (USA)
NEC	National Electrical Code (USA)

NECA	National Energy Conservation Association
NEMA	National Electrical Manufacturers Association (USA)
NESC	National Electric Safety Code (published by IEEE)
NFPA	National Fire Protection Association (USA)
NLGA	National Lumber Grades Authority
NRC	National Research Council Canada
NSF	National Sanitation Foundation
OECI	Overhead Electrical Crane Institute
OSHA	Occupational Safety & Health Administration (USA)
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
RMA	Rubber Manufacturers Association
RSIC	Reinforcing Steel Institute of Canada
SAE	Society of Automotive Engineers
SI	International System of Units
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association (USA)
SSPC	The Society for Protective Coatings
TAC	Transportation Association of Canada
TIAC	Thermal Insulation Association of Canada
UL	Underwriters Laboratories Inc.
ULC	Underwriters Laboratories of Canada
WCB	Workers Compensation Board (Manitoba)

D3.3 Where the edition, version or revision date of a referenced regulation, code or standard is not identified, conform to the latest edition or revision of the referenced regulation, code or standard, including amendments and revisions.

D3.3.1 Where a regulation, code or standard stipulates the edition, version or revision date of a subordinate regulation, code or standard, conform to the stipulated edition, version or revision of the subordinate regulation, code or standard to the extent of the primary regulation, code or standard.

**D4. CONTRACT ADMINISTRATOR**

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

David Wiebe, P.Eng., PTOE  
Project Manager

Telephone No. 204 453-2301

Email Address [dwiebe@dillon.ca](mailto:dwiebe@dillon.ca)

D4.2 At the pre-construction meeting, David Wiebe, P.Eng., PTOE will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D4.3 Bids Submissions must be submitted to the address in B9.7.



**D5. CONTRACTOR'S SUPERVISOR**

- D5.1 At the pre-construction meeting, the Contractor shall identify their designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.
- D5.2 At least two (2) Business Days prior to the commencement of any Work on the site, the Contractor shall provide the Contract Administrator with a phone number where the supervisor identified in D6.1 or an alternate can be contacted twenty-four (24) hours a day to respond to an emergency.

**D6. OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON DISCLOSURE**

- D6.1 The Contract, all deliverables produced or developed, and information provided to or acquired by the Contractor are the property of the City and shall not be appropriated for the Contractors own use, or for the use of any third party.
- D6.2 The Contractor shall not make any public announcements or press releases regarding the Contract, without the prior written authorization of the Contract Administrator.
- D6.3 The following shall be confidential and shall not be disclosed by the Contractor to the media or any member of the public without the prior written authorization of the Contract Administrator:
- (a) information provided to the Contractor by the City or acquired by the Contractor during the course of the Work;
  - (b) the Contract, all deliverables produced or developed; and
  - (c) any statement of fact or opinion regarding any aspect of the Contract.
- D6.4 A Contractor who violates any provision of D6 may be determined to be in breach of Contract.

**D7. NOTICES**

- D7.1 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.
- D7.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D7.3, D7.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the facsimile number identified in D4.1.
- D7.3 Notwithstanding C21, all notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following facsimile number:
- The City of Winnipeg  
Chief Financial Officer  
Facsimile No.: 204 949-1174
- D7.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following facsimile number:
- The City of Winnipeg  
Legal Services Department  
Attn: Director of Legal Services  
Facsimile No.: 204 947-9155
- D7.5 **Bids Submissions must not be submitted to this facsimile number. Bids must be submitted in accordance with B9.**

**D8. FURNISHING OF DOCUMENTS**

D8.1 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/her at cost.

**D9. BUILDING CANADA FUND – MAJOR INFRASTRUCTURE COMPONENT**

D9.1 Funding for the Waverley Street Underpass At CN Mile 3.89 Rivers Sub: Contract 2 - Underpass Structure, Railworks, Roadworks, Land Drainage Sewer, Pumping Station and Landscaping Works (Contract 2 is being provided to the City of Winnipeg by the Government of Canada (“Canada”) and The Province of Manitoba (“Manitoba”). As required by the City’s funding agreements with Canada and Manitoba, the Contractor must:

- (a) establish and maintain for a period of at least six (6) years following the date of substantial completion of Contract 2 proper and accurate financial accounts and records, including but not limited to its contracts, invoices, statements, receipts and vouchers, (including supporting documents), prepared in accordance with generally accepted accounting principles, as are necessary to properly account for the services or goods provided by the Contractor to the City;
- (b) establish and maintain for a period of at least six (6) years, beginning at the Project Closure Date of Contract 2 proper and accurate financial accounts and records including, but not limited to, its contracts, invoices, statements, receipts and vouchers, (including supporting documents), prepared in accordance with generally accepted accounting principles, as are necessary to properly account for the services or goods provided by the Contractor to the City;
- (c) permit The City, Manitoba, Canada, the Auditor General of Canada, and/or their designated representatives, to the extent permitted by law, at all times, to inspect the terms of the Contract and any records and accounts respecting the Project, and to have free access to the Project sites and any documentation relevant for the purpose of audit;
- (d) permit the City, Canada and/or Manitoba and its agents, and their respective authorized representatives, to monitor the Work and to inspect and audit the accounting and other records relating to the Work for a period of six (6) years following the Agreement End Date;
- (e) indemnify and save Manitoba and its Ministers, officers, employees and agents harmless from and against all claims and demands, losses, costs, damages, actions, suit or other proceedings brought or pursued in any manner in respect of any matter caused by the Contractor or arising from the Contract or from the goods or services provided, or required to be provided, by the Contractor, except those resulting from the negligence of any of Manitoba’s Ministers, officers, servants, employees or agents;
- (f) respect and comply with all applicable legislation and standards, whether federal, provincial or municipal, including (without limitation) labour, environmental, and human rights legislation;
- (g) consent to the City providing a copy of the Contract to Manitoba and its agent upon request from Manitoba; and
- (h) consent to the City providing Manitoba and its agents with the results of the City’s inspections and audits of the Work and of the Contractor’s accounts and records.

**D10. INFRASTRUCTURE SIGNS**

D10.1 The City of Winnipeg will be responsible for the supply and initial installation of the infrastructure signs. For each location, three (3) signs will be installed (Winnipeg, Manitoba, and Canada). The Contractor shall be responsible for the protection and any relocations of the signs at each street as required during the course of the Project. When the Contract Administrator considers the Work on the street complete, the Contractor shall remove and dispose of the signs and supports. No measurement for payment will be made for performing all operations herein described and all other items incidental to the Work described.

D10.2 Each sign is free standing, with wood frame support. Each panel is approximately 48 inches tall by 80 inches wide and must be affixed to the ground so as to remain upright in all weather conditions.

D10.3 Expected Locations of Signs are as follows:

- (a) westbound Grant Avenue, north boulevard east of Oxford Street;
- (b) westbound Taylor Avenue, centre median east of Cambridge Street ;
- (c) southbound Waverley Street, west boulevard south of Mathers Avenue;
- (d) eastbound Taylor Avenue, centre median west of Lindsay Street; and
- (e) northbound Waverley Street, east boulevard north of Hurst Way.

#### D11. **GOOD FAITH**

D11.1 Due to the Province of Manitoba's participation in funding the Waverley Street Underpass project, clause C3.2 (a) of the *General Conditions for Construction* is amended to add Members of the Legislative Assembly of Manitoba to that clause as shown in D11.2.

D11.2 C3.2 (Good Faith) The Contractor declares that, in bidding for the Work and in entering into the Contract, he:

- (a) does so in good faith and that to the best of his knowledge no member of Council or any officer or employee of the City **and no member of the Legislature Assembly of Manitoba or any officer or employee of the Province of Manitoba**, has any pecuniary interest, direct or indirect, in the Contract which has not been disclosed to and approved by the authority having jurisdiction;
- (b) has not participated in any collusive scheme or combine; and,
- (c) shall forfeit all claims under the Contract as well as refund to the City any monies paid to him, beyond his actual proven expenses for Work done, if C3.2(a) or (b) are shown to be false.

#### D12. **NO LOBBYING**

D12.1 Bidders are prohibited from engaging in any form of political or other lobbying, of any kind whatsoever in relation to this Bid Opportunity, or to influence the outcome of the procurement process.

D12.2 Without limiting the generality of D12.1, Bidders shall not contact or attempt to contact anyone other than the Contract Administrator, either directly or indirectly, at any time during the procurement process on matters related to the procurement process, the Bid Opportunity documents, or the Bids.

### **SUBMISSIONS**

#### D13. **AUTHORITY TO CARRY ON BUSINESS**

D13.1 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.

**D14. SAFE WORK PLAN**

- D14.1 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.
- D14.2 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>
- D14.3 Notwithstanding D14.1, D14.2, and Appendix 'B' CN Safety Requirements and CN Work Permit Form, the Contractor shall conform and operate in accordance with the CN "Safety Guidelines for Contractor's" for works within CN Right-of-Way.

**D15. INSURANCE**

- D15.1 The City shall provide and maintain the following owner controlled project insurance coverage to remain in place at all times during the performance of the Work:
- (a) wrap-up general liability insurance in an amount of no less than twenty-five million dollars (\$25,000,000.00) inclusive per occurrence and twenty-five millions dollars (\$25,000,000) general aggregate, covering bodily injury, personal injury, property damage and products and completed operations consistent with industry standard insurance policy wordings. Wrap up liability insurance to also include evidence of contractual liability and cross liability clauses. The Contractor shall be responsible for deductibles up to fifty thousand dollars (\$50,000.00) maximum of any one loss;
  - (b) wrap-up liability insurance shall be maintained from the date of the commencement of the Work until the date of Total Performance of the work and shall include an additional twenty-four (24) months completed operation coverage which will take affect after Total Performance; and,
  - (c) all risks course of construction insurance, including testing and commissioning, in an amount of one hundred percent (100%) of the underpass structure, land drainage and Pumping Station and track construction. Coverage will extend for at least ten (10) days after the substantial completion date and if all testing and commissioning has not been completed at that time, the policy will extend until such time as all testing and commissioning has been completed.
- D15.2 The Contractor shall be responsible for deductibles up to fifty thousand dollars (\$50,000.00) maximum of any one loss except one hundred thousand (\$100,000.00) dollars for flood and water damage.
- D15.3 The City will carry such insurance to cover the City, Manitoba, Canada, contractors, subcontractors and the Contract Administrator as insured's. Provision of this insurance by the City is not intended in any way to relieve the Contractor from their 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 remains with the contractor.
- D15.4 The Contractor shall provide and maintain the following insurance coverage at all times during the performance of the work:
- (a) commercial general liability insurance, in the minimum amount of ten million dollars (\$10,000,000) inclusive. The said Commercial General Liability insurance shall include coverage for products and completed operations, blanket contractual liability, cross liability, contingent employer's liability, owner and contractors protective, non-owned automobile, no XCU exclusion and unlicensed motor vehicle liability. Manitoba, Canada and their ministers, officers, employees and agents, the City and Canadian National Railway shall be added as additional insured's. The policy to specifically include liability

for operations within or around railroads and railway tracks. Subrogation will be waived against the City, Manitoba, Canada and Canadian National Railway;

- (b) Contractors Pollution Liability (CPL) insurance in the amount of at least five million dollars (\$5,000,000) per occurrence and ten million dollars (\$10,000,000) aggregate covering third party injury and property damage claims, including clean-up costs and transported cargo as a result of pollution conditions arising from the Contractor's operations and completed operations. Such policy shall name the City, Manitoba and Canada as additional insureds and include a twenty-four (24) month extended reporting period;
- (c) automobile liability Insurance covering all motor vehicles, owned and operated and used or to be used by the Contractor directly or indirectly in the performance of the Work. The Limit of Liability shall not be less than five million dollars (\$5,000,000) inclusive for loss or damage including personal injuries and death resulting from any one accident or occurrence; and,
- (d) property insurance for site office and contents, washroom, equipment and tools used on the Project that may be owned, rented, leased or borrowed. Subrogation will be waived against the City, Manitoba, Canada and the Canadian National Railway.

D15.5 All policies must be taken out with insurers licensed to carry on business in the Province of Manitoba.

D15.6 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.

D15.7 The Contractor shall provide the Contract Administrator with evidence of insurance at least five (5) 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 the Contract. The evidence shall be in a form of a certificate of insurance and must be satisfactory to the City Solicitor.

D15.8 All policies shall be in a form satisfactory to the City of Winnipeg and shall be kept in full force during the Work.

## D16. **PERFORMANCE SECURITY**

D16.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

- (a) a performance bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H1: Performance Bond), in the amount of fifty percent (50%) of the Contract Price; or
- (b) an irrevocable standby letter of credit issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form attached to these Supplemental Conditions (Form H2: Irrevocable Standby Letter of Credit), in the amount of fifty percent (50%) of the Contract Price; or
- (c) a certified cheque or draft payable to "The City of Winnipeg", drawn on a bank or other financial institution registered to conduct business in Manitoba, in the amount of fifty percent (50%) of the Contract Price.

D16.1.1 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.

D16.2 If the bid security provided in their Bid was not a certified cheque or draft pursuant to B15.1(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.

**D17. DETAILED PRICES**

D17.1 The Contractor shall provide the Contract Administrator with a detailed price breakdown (Form I: Detailed Prices) for the Pumping Station 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 Contractor shall state a price for each item or sub-item of the Work identified on Form I: Detailed Prices. The detailed prices must be consistent with the price(s) provided in the Contractor's Bid.

**D18. SUBCONTRACTOR LIST**

D18.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the General Conditions for the return of the executed Contract.

**D19. EQUIPMENT LIST**

D19.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment List) at or prior to a pre-construction meeting, or at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in the C4.1 for the return of the executed Contract.

**D20. DETAILED WORK SCHEDULE**

D20.1 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.

D20.2 The Detailed Work Schedule shall consist of a "baseline schedule" component showing the planned start and completion dates for all activities/tasks. In addition, the Detailed Work Schedule shall consist of an "update schedule" component showing the Contractor's updated planned or actual start, progress and completion dates for each activity/task as construction proceeds in order to compare Contractor's planned baseline schedule versus actual execution of the Work.

D20.3 The Contractor's planned baseline Detailed Work Schedule will be reviewed by Contract Administrator as a Submittal for conformance to the Project intent and general conformance to the requirements of the Contract.

D20.4 Contractor shall not change the baseline portion of the Detailed Work Schedule, once it has been reviewed without issue by Contract Administrator, without prior consent or until requested by the Contract Administrator.

D20.5 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) capacity to show simultaneously the planned baseline schedule as well as the update schedule for each activity/task; and,
- (d) all acceptable to the Contract Administrator.

- D20.6 Further to D20.5(a), the C.P.M. schedule shall at a minimum clearly identify the start and completion dates of the activities/tasks listed in D2.1, distributed into the Phases/Stages shown in Drawings C2-GE-025 through C2-GE-052. The critical path shall be highlighted. In addition to the items in D2.1, and further detail as determined by the Contractor, the following shall be included:
- (a) Date of Commencement of the Work;
  - (b) Mobilization to Site;
  - (c) Critical Stages as listed in D31;
  - (d) Substantial Performance;
  - (e) Total Performance;
  - (f) Demobilization from Site; and
  - (g) Landscaping Maintenance and other Maintenance.
- D20.7 Further to D20.5(b), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each activity/task, or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.
- D20.8 Without changing the baseline portion of the Detailed Work Schedule, at least once per month or within two (2) Working Days upon request from the Contract Administrator, Contractor shall accurately update the "update schedule".
- D20.9 Should Contractor's operations fall behind the accepted Detailed Work Schedule, Contractor shall, at no change in Contract Price, take corrective action to get back on schedule.
- D20.10 Contractor shall provide sub-schedules to define critical portions of the Work upon reasonable request from the Contract Administrator.

**D21. ENVIRONMENTAL PROTECTION PLAN**

- D21.4 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 all of the Contractor's chosen means and methods towards performing the Work that may impact the environment. 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.
- D21.5 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:
- (a) Federal
    - (i) Canadian Environmental Protection Act (CEPA) C.33;
    - (ii) Fisheries Act C.F-14;
    - (iii) Hazardous Products Act C.H.-3; and
    - (iv) Transportation of Dangerous Goods Act and Regulations C.34.
  - (b) Provincial
    - (i) The Dangerous Goods Handling and Transportation Act D12;
    - (ii) The Endangered Species Act E111;
    - (iii) The Environment Act C.E125;
    - (iv) The Fire Prevention Act F80;
    - (v) The Manitoba Heritage Resources Act H39-1;
    - (vi) The Manitoba Noxious Weeds Act N110;
    - (vii) The Manitoba Nuisance Act N120;
    - (viii) Pesticides and Fertilizers Control Act P40;

- (ix) The Public Health Act C.P210; and
  - (x) The Workplace Safety and Health Act W210.
- (c) Municipal
- (i) The City of Winnipeg By-law Neighbourhood Liveability No. 1/2008 and all amendments;
  - (ii) The City of Winnipeg Traffic By-law No. 1573/77 and all amendments;
  - (iii) The City of Winnipeg Sewer By-law No. 92/2010 and all amendments; and
  - (iv) Any other applicable Acts, Regulations, and By-laws and associated updates and amendments.

D21.6 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 materials and 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) Noise and Vibration control / management plan that identifies means and methods proposed for mitigating noise and vibration complaints/issues, namely for pile driving.
- (m) Monitor and report to ensure implementation of environmental protection measures.

D21.7 Fires

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

D21.8 Disposal of Waste

- (a) Dispose all waste at licensed facilities or with licensed haulers.
- (b) Dispose of all sewage and seepage from the on-site sanitary facilities in accordance with the City of Winnipeg Sewer By-law No. 92/2010.



- (c) Do not bury waste materials on Site.
- (d) Do not dispose of solid or liquid wastes in drains or waterways.

#### D21.9 Noise and Vibration

- (a) General
  - (i) The following sections (b) and (c) are intended as information only for the Contractor to assist in developing the noise and vibration control/management plan indicated in D21.6(l).
- (b) Vibration
  - (i) Vibration due to construction activities has the potential to cause human annoyance and result in complaints as well as cause structural damage to nearby buildings. Human perception of vibration typically occurs at much lower levels than those that can result in structural damage. Pre-consultation with stakeholders prior to start of construction activities and proper management of their complaints (if any) through a complaint response plan can help reduce concerns / complaints.
  - (ii) Manitoba Sustainable Development (MSD) does not have guideline limits for ground vibration other than for quarry operations. The Manitoba Regulation MR65/92 specifies a limit of 12 mm/s for residential areas near quarry operations, which relates mainly to blasting operations at quarries. The Ontario Ministry of the Environment and Climate Change (MOECC) has a publication on ground vibration specific to impulse vibrations (NPC-207) which specifies a limit on peak vibration velocity of 0.30 mm/s for both daytime and night time (for 20 or more impulses during the observation period). The International Standards Organization (ISO) Standard 2631 (ISO-2631) *Part 2: Continuous and Shock Induced Vibrations in Buildings (1 to 80 Hz)* recommends a Peak Particle Velocity (PPV) of 0.30 mm/s for continuous vibration during daytime, 0.14 mm/s for night time and between 5 to 10 mm/s for transient short duration events for residential areas. The City of Toronto By-law on Construction and Demolition Vibration provides specific guidelines on zones of influence and prohibited construction vibrations for various frequencies [Toronto Municipal Code - Chapter 363 – Building Construction and Demolition – 2014]. The City of Toronto prohibits any construction activity that results in vibrations exceeding 8 mm/s for frequencies of less than 4 Hz, 15 mm/s for frequencies between 4 and 10 Hz and 25 mm/s for frequencies of greater than 10 Hz.
- (c) Noise
  - (i) Noise due to construction activities has the potential to cause human annoyance, especially in rural settings or during night time hours where the background noise levels are typically lower.
  - (ii) Limiting noise is a driving factor in City regulations applicable to this Contract including Restricted Work Hours listed under Clause 3.10 of CW 1130 and D28.

#### D21.10 Hazardous Waste

##### D21.10.1 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.

D21.10.2 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.

D21.10.3 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) store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum; and
  - (v) 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 (ULC) Certified Mark or Factory Mutual (FM) Approved Mark;
  - (ii) storage of quantities of flammable and combustible liquids exceeding 100 litres for Work purposes requires the written approval of the Contract Administrator; and
  - (iii) fuel storage exceeding 100 litres shall be a minimum distance of 100 m 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 one hundred and ten percent (110%) capacity;
  - (ix) do not store within 30 m of a waterway or drain;
  - (x) have appropriate emergency spill response equipment available near storage area, including personal protective equipment; and
  - (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 Sustainable Development (MSD) Accident Reporting Line at 204-944-4888 in accordance with Manitoba Regulation 439/87 of the Dangerous Goods and Transportation Act; and
  - (iii) Submit a written spill report to the Contract Administrator outlining cause and proposed corrective action and MSD as required. Provide copies of reports submitted to MSD to the Contract Administrator.

D21.10.4 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 copy of shipping documents and waste manifests to the Contract Administrator;
  - (v) track receipt of completed manifest from consignee after shipping dangerous goods. Provide a copy of completed manifest to the Contract Administrator; and
  - (vi) report discharge, emission, or escape of hazardous materials immediately to the Contract Administrator and appropriate provincial authority. Take measures to control release.

D21.10.5 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; and
  - (iv) disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

D21.10.6 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; and
  - (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; and
  - (ii) routinely inspect all erosion and sediment control measures and installations and immediately repair any deficiencies.

D21.10.7 Work Adjacent Waterways

- (a) Do not operate construction equipment in waterways and, where possible, avoid operating equipment within 30 m 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 m way from a watercourse.

D21.10.8 Drainage

- (a) Provide temporary drainage and pumping as necessary to keep excavations and Site free from water as per D22.
- (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.

D21.10.9 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; and
  - (iii) avoid soil compaction where possible.

D21.10.10 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.

D21.10.11 CN Environmental Requirements

- (a) Carry out all measures which CN, in its sole discretion considers necessary to keep the work free and clear of all environmental contaminants or residue results from the Contractor's occupation or use of the CN's premises (Premises), such condition to be

confirmed by a post-termination environmental inspection/audit of the Premises to be carried out by CN. The Contractor shall be solely responsible for the cost of all work carried out to correct any environmental contamination which occurs on the Premises, or which occurs on other lands as a result of the Contractor's occupation or use of the Premises.

- (b) CN shall have the right to enter upon the Premises, at all reasonable times and from time to time, in order to inspect the Premises and conduct or require the Contractor to conduct, at the Contractor's expense, such tests as may be required to verify the condition of the Premises.
- (c) The Contractor shall be responsible to notify CN of all environmental contamination that the Contractor suspects is occurring on or escaping onto the Premises from adjacent lands or resulting from third party occupation.
- (d) If the Contractor fails to correct any environmental contamination to the satisfaction of CN and any public authority having jurisdiction, CN may perform such work by its employees or agents. CN may charge the Contractor from time to time for all the costs incurred by CN in correcting such environmental contamination, plus fifteen percent (15%) for overhead, and the Contract shall pay CN's invoice or invoices for such costs within ten (10) Calendar Days of receipt of each invoice. In the event such remedial work is carried out by any public authority, the cost of such work shall be borne by the Contractor.
- (e) Upon completion of the Contract, the Contractor shall leave the Premises in a clean and tidy condition, free of any environmental contamination resulting from or occurring during the Contractor's occupation or use of the Premises. If the Contractor has installed any facility on or under the Premises, the Contractor shall remove such facility. The Contractor shall have the burden of proving that any environmental contamination has not resulted from or occurred during its occupation or use of the Premises.
- (f) The responsibility of the Contractor to CN with respect to the environmental obligations contained herein shall continue to be enforceable by CN.

## **D22. DEWATERING AND DRAINAGE DURING CONSTRUCTION**

- D22.1 In addition to C6 and in co-ordination with E104, the Contractor is solely responsible for planning, implementing, maintaining and monitoring an effective dewatering and drainage system for the Site during performance of the Work.
- D22.2 The Contractor is responsible for the control, diversion, storage and pumping of all water including without limitation rain, snow melt, groundwater, leaking infrastructure and water in pipes throughout all stages of the Work.
- D22.3 Be aware, a portion of the Work involves connecting the new land drainage system to portions of the existing land drainage system that are located below the operating levels of SRB 6-22 which are identified on the Drawings. The low elevation of the proposed underpass is also well below the operating levels of SRB 6-22.
- D22.4 The Contractor shall submit a Dewatering and Drainage Plan to the Contract Administrator at least fourteen (14) Calendar Days of prior to commencement of Work at the Site. As construction progresses and the Contractor's chosen means and methods of dewatering and drainage change, the Contractor shall submit to the Contract Administrator, and obtain Contract Administrator's review without issue, revised Dewatering and Drainage Plans to communicate changes to the Contractor's Dewatering and Drainage Plan in advance of the Contractor implementing the changes. The Dewatering and Drainage Plan submittal shall include the following at a minimum:
  - (a) co-ordination and consistency with the Groundwater Management Plan for Pumping Station, which shall be a separate Submittal, as specified in E104.5;

- (b) a sketch or sketches of the Site clearly showing the drainage scheme and flow paths including temporary and permanent features such as ditches/swales, pipe route and layout, pump staging, pump redundancy, groundwater well pumps as required in E104.5, storage elements and connections or outlets to the existing land drainage system;
  - (c) information for all pumps to be used including make, model, pump curves, noise attenuation features (to be less than 65 dBa), pump power source, design calculations showing the anticipated pumped flow, operating and control description;
  - (d) information for all pipe used including material, diameter, length, fittings, connections, restraints, blocking, protection features;
  - (e) dimensions for all swales and ditches to be used;
  - (f) description of all erosion protection measures and material used;
  - (g) monitoring and maintenance plan including Contractor's designated contact person responsible for dewatering and drainage, inspection intervals and means for supervising and monitoring pumping activity; and,
  - (h) any other related information reasonably requested by the Contract Administrator.
- D22.5 Contractor shall only discharge to the land drainage system meeting in accordance with the requirements specified. The combined sewer system is ineligible to use for discharge as part of the scheme identified in the Contractor's Dewatering and Drainage Plan(s).
- D22.6 Do not pump or drain any water containing excessive suspended materials or harmful substances into waterways, sewers or other drainage systems. Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with governing authority's limitations and requirements.
- D22.7 The Contractor shall be responsible for all damages within or outside the Site directly resultant from Contractor's actions, omissions or neglect which may be caused by or which may result from water backing up, flowing through, overflowing or excessive surcharge of drainage systems.
- D22.8 The Contractor shall organize and bear all costs related to the effective dewatering of excavations and all other pumping and drainage necessary for the proper execution of the Work, including keeping the pipes, structures, shafts, excavations and trenches free of undesirable accumulations of groundwater, seepage, surface water, melt water or rainwater.
- D22.9 Dispose of all water drained or pumped as above by discharging it to drainage ditches or natural water course as reviewed by the Contract Administrator, and in compliance with all local, Municipal, Provincial and Federal environmental regulations, ordinances, bylaws, etc., and provide documentation indicating that authority has been granted to discharge effluent water into any drainage ditch, brook, creek or river. Contractor shall develop and implement at their own cost any filtration, settlement or other acceptable treatment methods required prior to disposal.
- D22.10 Keep all drainage channels, gutters, swales, ditches, sewers, culverts and disposal areas free of silt, sand, debris and gravel and remove such deposits as required.
- D22.11 Accept responsibility for any actionable damage, inconvenience or interference caused by the dewatering and drainage operations to the surrounding properties, yards, businesses, fields, houses, other buildings, roads, streets, approaches, driveways, utilities, services or other improvements which may be affected by a lowering or raising of the water table and bear all costs of repair, replacement, reinstatement or alteration of same.
- D22.12 Notwithstanding the measurement and payment terms of E104, dewatering and drainage during construction, including groundwater not related to Pumping Station construction, will be considered incidental to the Contract and there will be no measurement and payment item for this portion of the Work.

**D23. SITE PLAN**

D23.1 The Contractor shall provide the Contract Administrator with a Site 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.

D23.2 The Contractor shall submit a Site Plan for Phase I of the Work to the Contract Administrator with:

- (a) access points from public roads to laydown areas;
- (b) construction access crossings of the rail lines (if any);
- (c) fenced laydown area locations including gates;
- (d) staging areas for various types of work (Undergrounds, Rail, Roadworks, etc.); and
- (e) office facility locations with power supply, for both the Contractor and Contract Administrator.

D23.3 Site Plans after Phase I to be submitted after Phase I works are underway.

**D24. WORK PRACTICES ON ASBESTOS CEMENT PIPE**

D24.4 Further to C.6.26(d), the Contractor's attention is directed to the possible health dangers associated with working with asbestos cement pipe and all work associated with the existing AC watermains shall conform to the following publications:

- (a) the Contractor shall address in the Safe Work Plan outlined in D15 the proposed procedure for working on AC Pipe. Contractor shall also provide proof of asbestos handling training or certification; and,
- (b) further to D21.10.5, the Contractor shall dispose of all asbestos containing waste materials at a disposal site licenced to accept asbestos.

**SCHEDULE OF WORK**

**D25. COMMENCEMENT**

D25.1 The Contractor shall not commence any Work until he/she is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D25.2 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 D13;
  - (ii) evidence of the workers compensation coverage specified in C6.15;
  - (iii) the Safe Work Plan specified in D14;
  - (iv) evidence of the insurance specified in D15;
  - (v) the performance security specified in D16;
  - (vi) the detailed prices specified in D17;
  - (vii) the Subcontractor list specified in D18;
  - (viii) the equipment list specified in D19;
  - (ix) the detailed work schedule specified in D20;
  - (x) the Environmental Protection Plan specified in D21;
  - (xi) the Dewatering and Drainage Plan specified in D22.4; and
  - (xii) the Site Plan specified in D23.
- (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; and,

- (c) the Contractor has provided proof of CN Contractor Safety Training for each individual proposed to work on the Site to the Contract Administrator.

- D25.3 The Contractor shall not commence OHSS S784 on private property prior to receipt of confirmation from the City of Winnipeg and Contract Administrator regarding successful acquisition of the property in question.
- D25.4 Be aware that the City is anticipating an overall crossing agreement with CN will be in place by May 1, 2017. Work on CN property shall not commence until the crossing agreement is in place.
- D25.5 The Contractor shall not commence work on CN property until the Contractor has a completed CN Work Permit as included in Appendix 'B'.
- D25.6 The Contractor will not access or commence mobilization of the Site until after May 1, 2017 but before May 31, 2017 unless otherwise approved by the Contract Administrator.
- D25.7 The City intends to award this Contract by May 1, 2017.

**D26. DAMAGE TO EXISTING STRUCTURES AND PROPERTY**

- D26.1 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.
- D26.2 Any damage cause by the Contractor or their Subcontractors to the adjacent structures or properties shall be promptly repaired by the Contractor at their own expense to the satisfaction of the Contract Administrator.

**D27. ENCROACHMENT ON PRIVATE PROPERTY**

- D27.1 Further to Section 3.11 of CW 1130 of the General Requirements, the Contractor shall confine their work to the Site at all times, except if he has received written permission from the property owner to use lands outside of Site. The Contractor shall provide the Contract Administrator with a copy of any written permission he has received to enter onto private property, if requested by the Contract Administrator, and the Contractor is solely responsible for all costs associated with such arrangements.
  - (a) Private property for which the City has obtained temporary construction easements or permanent easements is excluded from the requirements of D27.1.
- D27.2 The Contractor's construction activities shall be confined to the minimum area necessary for undertaking the work and they shall be responsible for all damage to private property resulting from their work. Particular care shall be taken to assure no damage is done to building, fencing, trees and plants, and provision shall be made to maintain full drainage for private properties during construction.

**D28. RESTRICTED WORK HOURS**

- D28.1 Further to clause 3.10 of CW 1130, the Contractor shall require written permission forty-eight (48) hours in advance from the Contract Administrator for any work to be performed between 2000 hours and 0700 hours, or on Saturdays, Sundays, Statutory Holidays and or Civic Holidays.
  - (a) It is anticipated that some stages of the Work will require work to be performed during these times.

**D29. WORK BY OTHERS**

- D29.1 City reserves the right to enter into multiple separate contracts directly or indirectly in connection with Contract 2 of which the Work is a part, or do certain work by City forces.



- D29.2 Contractor shall coordinate the Work of this Contract with the work of Others and City forces so as to not hinder, delay or interfere with the Others and/or City forces in the performance of their work. Contractor shall connect their Work with the work of Others as shown in the Contract.
- D29.3 Contractor shall report to the Contract Administrator any apparent deficiencies in other's and/or City's work which would affect the Work of this Contract immediately as they come to Contractor's attention and Contractor shall confirm such report in writing within ten (10) Calendar Days of becoming aware of the deficiency. Failure by Contractor to so report shall invalidate any claims against the City by reason of the deficiencies of other's and/or City forces work except as to those of which Contractor was not reasonably aware.
- D29.4 Work by Others on, adjacent to or near the Site may include but are not necessarily limited to:
- (a) Manitoba Telecom Services – Relocation/protection of existing lines;
  - (b) Shaw – Relocation/protection of existing lines;
  - (c) Manitoba Hydro – Removal/relocation of existing hydro poles and street lighting;
  - (d) Manitoba Hydro Gas Division – Relocation/protection of existing lines;
  - (e) TeraSpan – Relocation/protection of existing lines;
  - (f) Bell-Fiber - Relocation, temporary and permanent;
  - (g) CN – Fiber relocation, temporary and permanent;
  - (h) CN – CN Signal and Communication Works - Signal and communication cable and train movement control signal installation;
  - (i) CN and CN's agents/contractors - Shoofly and Mainline track construction and Shoofly track removal;
  - (j) Outfront Media/Winnipeg Transit – removal/reinstallation of bus stop shelter from concrete base SB Waverley Street approx. Sta 1+535 (reinstall Sta 1 +630) and NB Waverley Street approx. Sta 1+455 (reinstall Sta 1+470). Various removal/reinstallation of bus stop flags and signage;
  - (k) City of Winnipeg Traffic Services – Erection and maintenance of temporary traffic control signs in accordance with Section 2.04 of the “Manual of Temporary Traffic Control on City Streets (Revision 1 – 2016)” and E10. Supply and installation of permanent traffic signs and bases;
  - (l) City of Winnipeg Traffic Services –Modification/installation of line painting. Installation required throughout various Phases/Stages of the Work;
  - (m) City of Winnipeg Traffic Signals – Removal/modification of existing traffic signals plant and Installation of new Traffic Signals plant. Modifications/installations required throughout various Phases/Stages of the Work; and,
  - (n) Borland Construction Inc. – Contract 1 Contractor – underground LDS and watermain works to be substantially completed by May 1, 2017 in advance of commencement of Contract 2. LDS outfall to SRB 6-22 for future connection to Contract 2 LDS. The Contract 2 Project area encompasses the Contract 1 area. The Contractor will be required to co-ordinate with Contract 1 works

D30. **SEQUENCE OF WORK**

- D30.1 Further to C6.1, the sequence of work shall be as follows:
- (a) the Work is divided into four Phases. Each Phase is subdivided into stages. Stages are further subdivided into major items of work; and,
  - (b) refer to Staging Drawings C2-GE-025 to C2-GE-052 for the proposed sequence of work.

### D31. CRITICAL STAGES

D31.1 As noted on Drawing C2-GC-025, the Contractor shall achieve critical stages of the Work in accordance with the following requirements:

- (a) Phase I – Detour Construction
  - (i) Shoofly Rail Embankment shall be completed and ready for laying of ballast and track by Others by July 15, 2017;
  - (ii) All roadworks on Waverley Street north of Mathers Avenue and all roadworks on Grant Avenue shall be completed by September 22, 2017;
  - (iii) Detour roadway shall be open to traffic by October 2, 2017; and,
  - (iv) Stage 2 must occur and be completed on a weekend between 17:30 Friday and 04:00 Monday (specific weekend subject to Contract Administrator approval).
- (b) Phase II – Bridge Construction
  - (i) Mainline Railway Embankment shall be completed and ready for laying of ballast and track by Others by July 23, 2018;
  - (ii) Bridge Structure shall be completed by August 17, 2018; and,
  - (iii) Stage 3 must occur and be completed on a weekend between 17:30 Friday and 04:00 Monday (specific weekend subject to Contract Administrator approval).
- (c) Phase III – Underpass Construction
  - (i) Underpass area excavation shall be completed by March 1, 2019;
  - (ii) Waverley Underpass roadway open to traffic by September 23, 2019;
  - (iii) Pumping Station shall be commissioned and operating by September 23, 2019; and,
  - (iv) Stage 2 must occur and be completed on a weekend between 17:30 Friday and 04:00 Monday (specific weekend subject to Contract Administrator approval).

D31.2 When the Contractor considers the Work associated with each critical stage to be completed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Completion. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.

D31.3 The date on which each critical stage has been accepted by the Contract Administrator as being completed to the requirements of the Contract is the date on which completion of that critical stage has been achieved.

### D32. WORK ADJACENT TO 1360 TAYLOR AVENUE (PIAZZA DE NARDI)

D32.1 The limits of the available right of way adjacent to the 1360 Taylor Avenue complex are shown on the drawings. The land was formerly leased to 1360 Taylor Avenue, including the west parking lot, the “globe” sign, landscaped area around said sign, and the refuse container area. The Contractor may occupy these areas excluding the “globe” sign, refuse area, and parking stalls along the north-south parking lot aisle. Contractor erected fencing or other structures may not impinge on vehicular movements for the property.

D32.2 The Contractor shall not commence work on the 1360 Taylor Avenue property until authorization is received from the Contract Administrator.

### D33. TRANSIT SHELTER RELOCATIONS

D33.1 Through the coordination of the Contract Administrator, the removal and installation of these transit shelter structures shall be done by Outfront Media. The locations of these shelters are as follows:

- (a) shelter number 7777/7778 is located at the SE corner of Waverley and Wilkes Ave. with bus stop location #60216; and,

- (b) shelter number 7779/7780 are located at the NW corner of Waverley and Wilkes Ave. with bus stop location #60217.

D33.2 Through the coordination of the Contract Administrator, the removal and installation of these transit shelter structures shall be done by Winnipeg Transit. The locations of these shelters are as follows:

- (a) bus stop location #60730 is located at the NE corner of Waverley/ Wilkes at Chamois; and,
- (b) bus stop location #60303 is located at the NW corner Grant/Cambridge

D34. **SUBSTANTIAL PERFORMANCE**

D34.1 The Contractor shall achieve Substantial Performance by November 1, 2019.

D34.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be re-inspected.

D34.3 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.

D35. **TOTAL PERFORMANCE**

D35.1 The Contractor shall achieve Total Performance by July 31, 2020.

D35.2 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.

D35.3 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.

D36. **LIQUIDATED DAMAGES**

D36.1 If the Contractor fails to achieve Critical Stages, Substantial Performance or Total Performance in accordance with the Contract by the days (or hours if indicated) fixed herein for same, the Contractor shall pay the City the following amounts per Calendar Day (or per hour if indicated) for each and every Calendar Day (or each and every full hour if indicated) following the days (or hours if indicated) fixed herein for same during which such failure continues:

- (a) Phase I – Detour Construction
  - (i) D31.1(a)(i) - Twenty thousand dollars (\$20,000.00);
  - (ii) D31.1(a)(ii) - Four thousand dollars (\$4,000.00);
  - (iii) D31.1(a)(iii) - Five thousand dollars (\$5,000.00); and,
  - (iv) D31.1(a)(iv) - One thousand dollars (\$1,000.00) per hour.
- (b) Phase II – Bridge Construction
  - (i) D31.1(b)(i) - Twenty thousand dollars (\$20,000.00);
  - (ii) D31.1(b)(ii) - Six thousand dollars (\$6,000.00); and,
  - (iii) D31.1(b)(iii) - One thousand dollars (\$1,000.00) per hour.
- (c) Phase III – Underpass Construction

- (i) D31.1(c)(i) - One thousand dollars (\$1,000.00);
    - (ii) D31.1(c)(ii) - Two thousand dollars (\$2,000.00);
    - (iii) D31.1(c)(iii) - Three thousand dollars (\$3,000.00); and,
    - (iv) D31.1(c)(iv) - One thousand dollars (\$1,000.00) per hour.
  - (d) Substantial Performance - Ten thousand dollars (\$10,000.00); and,
  - (e) Total Performance - Three thousand dollars (\$3,000.00).
- D36.2 The amounts specified for liquidated damages in D36.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve Critical Stages, Substantial Performance or Total Performance by the days (or hours) fixed herein for same.
- D36.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.
- D37. **ACCELERATED COMPLETION**
- D37.1 This Specification shall cover the accelerated completion of the Works of this Contract.
- D37.2 At no risk to the City, the Contractor at his own initiative, means, and expense, may undertake to complete the Works of this Contract to facilitate the safe reopening of traffic following weekend traffic shutdown periods described in Critical Stages D31.1(a)(iv), D31.1(b)(iii), and D31.1(c)(iv) specified here.
- (a) In recognition of the fact that an early completion of Critical Stages D31.1(a)(iv), D31.1(b)(iii), and D31.1(c)(iv) is of benefit to the City, the City will compensate the Contractor for said early completion on a per hour unit price basis, as hereinafter set out, provided that the City will not be liable to pay for any period of acceleration in excess of twenty four (24) Hours.
  - (b) It is noted that certain delays during construction are normal, due to site conditions, necessary layout and dimensional changes. The Contract Administrator will attempt to resolve the situation as soon as possible. The Contractor is advised that no extension to time will be given for events of this sort which cause construction delays.
  - (c) It is also noted that work by Others will be ongoing during the Work, including temporary traffic control installations by the City of Winnipeg Traffic Services, traffic signal installations by City of Winnipeg Traffic Signals, track and signal works by CN, and Others as required. Coordination and accommodation of work by Others shall be considered integral and incidental to the work and no extension of time will be given for delays related to coordination and/or accommodation of work by Others.
  - (d) The final determination of compensable acceleration or delay shall be at the sole discretion of the Contract Administrator.
- D37.3 Method of Measurement
- (a) Subject to Clause D37.2 hereof, accelerated completion will be measured on a unit basis per hour. The number of hours to be paid for will be the total number of full hours which the intended roadways and sidewalks are safely re-opened to vehicular and pedestrian traffic in advance of the Critical Stage(s) specified herein, with all specified Works completed acceptable to the Contract Administrator.
- D37.4 Basis of Payment
- (a) Subject to Clause D37.2 hereof, accelerated completion will be paid for at the Unit Price per hour specified hereinafter for "Accelerated Completion" which price shall be payment in full for performing all operations undertaken and all other items incidental to the Work included in this Specification. The Unit Price for Accelerated Completion shall be one thousand dollars (\$1,000.00) per hour.

- (b) Payment for this item is not identified on Form B: Prices, and shall not be included thereon. If accelerated completion does occur as specified herein, then payment will be made for this item as a change to the Contract.

#### **D38. SCHEDULED MAINTENANCE**

- D38.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:
- (a) Maintenance of Sod Areas as specified in CW 3510;
  - (b) Maintenance of Seed Areas as specified in CW 3520;
  - (c) Maintenance of Trees and Shrubs and Planting Beds as specified in E49;
  - (d) Reflective Crack Maintenance during two (2) year maintenance warranty period as specified in CW 3250; and,
  - (e) Crack sealing the interface between all Curb and Gutter and Asphalt Pavements shall be completed as per E27 one year after Substantial Performance has been achieved, unless directed by the Contract Administrator.
- D38.2 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**

##### **D39. JOB MEETINGS**

- D39.1 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.
- D39.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he/she deems it necessary.

##### **D40. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)**

- D40.1 Further to C6.26, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).
- D40.2 Borland Construction Inc. shall be considered the Prime Contractor of the construction project site in accordance with The Workplace Safety and Health Act (Manitoba) from commencement of the Work of Contract 1 until commencement of the Work of Contract 2.
- D40.3 The Contractor for Contract 2 shall be considered the Prime Contractor of the construction project site in accordance with The Workplace Safety and Health Act (Manitoba) upon commencement of the Work of Contract 2 until completion of Contract 2.
- (a) The Contractor is advised that work will be performed by Others on the site as described in D29, and the duties of the Prime Contractor under The Workplace Safety and Health Act (Manitoba) include co-ordination of the workplace safety and health programs of other employers working at a construction project site.

**D41. THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA) – QUALIFICATIONS**

D41.1 Further to B14.4, the Contractor/Subcontractor must, throughout the term of the Contract, have a Workplace Safety and Health Program meeting the requirements of The Workplace Safety and Health Act (Manitoba). At any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require updated proof of compliance, as set out in B14.4.

**D42. LAYOUT OF THE WORKS**

D42.1 Further to C6 and CW 1130 Clause 3.15, the Contract Administrator will provide the following:

- (a) basic centrelines and an elevation of the proposed works for:
  - (i) Part A-F - Landscaping Works only;
  - (ii) Part G-I, K-M - Underground Works;
  - (iii) Part J - Midtown Feeder Main Protection;
  - (iv) Part N - Pumping Station;
  - (v) Part O – Railworks; and,
  - (vi) Part P – Bridge and OHSS.
- (b) reference lines and final design elevations of the proposed works at intervals and offsets deemed necessary by the Contract Administrator for:
  - (i) Part A-F - Surface Works (excluding Landscaping Works).

D42.2 The Contractor shall be responsible for the following related to D42.1(a):

- (a) 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;
- (b) 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 their own expense;
- (c) 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 their discretion;
- (d) 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; and,
- (e) the Contractor shall arrange and carry on their Work so as not to conflict with the collection of any data in anyway by the Contract Administrator. The Contractor shall adjust Work and/or remove any interference as directed by the Contract Administrator at the expense of the Contractor.

D42.3 The Contractor shall be responsible for the following related to D42.1(b):

- (a) the layout of any additional grades required as deemed necessary by the Contractor. Grades that the Contractor is responsible for includes but is not limited to sub-grade, sub-base, and base course elevations;
- (b) the Contractor shall provide all required instruments and competent personnel for performing all layouts. Any Work found to be defective due to errors in layout by the Contractor shall be corrected at the expense of the Contractor;
- (c) 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 their discretion;
- (d) 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. The Contract Administrator shall be notified at least two (2) Working Days prior to expecting replacement of any benchmarks, stakes, and other items used to convey the basic data to the Contractor;

- (e) the Contractor shall arrange and carry on their Work so as not to conflict with the collection of any data and layout of reference lines and design elevations in anyway by the Contract Administrator. The Contractor shall adjust Work and/or remove any interference as directed by the Contract Administrator at the expense of the Contractor.

## **MEASUREMENT AND PAYMENT**

### **D43. PAYMENT**

- D43.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

### **D44. PAYMENT SCHEDULE**

- D44.1 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-rated 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.

### **D45. WARRANTY**

- D45.1 Notwithstanding C13.2, the warranty period shall begin on the date of Substantial Performance and shall expire two (2) year 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.
  - D45.1.1 For the purpose of Performance Security, the warranty period shall be two (2) year.
- D45.2 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 Substantial 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.
  - D45.2.1 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 D16)

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. 473-2016

**WAVERLEY STREET UNDERPASS AT CN MILE 3.89 RIVERS SUB: CONTRACT 2 – UNDERPASS STRUCTURE, RAILWORKS, ROADWORKS, LAND DRAINAGE SEWER, PUMPING STATION AND LANDSCAPING 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)



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

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

\_\_\_\_\_  
(Date)

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

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

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

\_\_\_\_\_  
(Name of bank or financial institution)

Per: \_\_\_\_\_  
(Authorized Signing Officer)

Per: \_\_\_\_\_  
(Authorized Signing Officer)

**FORM I: DETAILED PRICES**

(See D17)

**WAVERLEY STREET UNDERPASS AT CN MILE 3.89 RIVERS SUB: CONTRACT 2 – UNDERPASS  
 STRUCTURE, RAILWORKS, ROADWORKS, LAND DRAINAGE SEWER, PUMPING STATION AND  
 LANDSCAPING WORKS**

ITEM NO.	DESCRIPTION	SPEC. REF.	UNIT	APPROX. QUANTITY	UNIT PRICE	AMOUNT
1.	Sub Structure					
2.						
3.						
4.						
5.						
6.						
7.	Pumping Station Super Structure					
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						
17.	Pumping Station Process Mechanical Systems					
18.						
19.						
20.						
21.						
22.						
23.						
24.						
25.						

**FORM I: DETAILED PRICES**

(See D17)

**WAVERLEY STREET UNDERPASS AT CN MILE 3.89 RIVERS SUB: CONTRACT 2 – UNDERPASS  
 STRUCTURE, RAILWORKS, ROADWORKS, LAND DRAINAGE SEWER, PUMPING STATION AND  
 LANDSCAPING WORKS**

ITEM NO.	DESCRIPTION	SPEC. REF.	UNIT	APPROX. QUANTITY	UNIT PRICE	AMOUNT	
26.	Pumping Station Plumbing and HVAC Systems						
27.							
28.							
29.							
30.							
31.							
32.							
33.							
34.							
35.		Pumping Station Electrical, Instrumentation and Control Systems					
36.							
37.							
38.							
39.							
40.							
41.							
42.							
43.							
44.							
45.							
46.							
47.							
48.							
49.							

**FORM J: SUBCONTRACTOR LIST**  
 (See D18)

**WAVERLEY STREET UNDERPASS AT CN MILE 3.89 RIVERS SUB: CONTRACT 2 – UNDERPASS  
 STRUCTURE, RAILWORKS, ROADWORKS, LAND DRAINAGE SEWER, PUMPING STATION AND  
 LANDSCAPING WORKS**

<u>Portion of the Work</u>	<u>Name</u>	<u>Address</u>
A, B, C, D, E, F: SURFACE WORKS::		
<u>Supply of Materials:</u>		
Concrete		
Asphalt		
Base Course & Sub-Base		
Geotextile Materials		
Sub-drain Pipe		
Roadside Hazard Barrier Systems		
<u>Installation/Placement:</u>		
Asphalt Planing		
Concrete		
Asphalt		
Base Course & Sub-Base		
Roadside Hazard Barrier Systems		
<u>LANDSCAPING:</u>		
<u>Supply of Materials:</u>		
Topsoil and Soil Amendments		
Plant Material – Trees and Shrubs		
Seed Mixes		
Bluegrass/Fescue Sod		
Interlocking Paving Stones		
Site Furnishings		
Fencing		
<u>Installation/Placement:</u>		
Topsoil and Soil Amendments		
Plant Material – Trees and Shrubs		
Seed Mixes		
Bluegrass/Fescue Sod		

**FORM J: SUBCONTRACTOR LIST**  
 (See D18)

**WAVERLEY STREET UNDERPASS AT CN MILE 3.89 RIVERS SUB: CONTRACT 2 – UNDERPASS  
 STRUCTURE, RAILWORKS, ROADWORKS, LAND DRAINAGE SEWER, PUMPING STATION AND  
 LANDSCAPING WORKS**

<u>Portion of the Work</u>	<u>Name</u>	<u>Address</u>
Interlocking Paving Stones		
Site Furnishings		
Fencing		
<u>G, H, I, J, K, L, M-UNDERGROUND WORKS</u>		
Pipe Installations in a trench		
Trenchless pipe installations		
<u>N: PUMPING STATION</u>		
<u>Supply of Materials:</u>		
Sub Structure Works		
Super Structure		
Mechanical		
HVAC Systems		
Electrical Systems		
Instrumentation		
Control Systems		
Process Systems		
<u>Installation/Placement:</u>		
Sub Structure Works		
Super Structure		
Sub Structure Works		
Super Structure		
Mechanical		
HVAC Systems		
Electrical Systems		
Instrumentation		
Control Systems		
Process Systems		
<u>O: RAILWORKS</u>		

**FORM J: SUBCONTRACTOR LIST**  
(See D18)

**WAVERLEY STREET UNDERPASS AT CN MILE 3.89 RIVERS SUB: CONTRACT 2 – UNDERPASS  
STRUCTURE, RAILWORKS, ROADWORKS, LAND DRAINAGE SEWER, PUMPING STATION AND  
LANDSCAPING WORKS**

<u>Portion of the Work</u>	<u>Name</u>	<u>Address</u>
<u>Supply of Materials:</u>		
Subballast		
<u>P: BRIDGE AND OHSS</u>		



**FORM K: EQUIPMENT**  
(See D19)

Waverley Street Underpass at CN Mile 3.89 Rivers sub: Contract 2 – Underpass Structure, Railworks, Roadworks, Land Drainage Sewer, Pumping Station and Landscaping Works

<p><b>1. Category/type: Earth Moving / Excavation</b></p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p>
<p><b>2. Category/type: Base Placement/Compaction/Grading</b></p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p>
<p><b>3. Category/type: Concrete Slipform Paving</b></p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Min Calendar Days Committed to Project: _____</p> <p>Registered owner: _____</p>

**FORM K: EQUIPMENT**  
(See D19)

Waverley Street Underpass at CN Mile 3.89 Rivers sub: Contract 2 – Underpass Structure, Railworks,  
Roadworks, Land Drainage Sewer, Pumping Station and Landscaping Works

**4. Category/type: Asphalt Paving – Asphalt Curb**

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

**5. Category/type: Miscellaneous**

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

**6. Category/type: Asphalt Milling**

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

**FORM K: EQUIPMENT**  
(See D19)

Waverley Street Underpass at CN Mile 3.89 Rivers sub: Contract 2 – Underpass Structure, Railworks,  
Roadworks, Land Drainage Sewer, Pumping Station and Landscaping Works

**7. Category/type: Other**

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

**8. Category/type: Other**

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

**9. Category/type: Other**

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

Make/Model/Year: \_\_\_\_\_ Min Calendar Days Committed to Project: \_\_\_\_\_

Registered owner: \_\_\_\_\_

## 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 Appendix 'B' CN Safety Requirements & Work Permit Form take precedence on all matters within CN property.

E1.4 The following are applicable to the Work:

<u>Specification No.</u>	<u>Specification Title</u>
<b>DIVISION 01</b>	<b>GENERAL REQUIREMENTS</b>
01 65 00	EQUIPMENT INSTALLATION
01 77 00	CLOSEOUT PROCEDURES
01 78 00	CLOSEOUT SUBMITTALS
01 91 13	GENERAL COMMISSIONING REQUIREMENTS
<b>DIVISION 04</b>	<b>MASONRY</b>
04 04 00	COMMON WORK RESULTS FOR MASONRY
04 05 12	MASONRY MORTAR AND GROUT
04 05 19	MASONRY ANCHORAGE AND REINFORCING
04 22 00	CONCRETE UNIT MASONRY
04 43 26	DIMENSION STONE VENEER
<b>DIVISION 05</b>	<b>METALS</b>
05 50 00	METAL FABRICATIONS
<b>DIVISION 06</b>	<b>WOOD, PLASTICS, AND COMPOSITES</b>
06 05 73	WOOD TREATMENT
06 10 00	ROUGH CARPENTRY
06 17 53	SHOP-FABRICATED WOOD TRUSSES
<b>DIVISION 07</b>	<b>THERMAL &amp; MOISTURE PROTECTION</b>
07 11 13	BITUMINOUS DAMPPROOFING
07 21 13	BOARD INSULATION
07 21 16	BLANKET INSULATION
07 26 00	AIR VAPOUR BARRIERS
07 46 13	PREFORMED METAL SIDING
07 61 00	SHEET METAL ROOFING
07 84 00	FIRE STOPPING
07 92 00	JOINT SEALANTS

**DIVISION 08**

08 11 00  
08 71 00

**OPENINGS**

METAL DOORS AND FRAMES  
DOOR HARDWARE

**DIVISION 09**

09 91 00  
09 96 23  
09 97 00

**FINISHES**

PAINTING – BUILDINGS  
GRAFFITI RESISTANT COATINGS  
SPECIALTY COATING FOR CONCRETE

**DIVISION 10**

10 44 16.19

**SPECIALTIES**

FIRE EXTINGUISHERS AND SAFETY BLANKETS

**DIVISION 21**

21 05 01

**MECHANICAL GENERAL REQUIREMENTS**

COMMON WORK RESULTS FOR MECHANICAL

**DIVISION 22**

22 11 16  
22 42 01

**PLUMBING**

DOMESTIC WATER PIPING  
PLUMBING SPECIALTIES AND ACCESSORIES

**DIVISION 23**

23 05 23.01  
23 05 29  
23 05 48  
23 05 53.01  
23 05 93  
23 07 13  
23 07 15  
23 09 33  
23 11 23  
23 31 13.01  
23 33 00  
23 33 15  
23 33 16  
23 34 00  
23 34 25  
23 35 16  
23 37 13  
23 37 20  
23 44 00  
23 73 11

**HEATING, VENTILATING, AND AIR CONDITIONING**

VALVES - BRONZE  
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT  
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT  
MECHANICAL IDENTIFICATION  
TESTING, ADJUSTING AND BALANCING FOR HVAC  
DUCT INSULATION  
THERMAL INSULATION FOR PIPING  
ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC  
FACILITY GAS PIPING  
METAL DUCTS – LOW PRESSURE TO 500 PA  
AIR DUCT ACCESSORIES  
DAMPERS – OPERATING  
DAMPERS – FIRE AND SMOKE  
HVAC FANS  
PACKAGED ROOF AND WALL EXHAUSTERS  
ENGINE EXHAUST SYSTEMS  
DIFFUSERS, REGISTERS AND GRILLES  
LOUVRES, INTAKES AND VENTS  
HVAC AIR FILTRATION  
AIR HANDLING UNITS – PACKAGED

**DIVISION 26**

26 05 00  
26 05 01  
26 05 02  
26 05 03  
26 05 04  
26 05 05  
  
26 05 20  
26 05 21  
26 05 25  
26 05 28  
26 05 29  
26 05 31  
26 05 32  
26 05 36  
26 05 37

**ELECTRICAL**

COMMON WORK RESULTS – FOR ELECTRICAL  
SCOPE OF ELECTRICAL WORK  
CONNECTIONS TO MECHANICAL EQUIPMENT  
SYSTEMS DEMONSTRATION AND INSTRUCTION  
STARTING OF ELECTRICAL EQUIPMENT AND SYSTEM  
TESTING, ADJUSTING AND BALANCING OF ELECTRICAL EQUIPMENT AND SYSTEMS  
  
WIRE AND BOX CONNECTORS 0 – 1000 V  
WIRES AND CABLES 0 – 1000 V  
CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS  
GROUNDING  
FASTENINGS AND SUPPORTS  
SPLITTERS, JUNCTION BOXES, PULL BOXES AND CABINETS  
OUTLET BOXES, CONDUIT BOXES AND FITTINGS  
CABLE TRAYS FOR ELECTRICAL SYSTEMS  
WIREWAYS AND AUXILIARY GUTTERS

26 05 43.01	INSTALLATION OF CABLES IN TRENCHES AND IN DUCTS
26 05 70	COORDINATION AND SHORT CIRCUIT STUDY
26 09 23	METERING AND SWITCHBOARD INSTRUMENTS
26 12 16.01	DRY TYPE TRANSFORMERS UP TO 600 V - PRIMARY
26 24 16.01	PANELBOARDS – BREAKER TYPE
26 24 19	MOTOR CONTROL CENTRE
26 27 26	WIRING DEVICES
26 28 16.02	MOULDED CASE CIRCUIT BREAKERS
26 28 23	DISCONNECT SWITCHES FUSED AND NON-FUSED UP TO 600 V - PRIMARY
26 29 03	CONTROL DEVICES
26 29 10	MOTOR STARTERS TO 600 V
26 29 13.20	COMBINATION SOFT START CONTROLLERS
26 32 14	POWER GENERATION NATURAL GAS
26 36 23	AUTOMATIC TRANSFER SWITCHES
26 43 00	SURGE PROTECTION DEVICES
26 80 00	COMMISSIONING OF ELECTRICAL SYSTEMS

**DIVISION 40**

**PROCESS INTEGRATION**

40 05 90.01	CAST IRON SLIDE GATES AND APPURTENANCES
40 05 90.02	STAINLESS STEEL SLIDE GATES AND APPURTENANCES
40 23 19.01	PROCESS PIPE HANGARS AND SUPPORTS
40 23 19.03	STEEL PROCESS PIPE AND FITTINGS
40 90 00	COMMON WORK – INSTRUMENTATION AND CONTROL
40 90 01	PROCESS CONTROL NARRATIVE
40 91 00	TRANSMITTER AND INDICATORS
40 95 13	ENCLOSURES
40 95 14	MISCELLANEOUS PANEL DEVICES
40 95 53	SWITCHES AND RELAYS
40 95 56	POWER SUPPLIES
40 95 73	INSTRUMENTATION CABLE
40 96 05	INSTRUMENTATION SPECIFICATION SHEETS
40 96 10	INSTRUMENT LOOP DRAWINGS
40 96 12	INSTRUMENT STANDARD DRAWINGS
40 96 15	PLC I-O INDEX
40 96 20	INSTRUMENTATION INDEX
40 96 30	PROGRAMMABLE LOGIC CONTROLLERS
40 96 35	CONTROL AND OPERATOR INTERFACE REQUIREMENTS
40 96 50	SITE ACCEPTANCE TEST

**DIVISION 41**

**MATERIAL PROCESSING AND HANDLING EQUIPMENT**

41 22 23	MONORAIL HOISTS
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**DIVISION 43**

**PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT**

43 21 39.02	SUBMERSIBLE PUMPS
43 21 43.01	VERTICAL AXIAL FLOW PUMPS

City of Winnipeg  
Drawing No.

Contract  
 Administrator Drawing Name/Title  
Drawing No.

**GENERAL**

U-239-2016-C2-GE-001	C2-GE-001	COVER_SHEET
U-239-2016-C2-GE-002	C2-GE-002	DRAWING LIST
U-239-2016-C2-GE-003	C2-GE-003	GENERAL LAYOUT AND MAJOR ITEMS OF WORK
U-239-2016-C2-GE-004	C2-GE-004	WAVERLEY REMOVALS (1 OF 8)
U-239-2016-C2-GE-005	C2-GE-005	WAVERLEY REMOVALS (2 OF 8)

U-239-2016-C2-GE-006	C2-GE-006	WAVERLEY REMOVALS (3 OF 8)
U-239-2016-C2-GE-007	C2-GE-007	WAVERLEY REMOVALS (4 OF 8)
U-239-2016-C2-GE-008	C2-GE-008	WAVERLEY REMOVALS (5 OF 8)
U-239-2016-C2-GE-009	C2-GE-009	WAVERLEY REMOVALS (6 OF 8)
U-239-2016-C2-GE-010	C2-GE-010	WAVERLEY REMOVALS (7 OF 8)
U-239-2016-C2-GE-011	C2-GE-011	WAVERLEY REMOVALS (8 OF 8)
U-239-2016-C2-GE-012	C2-GE-012	TAYLOR REMOVALS (1 OF 8)
U-239-2016-C2-GE-013	C2-GE-013	TAYLOR REMOVALS (2 OF 8)
U-239-2016-C2-GE-014	C2-GE-014	TAYLOR REMOVALS (3 OF 8)
U-239-2016-C2-GE-015	C2-GE-015	TAYLOR REMOVALS (4 OF 8)
U-239-2016-C2-GE-016	C2-GE-016	TAYLOR REMOVALS (5 OF 8)
U-239-2016-C2-GE-017	C2-GE-017	TAYLOR REMOVALS (6 OF 8)
U-239-2016-C2-GE-018	C2-GE-018	TAYLOR REMOVALS (7 OF 8)
U-239-2016-C2-GE-019	C2-GE-019	TAYLOR REMOVALS (8 OF 8)
U-239-2016-C2-GE-020	C2-GE-020	HURST REMOVALS (1 OF 2)
U-239-2016-C2-GE-021	C2-GE-021	HURST REMOVALS (2 OF 2)
U-239-2016-C2-GE-022	C2-GE-022	WILKES REMOVALS
U-239-2016-C2-GE-023	C2-GE-023	GRANT REMOVALS (1 OF 2)
U-239-2016-C2-GE-024	C2-GE-024	GRANT REMOVALS (2 OF 2)
U-239-2016-C2-GE-025	C2-GE-025	CONSTRUCTION STAGING OVERVIEW AND GENERAL NOTES
U-239-2016-C2-GE-026	C2-GE-026	CONSTRUCTION STAGING – PHASE I – STAGE 1 (1 OF 4)
U-239-2016-C2-GE-027	C2-GE-027	CONSTRUCTION STAGING – PHASE I – STAGE 1 (2 OF 4)
U-239-2016-C2-GE-028	C2-GE-028	CONSTRUCTION STAGING – PHASE I – STAGE 1 (3 OF 4)
U-239-2016-C2-GE-029	C2-GE-029	CONSTRUCTION STAGING – PHASE I – STAGE 1 (4 OF 4)
U-239-2016-C2-GE-030	C2-GE-030	CONSTRUCTION STAGING – PHASE I – STAGE 2 (1 OF 2)
U-239-2016-C2-GE-031	C2-GE-031	CONSTRUCTION STAGING – PHASE I – STAGE 2 (2 OF 2)
U-239-2016-C2-GE-032	C2-GE-032	CONSTRUCTION STAGING – PHASE I – STAGE 3 (1 OF 1)
U-239-2016-C2-GE-033	C2-GE-033	CONSTRUCTION STAGING – PHASE II – STAGE 1 (1 OF 4)
U-239-2016-C2-GE-034	C2-GE-034	CONSTRUCTION STAGING – PHASE II – STAGE 1 (2 OF 4)
U-239-2016-C2-GE-035	C2-GE-035	CONSTRUCTION STAGING – PHASE II – STAGE 1 (3 OF 4)
U-239-2016-C2-GE-036	C2-GE-036	CONSTRUCTION STAGING – PHASE II – STAGE 1 (4 OF 4)
U-239-2016-C2-GE-037	C2-GE-037	CONSTRUCTION STAGING – PHASE II – STAGE 2 (1 OF 4)
U-239-2016-C2-GE-038	C2-GE-038	CONSTRUCTION STAGING – PHASE II – STAGE 2 (2 OF 4)
U-239-2016-C2-GE-039	C2-GE-039	CONSTRUCTION STAGING – PHASE II – STAGE 2 (3 OF 4)
U-239-2016-C2-GE-040	C2-GE-040	CONSTRUCTION STAGING – PHASE II – STAGE 2 (4 OF 4)
U-239-2016-C2-GE-041	C2-GE-041	CONSTRUCTION STAGING – PHASE II – STAGE 3 (1 OF 1)
U-239-2016-C2-GE-042	C2-GE-042	CONSTRUCTION STAGING – PHASE II – STAGE 4 (1 OF 1)
U-239-2016-C2-GE-043	C2-GE-043	CONSTRUCTION STAGING – PHASE III – STAGE 1 (1 OF 3)
U-239-2016-C2-GE-044	C2-GE-044	CONSTRUCTION STAGING – PHASE III – STAGE 1 (2 OF 3)
U-239-2016-C2-GE-045	C2-GE-045	CONSTRUCTION STAGING – PHASE III – STAGE 1 (3 OF 3)
U-239-2016-C2-GE-046	C2-GE-046	CONSTRUCTION STAGING – PHASE III – STAGE 2 (1 OF 3)
U-239-2016-C2-GE-047	C2-GE-047	CONSTRUCTION STAGING – PHASE III – STAGE 2 (2 OF 3)
U-239-2016-C2-GE-048	C2-GE-048	CONSTRUCTION STAGING – PHASE III – STAGE 2 (3 OF 3)
U-239-2016-C2-GE-049	C2-GE-049	CONSTRUCTION STAGING – PHASE IV – STAGE 1 (1 OF 3)
U-239-2016-C2-GE-050	C2-GE-050	CONSTRUCTION STAGING – PHASE IV – STAGE 1 (2 OF 3)
U-239-2016-C2-GE-051	C2-GE-051	CONSTRUCTION STAGING – PHASE IV – STAGE 1 (3 OF 3)
U-239-2016-C2-GE-052	C2-GE-052	CONSTRUCTION STAGING – PHASE IV – STAGE 2 (1 OF 1)

## CIVIL – STRUCTURAL

U-239-2016-C2-CS-001	C2-CS-001	GENERAL NOTES AND CLEARANCE DIAGRAM
U-239-2016-C2-CS-002	C2-CS-002	BRIDGE SITE PLAN
U-239-2016-C2-CS-003	C2-CS-003	ROAD AND RAILWAY PROFILE AT BRIDGE SITE
U-239-2016-C2-CS-004	C2-CS-004	GENERAL ARRANGEMENT OF BRIDGE
U-239-2016-C2-CS-005	C2-CS-005	EXCAVATION PLAN
U-239-2016-C2-CS-006	C2-CS-006	EXCAVATION DETAILS
U-239-2016-C2-CS-007	C2-CS-007	BORING LOGS – SHEET 1
U-239-2016-C2-CS-008	C2-CS-008	BORING LOGS – SHEET 2

U-239-2016-C2-CS-009	C2-CS-009	BORING LOGS – SHEET 3
U-239-2016-C2-CS-010	C2-CS-010	BORING LOGS – SHEET 4
U-239-2016-C2-CS-011	C2-CS-011	BORING LOGS – SHEET 5
U-239-2016-C2-CS-012	C2-CS-012	BORING LOGS – SHEET 6
U-239-2016-C2-CS-013	C2-CS-013	BORING LOGS – SHEET 7
U-239-2016-C2-CS-014	C2-CS-014	FOUNDATION LAYOUT
U-239-2016-C2-CS-015	C2-CS-015	FOUNDATION DETAILS – SHEET 1
U-239-2016-C2-CS-016	C2-CS-016	FOUNDATION DETAILS – SHEET 2
U-239-2016-C2-CS-017	C2-CS-017	ABUTMENT SU.1 AND SU.5 CONCRETE DETAILS – SHEET 1
U-239-2016-C2-CS-018	C2-CS-018	ABUTMENT SU.1 AND SU.5 CONCRETE DETAILS – SHEET 2
U-239-2016-C2-CS-019	C2-CS-019	ABUTMENT SU.1 AND SU.5 REINFORCING DETAILS - SHEET 1
U-239-2016-C2-CS-020	C2-CS-020	ABUTMENT SU.1 AND SU.5 REINFORCING DETAILS – SHEET 2
U-239-2016-C2-CS-021	C2-CS-021	ABUTMENT SU.1 AND SU.5 REINFORCING DETAILS – SHEET 3
U-239-2016-C2-CS-022	C2-CS-022	PIER SU.2, SU.3 AND SU.4 CONCRETE DETAILS
U-239-2016-C2-CS-023	C2-CS-023	PIER SU.2, SU.3 AND SU.4 REINFORCING DETAILS – SHEET 1
U-239-2016-C2-CS-024	C2-CS-024	BEARING LAYOUT
U-239-2016-C2-CS-025	C2-CS-025	BEARING DETAILS – SHEET 1
U-239-2016-C2-CS-026	C2-CS-026	BEARING DETAIL – SHEET 2
U-239-2016-C2-CS-027	C2-CS-027	STEEL GIRDER LAYOUT
U-239-2016-C2-CS-028	C2-CS-028	STEEL GIRDER DETAILS SPAN 1 AND 4 (17.60 m)
U-239-2016-C2-CS-029	C2-CS-029	STEEL GIRDER DETAILS SPAN 2 (17.20 m)
U-239-2016-C2-CS-030	C2-CS-030	STEEL GIRDER DETAILS SPAN 3 (21.70 m)
U-239-2016-C2-CS-031	C2-CS-031	STEEL GIRDER DETAILS – SHEET 1
U-239-2016-C2-CS-032	C2-CS-032	STEEL GIRDER DETAILS – SHEET 2
U-239-2016-C2-CS-033	C2-CS-033	STEEL GIRDER CAMBER DIAGRAM SPAN 1 AND 2
U-239-2016-C2-CS-034	C2-CS-034	STEEL GIRDER CAMBER DIAGRAM SPAN 3 AND 4
U-239-2016-C2-CS-035	C2-CS-035	DECK SLAB LAYOUT
U-239-2016-C2-CS-036	C2-CS-036	DECK SLAB CONCRETE DETAILS
U-239-2016-C2-CS-037	C2-CS-037	DECK SLAB REINFORCING PLAN – SPAN 1 AND 4
U-239-2016-C2-CS-038	C2-CS-038	DECK SLAB REINFORCING PLAN – SPAN 2
U-239-2016-C2-CS-039	C2-CS-039	DECK SLAB REINFORCING PLAN – SPAN 3
U-239-2016-C2-CS-040	C2-CS-040	DECK SLAB REINFORCING DETAILS – SHEET 1
U-239-2016-C2-CS-041	C2-CS-041	DECK SLAB REINFORCING DETAILS – SHEET 2
U-239-2016-C2-CS-042	C2-CS-042	TRAINMAN'S WALKWAY LAYOUT
U-239-2016-C2-CS-043	C2-CS-043	TRAINMAN'S WALKWAY CONCRETE DETAILS
U-239-2016-C2-CS-044	C2-CS-044	TRAINMAN'S WALKWAY REINFORCING DETAILS
U-239-2016-C2-CS-045	C2-CS-045	
U-239-2016-C2-CS-046	C2-CS-046	EXPANSION JOINT DETAILS – SHEET 1
U-239-2016-C2-CS-047	C2-CS-047	EXPANSION JOINT DETAILS – SHEET 2
U-239-2016-C2-CS-048	C2-CS-048	EXPANSION JOINT DETAILS – SHEET 3
U-239-2016-C2-CS-049	C2-CS-049	EXPANSION JOINT DETAILS – SHEET 4
U-239-2016-C2-CS-050	C2-CS-050	EXPANSION JOINT DETAILS – SHEET 5
U-239-2016-C2-CS-051	C2-CS-051	HANDRAIL LAYOUT AND DETAILS
U-239-2016-C2-CS-052	C2-CS-052	HANDRAIL DETAILS
U-239-2016-C2-CS-053	C2-CS-053	SLOPE PAVING DETAILS – SHEET 1
U-239-2016-C2-CS-054	C2-CS-054	SLOPE PAVING DETAILS – SHEET 2
U-239-2016-C2-CS-055	C2-CS-055	SLOPE PAVING REINFORCING – SHEET 1
U-239-2016-C2-CS-056	C2-CS-056	SLOPE PAVING REINFORCING – SHEET 2
U-239-2016-C2-CS-057	C2-CS-057	SLOPE PAVING REINFORCING – SHEET 3
U-239-2016-C2-CS-058	C2-CS-058	TRAFFIC BARRIER CONCRETE DETAILS – SHEET 1
U-239-2016-C2-CS-059	C2-CS-059	TRAFFIC BARRIER CONCRETE DETAILS – SHEET 2
U-239-2016-C2-CS-060	C2-CS-060	TRAFFIC BARRIER REINFORCING DETAILS – SHEET 1
U-239-2016-C2-CS-061	C2-CS-061	TRAFFIC BARRIER REINFORCING DETAILS – SHEET 2



U-239-2016-C2-CS-062	C2-CS-062	ELECTRICAL DETAILS – SHEET 1
U-239-2016-C2-CS-063	C2-CS-063	ELECTRICAL DETAILS – SHEET 2
U-239-2016-C2-CS-064	C2-CS-064	REINFORCING SCHEDULE – SHEET 1
U-239-2016-C2-CS-065	C2-CS-065	REINFORCING SCHEDULE – SHEET 2
U-239-2016-C2-CS-066	C2-CS-066	REINFORCING SCHEDULE – SHEET 3
U-239-2016-C2-CS-067	C2-CS-067	REINFORCING SCHEDULE – SHEET 4
U-239-2016-C2-CS-068	C2-CS-068	S780 – WB GRANT AVE AT WAVERLEY ST
U-239-2016-C2-CS-069	C2-CS-069	S780 – FABRICATION DETAILS
U-239-2016-C2-CS-070	C2-CS-070	S781 – NB WAVERLEY ST AT TAYLOR AVE
U-239-2016-C2-CS-071	C2-CS-071	S781 – FABRICATION DETAILS
U-239-2016-C2-CS-072	C2-CS-072	S782 – WB TAYLOR AVE AT WAVERLEY ST
U-239-2016-C2-CS-073	C2-CS-073	S782 – FABRICATION DETAILS
U-239-2016-C2-CS-074	C2-CS-074	S783 – EB WILKES AVE AT WAVERLEY ST
U-239-2016-C2-CS-075	C2-CS-075	S783 – FABRICATION DETAILS
U-239-2016-C2-CS-076	C2-CS-076	S783 – CRASH CUSHION WITH TENSION STRUT BACKUP
U-239-2016-C2-CS-077	C2-CS-077	S784 – SB WAVERLEY AT VICTOR LEWIS
U-239-2016-C2-CS-078	C2-CS-078	S784 – FABRICATION DETAILS
U-239-2016-C2-CS-079	C2-CS-079	S785 – SB WAVERLEY AT WILKES AVE
U-239-2016-C2-CS-080	C2-CS-080	S785 – FABRICATION DETAILS 1
U-239-2016-C2-CS-081	C2-CS-081	S785 – FABRICATION DETAILS 2
U-239-2016-C2-CS-082	C2-CS-082	S785 – GUARDRAIL LAYOUT
U-239-2016-C2-CS-083	C2-CS-083	S785 – GUARDRAIL DETAILS
U-239-2016-C2-CS-084	C2-CS-084	S785 – ET-31 DETAILS
U-239-2016-C2-CS-085	C2-CS-085	S785 – PIER GUARDRAIL

**CIVIL – TRANSPORTATION**

U-239-2016-C2-CT-001	C2-CT-001	DETOUR PLAN-PROFILE – START TO STA. 1+585
U-239-2016-C2-CT-002	C2-CT-002	DETOUR PLAN-PROFILE – STA.1+185 TO 1+905
U-239-2016-C2-CT-003	C2-CT-003	DETOUR PLAN-PROFILE – STA.1+905 TO 2+135
U-239-2016-C2-CT-004	C2-CT-004	DETOUR PLAN PROFILE – STA.2+135 TO END
U-239-2016-C2-CT-005	C2-CT-005	DETOUR PLAN-PROFILE- WAVERLEY NORTH LEG
U-239-2016-C2-CT-006	C2-CT-006	DETOUR PEDESTRIAN CROSSING DETAILS
U-239-2016-C2-CT-007	C2-CT-007	CONTROL LINE GEOMETRY – WAVERLEY STREET (1 OF 2)
U-239-2016-C2-CT-008	C2-CT-008	CONTROL LINE GEOMETRY – WAVERLEY STREET (2 OF 2)
U-239-2016-C2-CT-009	C2-CT-009	CONTROL LINE GEOMETRY – GRANT AVENUE
U-239-2016-C2-CT-010	C2-CT-010	CONTROL LINE GEOMETRY – TAYLOR AVENUE (1 OF 2)
U-239-2016-C2-CT-011	C2-CT-011	CONTROL LINE GEOMETRY – TAYLOR AVENUE (2 OF 2)
U-239-2016-C2-CT-012	C2-CT-012	CONTROL LINE GEOMETRY – WILKES AVENUE-HURST WAY
U-239-2016-C2-CT-013	C2-CT-013	CONTROL LINE GEOMETRY – ACCESS ROADS
U-239-2016-C2-CT-014	C2-CT-014	CONTROL LINE GEOMETRY – SMART CHANNELS (1 OF 2)
U-239-2016-C2-CT-015	C2-CT-015	CONTROL LINE GEOMETRY – SMART CHANNELS (2 OF 2)
U-239-2016-C2-CT-016	C2-CT-016	CONTROL LINE GEOMETRY – TAYLOR MULTI-USE PATH
U-239-2016-C2-CT-017	C2-CT-017	CONTROL LINE GEOMETRY – WAVERLEY WEST SIDEWALK-BIKE PATH
U-239-2016-C2-CT-018	C2-CT-018	CONTROL LINE GEOMETRY – HURST-WAVERLEY-EAST SIDEWALK-BIKE
U-239-2016-C2-CT-019	C2-CT-019	CONTROL LINE GEOMETRY – WAVERLEY MULTI-USE PATH
U-239-2016-C2-CT-020	C2-CT-020	GENERAL ARRANGEMENT
U-239-2016-C2-CT-021	C2-CT-021	WAVERLEY STREET – START TO STA. 1+105 (PLAN-PROFILE)
U-239-2016-C2-CT-022	C2-CT-022	WAVERLEY STREET – STA. 1+105 TO 1+265 (PLAN-PROFILE)
U-239-2016-C2-CT-023	C2-CT-023	WAVERLEY STREET – STA. 1+265 TO 1+425 (PLAN-PROFILE)
U-239-2016-C2-CT-024	C2-CT-024	WAVERLEY STREET – STA. 1+425 TO 1+585 (NB & SB PROFILE)
U-239-2016-C2-CT-025	C2-CT-025	WAVERLEY STREET – STA. 1+425 TO 1+585 (PLAN VIEW)
U-239-2016-C2-CT-026	C2-CT-026	WAVERLEY STREET – STA. 1+585 TO 1+745 (SB PROFILE)
U-239-2016-C2-CT-027	C2-CT-027	WAVERLEY STREET – STA. 1+585 TO 1+745 (NB PROFILE)
U-239-2016-C2-CT-028	C2-CT-028	WAVERLEY STREET – STA. 1+585 TO 1+745 (PLAN VIEW)
U-239-2016-C2-CT-029	C2-CT-029	WAVERLEY STREET – STA. 1+745 TO 1+905 (SB PROFILE)
U-239-2016-C2-CT-030	C2-CT-030	WAVERLEY STREET – STA. 1+745 TO 1+905 (NB PROFILE)

U-239-2016-C2-CT-031	C2-CT-031	WAVERLEY STREET – STA. 1+745 TO 1+905 (PLAN VIEW)
U-239-2016-C2-CT-032	C2-CT-032	WAVERLEY STREET – STA. 1+905 TO 2+065 (SB PROFILE)
U-239-2016-C2-CT-033	C2-CT-033	WAVERLEY STREET – STA. 1+905 TO 2+065 (NB PROFILE)
U-239-2016-C2-CT-034	C2-CT-034	WAVERLEY STREET – STA. 1+905 TO 2+065 (PLAN VIEW)
U-239-2016-C2-CT-035	C2-CT-035	WAVERLEY STREET – STA. 2+065 TO 2+225 (PLAN-PROFILE)
U-239-2016-C2-CT-036	C2-CT-036	WAVERLEY STREET – STA. 2+225 TO 2+385 (PLAN-PROFILE)
U-239-2016-C2-CT-037	C2-CT-037	WAVERLEY STREET – STA. 2+385 TO END (PLAN-PROFILE)
U-239-2016-C2-CT-038	C2-CT-038	TAYLOR AVENUE –START TO STA. 1+730 (PLAN-PROFILE)
U-239-2016-C2-CT-039	C2-CT-039	TAYLOR AVENUE –STA.1+730 TO 1+890 (PLAN-PROFILE)
U-239-2016-C2-CT-040	C2-CT-040	TAYLOR AVENUE –STA. 1+890 TO 2+050 (PLAN-PROFILE)
U-239-2016-C2-CT-041	C2-CT-041	TAYLOR AVENUE –STA. 2+050 TO 2+210 (PLAN-PROFILE)
U-239-2016-C2-CT-042	C2-CT-042	TAYLOR AVENUE –STA. 2+210 TO 2+365 (PLAN-PROFILE)
U-239-2016-C2-CT-043	C2-CT-043	TAYLOR AVENUE –STA. 2+365 TO 2+525 (PLAN-PROFILE)
U-239-2016-C2-CT-044	C2-CT-044	TAYLOR AVENUE –STA. 2+525 TO 2+690 (WB & EB PROFILES)
U-239-2016-C2-CT-045	C2-CT-045	TAYLOR AVENUE –STA 2+525 TO 2+690 (PLAN)
U-239-2016-C2-CT-046	C2-CT-046	TAYLOR AVENUE –STA 2+690 TO 2+850 (WB & EB PROFILES)
U-239-2016-C2-CT-047	C2-CT-047	TAYLOR AVENUE –STA. 2+690 TO 2+850 (PLAN VIEW)
U-239-2016-C2-CT-048	C2-CT-048	TAYLOR AVENUE –STA. 2+850 TO 3+010 (PLAN-PROFILE)
U-239-2016-C2-CT-049	C2-CT-049	TAYLOR AVENUE –STA. 3+010 TO END (PLAN-PROFILE)
U-239-2016-C2-CT-050	C2-CT-050	WILKES AVENUE-HURST WAY – START TO 1+165 (PLAN-PROFILE)
U-239-2016-C2-CT-051	C2-CT-051	WILKES AVENUE-HURST WAY –STA.1+165 TO 1+325 (PLAN-PROFILE)
U-239-2016-C2-CT-052	C2-CT-052	WILKES AVENUE-HURST WAY –STA.1+325 TO 1+485 (WB & EB PROFILES)
U-239-2016-C2-CT-053	C2-CT-053	WILKES AVENUE-HURST WAY –STA.1+325 TO 1+485 (PLAN)
U-239-2016-C2-CT-054	C2-CT-054	WILKES AVENUE-HURST WAY –STA. 1+485 TO END (PLAN-PROFILE)
U-239-2016-C2-CT-055	C2-CT-055	GRANT AVENUE - START TO STA. 1+150 (PLAN-PROFILE)
U-239-2016-C2-CT-056	C2-CT-056	GRANT AVENUE - STA. 1+150 TO 1+310 (PLAN-PROFILE)
U-239-2016-C2-CT-057	C2-CT-057	GRANT AVENUE - STA. 1+310 TO END (PLAN-PROFILE)
U-239-2016-C2-CT-058	C2-CT-058	WEST ACCESS - START TO STA. 1+135 (PLAN-PROFILE)
U-239-2016-C2-CT-059	C2-CT-059	WEST ACCESS - STA. 1+135 TO END (PLAN-PROFILE)
U-239-2016-C2-CT-060	C2-CT-060	EAST ACCESS - START TO STA. 1+105 (PLAN-PROFILE)
U-239-2016-C2-CT-061	C2-CT-061	EAST ACCESS - STA. 1+105 TO END (PLAN-PROFILE)
U-239-2016-C2-CT-062	C2-CT-062	COMMERCIAL APPROACHES (PLAN-PROFILE)
U-239-2016-C2-CT-063	C2-CT-063	WAVERLEY, HURST - WILKES TURN LANES (PLAN-PROFILE)
U-239-2016-C2-CT-064	C2-CT-064	WAVERLEY & TAYLOR TURN LANES (PLAN-PROFILE)
U-239-2016-C2-CT-065	C2-CT-065	WAVERLEY, TAYLOR & GRANT TURN LANES (PLAN-PROFILE)
U-239-2016-C2-CT-066	C2-CT-066	1360 TAYLOR PARKING LOT
U-239-2016-C2-CT-067	C2-CT-067	WAVERLEY SECTIONS (1 OF 2)
U-239-2016-C2-CT-068	C2-CT-068	WAVERLEY SECTIONS (2 OF 2)
U-239-2016-C2-CT-069	C2-CT-069	TAYLOR SECTIONS (1 OF 3)
U-239-2016-C2-CT-070	C2-CT-070	TAYLOR SECTIONS (2 OF 3)
U-239-2016-C2-CT-071	C2-CT-071	TAYLOR SECTIONS (3 OF 3)
U-239-2016-C2-CT-072	C2-CT-072	WILKES-HURST SECTIONS (1 OF 1)
U-239-2016-C2-CT-073	C2-CT-073	WEST ACCESS ROAD SECTIONS
U-239-2016-C2-CT-074	C2-CT-074	EAST ACCESS ROAD SECTIONS
U-239-2016-C2-CT-075	C2-CT-075	DETAILS (1 OF 4)
U-239-2016-C2-CT-076	C2-CT-076	DETAILS (2 OF 4)
U-239-2016-C2-CT-077	C2-CT-077	DETAILS (3 OF 4)
U-239-2016-C2-CT-078	C2-CT-078	DETAILS (4 OF 4)
U-239-2016-C2-CT-079	C2-CT-079	BUS STOP DETAILS
U-239-2016-C2-CT-080	C2-CT-080	CONCRETE JOINT LAYOUT - WAVERLEY-WILKES INTERSECTION
U-239-2016-C2-CT-081	C2-CT-081	CONCRETE JOINT LAYOUT - WAVERLEY-TAYLOR INTERSECTION

## CIVIL-RAIL

U-239-2016-C2-CR-001	C2-CR-001	SHOOFLY STA. 0+00 to STA. 6+712.360
U-239-2016-C2-CR-002	C2-CR-002	MAIN STA. 5+462.047 to STA. 6+720.056
U-239-2016-C2-CR-003	C2-CR-003	SHOOFLY OVERALL SITE DRAINAGE PLAN
U-239-2016-C2-CR-004	C2-CR-004	FINAL OVERALL SITE DRAINAGE PLAN
U-239-2016-C2-CR-101	C2-CR-101	SHOOFLY GRADING STA. 1+050.000 TO STA. 1+117.822
U-239-2016-C2-CR-102	C2-CR-102	SHOOFLY GRADING STA. 0+875.000 TO STA. 1+050.000
U-239-2016-C2-CR-103	C2-CR-103	SHOOFLY GRADING STA. 0+700.000 TO STA. 0+875.000
U-239-2016-C2-CR-104	C2-CR-104	SHOOFLY GRADING STA. 0+525.000 TO STA. 0+700.000
U-239-2016-C2-CR-105	C2-CR-105	SHOOFLY GRADING STA. 0+350.000 TO STA. 0+525.000
U-239-2016-C2-CR-106	C2-CR-106	SHOOFLY GRADING STA. 0+175.000 TO STA. 0+350.000
U-239-2016-C2-CR-107	C2-CR-107	SHOOFLY GRADING STA. 0+000.000 TO STA. 0+175.000
U-239-2016-C2-CR-108	C2-CR-108	SHOOFLY GRADING STA. 5+460.000 TO STA. 5+600.000
U-239-2016-C2-CR-109	C2-CR-109	MAIN TRACK GRADING STA. 6+600.000 TO STA. 6+719.000
U-239-2016-C2-CR-110	C2-CR-110	MAIN TRACK GRADING STA. 6+425.000 TO STA. 6+600.000
U-239-2016-C2-CR-111	C2-CR-111	MAIN TRACK GRADING STA. 6+250.000 TO STA. 6+425.000
U-239-2016-C2-CR-112	C2-CR-112	MAIN TRACK GRADING STA. 6+075.000 TO STA. 6+250.000
U-239-2016-C2-CR-113	C2-CR-113	MAIN TRACK GRADING STA. 5+900.000 TO STA. 6+075.000
U-239-2016-C2-CR-114	C2-CR-114	MAIN TRACK GRADING STA. 5+725.000 TO STA. 5+900.000
U-239-2016-C2-CR-115	C2-CR-115	MAIN TRACK GRADING STA. 5+550.000 TO STA. 5+725.000
U-239-2016-C2-CR-116	C2-CR-116	MAIN TRACK GRADING STA. 5+375.000 TO STA. 5+550.000
U-239-2016-C2-CR-301	C2-CR-301	EAST CROSSOVER GRADING SECTIONS STA. 5+447.230 TO STA. 5+575.000
U-239-2016-C2-CR-302	C2-CR-302	EAST CROSSOVER GRADING SECTIONS STA. 5+590.480 TO STA. 5+600.000
U-239-2016-C2-CR-303	C2-CR-303	SHOOFLY GRADING SECTIONS STA. 0+000.000 TO STA. 0+150.000
U-239-2016-C2-CR-304	C2-CR-304	SHOOFLY GRADING SECTIONS STA. 0+175.000 TO STA. 0+325.000
U-239-2016-C2-CR-305	C2-CR-305	SHOOFLY GRADING SECTIONS STA. 0+350.000 TO STA. 0+520.000
U-239-2016-C2-CR-306	C2-CR-306	SHOOFLY GRADING SECTIONS STA. 0+525.000 TO STA. 0+600.000
U-239-2016-C2-CR-307	C2-CR-307	SHOOFLY GRADING SECTIONS STA. 0+611.000 TO STA. 0+700.000
U-239-2016-C2-CR-308	C2-CR-308	SHOOFLY GRADING SECTIONS STA. 0+725.000 TO STA. 0+850.000
U-239-2016-C2-CR-309	C2-CR-309	SHOOFLY GRADING SECTIONS STA. 0+870.000 TO STA. 0+975.000
U-239-2016-C2-CR-310	C2-CR-310	SHOOFLY GRADING SECTIONS STA. 1+000.000 TO STA. 1+117.820
U-239-2016-C2-CR-311	C2-CR-311	MAIN TRACK GRADING SECTIONS STA. 5+925.000 TO STA. 6+100.000
U-239-2016-C2-CR-312	C2-CR-312	MAIN TRACK GRADING SECTIONS STA. 6+125.000 TO STA. 6+225.000
U-239-2016-C2-CR-313	C2-CR-313	MAIN TRACK GRADING SECTIONS STA. 6+250.000 TO STA. 6+375.000
U-239-2016-C2-CR-314	C2-CR-314	MAIN TRACK GRADING SECTIONS STA. 6+400.000 TO STA. 6+575.000
U-239-2016-C2-CR-315	C2-CR-315	MAIN TRACK GRADING SECTIONS STA. 6+600.000 TO STA. 6+712.380
U-239-2016-C2-CR-401	C2-CR-401	TYPICAL SECTIONS & DETAILS
U-239-2016-C2-CR-402	C2-CR-402	TYPICAL SECTIONS & DETAILS
U-239-2016-C2-CR-403	C2-CR-403	TYPICAL SECTIONS & DETAILS
U-239-2016-C2-CR-404	C2-CR-404	TYPICAL SECTIONS & DETAILS
U-239-2016-C2-CR-405	C2-CR-405	TYPICAL SECTIONS & DETAILS
U-239-2016-C2-CR-501	C2-CR-501	PROPOSED SHOOFLY TRACK CONSTRUCTION

U-239-2016-C2-CR-502	C2-CR-502	FINAL MAIN TRACK TRACK CONSTRUCTION
U-239-2016-C2-CR-701	C2-CR-701	SHOOFLY STAGING
U-239-2016-C2-CR-702	C2-CR-702	SHOOFLY STAGING
U-239-2016-C2-CR-703	C2-CR-703	SHOOFLY STAGING
U-239-2016-C2-CR-704	C2-CR-704	SHOOFLY STAGING
U-239-2016-C2-CR-705	C2-CR-705	SHOOFLY STAGING
U-239-2016-C2-CR-706	C2-CR-706	SHOOFLY STAGING
U-239-2016-C2-CR-707	C2-CR-707	SHOOFLY STAGING
U-239-2016-C2-CR-708	C2-CR-708	SHOOFLY STAGING
U-239-2016-C2-CR-709	C2-CR-709	FINAL STAGING
U-239-2016-C2-CR-710	C2-CR-710	FINAL STAGING
U-239-2016-C2-CR-711	C2-CR-711	FINAL STAGING
U-239-2016-C2-CR-712	C2-CR-712	FINAL STAGING
U-239-2016-C2-CR-713	C2-CR-713	FINAL STAGING

**CIVIL-UTILITIES**

U-239-2016C2-CU-001	C2-CU-001	GENERAL ARRANGEMENT DRAWING - CONTRACT 2
U-239-2016C2-CU-002	C2-CU-002	EXISTING UNDERGROUND UTILITIES - TAYLOR AVENUE - COMMUNICATIONS - MTS/SHAW/TERASPAN/FIBRE OPTICS
U-239-2016C2-CU-003	C2-CU-003	EXISTING UNDERGROUND UTILITIES - TAYLOR AVENUE - MUNICIPAL - SEWER / WATER / GAS
U-239-2016C2-CU-004	C2-CU-004	EXISTING UNDERGROUND UTILITIES - TAYLOR AVENUE – HYDRO - HYDRO O/H & U/G, STREET LIGHTING & TRAFFIC SIGNALS
U-239-2016C2-CU-005	C2-CU-005	EXISTING UNDERGROUND UTILITIES - WAVERLEY STREET – COMMUNICATIONS - MTS/SHAW/TERASPAN/FIBRE OPTICS
U-239-2016C2-CU-006	C2-CU-006	EXISTING UNDERGROUND UTILITIES - WAVERLEY STREET - MUNICIPAL - SEWER / WATER / GAS
U-239-2016C2-CU-007	C2-CU-007	EXISTING UNDERGROUND UTILITIES - WAVERLEY STREET - HYDRO - HYDRO O/H & U/G, STREET LIGHTING & TRAFFIC SIGNALS
U-239-2016C2-CU-008	C2-CU-008	EXISTING UNDERGROUND UTILITIES - CN ROW/SHOOFLY - COMMUNICATIONS - MTS/SHAW/TERASPAN/FIBRE OPTICS
U-239-2016C2-CU-009	C2-CU-009	EXISTING UNDERGROUND UTILITIES - CN ROW/SHOOFLY - MUNICIPAL - SEWER / WATER / GAS
U-239-2016C2-CU-010	C2-CU-010	EXISTING UNDERGROUND UTILITIES - CN ROW/SHOOFLY – HYDRO - HYDRO O/H & U/G, STREET LIGHTING & TRAFFIC SIGNALS
U-239-2016C2-CU-011	C2-CU-011	EXISTING UNDERGROUND UTILITIES - WILKES AVE/HURST WAY - COMMUNICATIONS - MTS/SHAW/TERASPAN/FIBRE OPTICS
U-239-2016C2-CU-012	C2-CU-012	EXISTING UNDERGROUND UTILITIES - WILKES AVE/HURST WAY - MUNICIPAL - SEWER / WATER / GAS
U-239-2016C2-CU-013	C2-CU-013	EXISTING UNDERGROUND UTILITIES - WILKES AVE/HURST WAY - HYDRO - HYDRO O/H & U/G, STREET LIGHTING & TRAFFIC SIGNALS
U-239-2016C2-CU-014	C2-CU-014	DETOUR DRAINAGE PLAN 1
U-239-2016C2-CU-015	C2-CU-015	DETOUR DRAINAGE PLAN 2
U-239-2016C2-CU-016	C2-CU-016	TAYLOR AVENUE - PLAN/PROFILE - LDS - STA. 1+550 to STA. 1+810
U-239-2016C2-CU-017	C2-CU-017	TAYLOR AVENUE - PLAN/PROFILE - LDS - STA. 1+810 to STA. 2+180
U-239-2016C2-CU-018	C2-CU-018	TAYLOR AVENUE - PLAN/PROFILE - LDS - STA. 2+180 to STA. 2+560
U-239-2016C2-CU-019	C2-CU-019	TAYLOR AVENUE - PLAN/PROFILE - LDS & WM RELOCATION - STA. 2+260 TO STA. 2+940

U-239-2016C2-CU-020	C2-CU-020	TAYLOR AVENUE - PLAN/PROFILE - WM RELOCATION STA. 2+560 to STA. 2+940
U-239-2016C2-CU-021	C2-CU-021	S.R.B. OUTFALL - PLAN/PROFILE - LDS - EXISTING S.B.R. to T NEW PUMPING STATION
U-239-2016C2-CU-022	C2-CU-022	WAVERLEY STREET - PLAN/PROFILE - LDS - STA. 1+250 to ST. 1+600
U-239-2016C2-CU-023	C2-CU-023	WAVERLEY STREET - PLAN/PROFILE - LDS - STA. 1+600 to STA. 1+900
U-239-2016C2-CU-024	C2-CU-024	WAVERLEY STREET - PLAN/PROFILE - LDS - STA. 1+900 to STA. 2+200
U-239-2016C2-CU-025	C2-CU-025	WAVERLEY STREET - PLAN/PROFILE - WM - PUMPING STATION ACCESS ROAD
U-239-2016C2-CU-026	C2-CU-026	WILKES AVENUE - PLAN/PROFILE - LDS - STA. 1+000 to STA. 1+250
U-239-2016C2-CU-027	C2-CU-027	HURST AVENUE - PLAN/PROFILE - LDS - STA. 1+250 to STA. 1+580
U-239-2016C2-CU-028	C2-CU-028	EXISTING MIDTOWN FEEDER MAIN - PLAN/PROFILE - RAIL CROSSING CASING PIPE
U-239-2016C2-CU-029	C2-CU-029	EXISTING MIDTOWN FEEDER MAIN - RAIL CROSSING CASING PIPE DETAILS
U-239-2016C2-CU-030	C2-CU-030	SHORING DETAILS FOR EXISTING MIDTOWN FEEDER MAIN - SHEET 1
U-239-2016C2-CU-031	C2-CU-031	SHORING DETAILS FOR EXISTING MIDTOWN FEEDER MAIN - SHEET 2
U-239-2016C2-CU-032	C2-CU-032	SHORING DETAILS FOR EXISTING MIDTOWN FEEDER MAIN - SHEET 3
U-239-2016C2-CU-033	C2-CU-033	CIVIL UTILITIES MISC DETAILS 1
U-239-2016C2-CU-034	C2-CU-034	CIVIL UTILITIES MISC DETAILS 2
U-239-2016C2-CU-035	C2-CU-035	LAND DRAINAGE SYSTEM - STRUCTURE & LOCATION SCHEDULE 1
U-239-2016C2-CU-036	C2-CU-036	LAND DRAINAGE SYSTEM - STRUCTURE & LOCATION SCHEDULE 2
U-239-2016C2-CU-037	C2-CU-037	LAND DRAINAGE SYSTEM - STRUCTURE & LOCATION SCHEDULE 3
U-239-2016C2-CU-038	C2-CU-038	LAND DRAINAGE SYSTEM - STRUCTURE & LOCATION SCHEDULE 4
U-239-2016C2-CU-039	C2-CU-039	LAND DRAINAGE SYSTEM - STRUCTURE & LOCATION SCHEDULE 5
U-239-2016C2-CU-040	C2-CU-040	LAND DRAINAGE SYSTEM - STRUCTURE & LOCATION SCHEDULE 6
U-239-2016C2-CU-041	C2-CU-041	LAND DRAINAGE SYSTEM - STRUCTURE & LOCATION SCHEDULE 7

**BUILDING-CIVIL**

U-239-2016-C2-BC-001	C2-BC-001	PUMPING STATION SITE PLAN
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**BUILDING-ARCHITECTURAL**

U-239-2016-C2-BB-001	C2-BB-001	GENERAL NOTES & ABBREVIATIONS
U-239-2016-C2-BB-002	C2-BB-002	STANDARD DETAILS
U-239-2016-C2-BB-100	C2-BB-100	LIFE SAFETY PLAN
U-239-2016-C2-BB-101	C2-BB-101	MAIN LEVEL PLAN
U-239-2016-C2-BB-102	C2-BB-102	REFLECTIVE CEILING PLAN & ROOF PLAN
U-239-2016-C2-BB-201	C2-BB-201	ELEVATIONS
U-239-2016-C2-BB-301	C2-BB-301	SECTIONS
U-239-2016-C2-BB-302	C2-BB-302	SECTIONS

U-239-2016-C2-BB-401 C2-BB-401 DETAILS

### **BUILDING-STRUCTURAL**

U-239-2016-C2-BS-001	C2-BS-001	GENERAL NOTES
U-239-2016-C2-BS-002	C2-BS-002	GENERAL NOTES
U-239-2016-C2-BS-003	C2-BS-003	SCHEDULES
U-239-2016-C2-BS-004	C2-BS-004	STANDARD DETAILS
U-239-2016-C2-BS-005	C2-BS-005	STANDARD DETAILS
U-239-2016-C2-BS-006	C2-BS-006	STANDARD DETAILS
U-239-2016-C2-BS-101	C2-BS-101	LOWER LEVEL PLAN & DETAILS
U-239-2016-C2-BS-102	C2-BS-102	INTERMEDIATE LEVEL PLAN & DETAILS
U-239-2016-C2-BS-103	C2-BS-103	MAIN FLOOR FRAMING & CURBS PLAN
U-239-2016-C2-BS-104	C2-BS-104	ROOF FRAMING PLAN
U-239-2016-C2-BS-201	C2-BS-201	FRAMING ELEVATIONS
U-239-2016-C2-BS-301	C2-BS-301	SECTIONS
U-239-2016-C2-BS-302	C2-BS-302	SECTIONS
U-239-2016-C2-BS-401	C2-BS-401	DETAILS
U-239-2016-C2-BS-402	C2-BS-402	DETAILS
U-239-2016-C2-BS-403	C2-BS-403	DETAILS

### **BUILDING -MECHANICAL**

CU-239-2016-C2-BM-001	C2-BM-001	MECHANICAL LEGENDS, NOTES
CU-239-2016-C2-BM-002	C2-BM-002	MECHANICAL MAIN & INTERMEDIATE LEVEL
CU-239-2016-C2-BM-003	C2-BM-003	MECHANICAL SECTIONS
CU-239-2016-C2-BM-004	C2-BM-004	MECHANICAL DETAILS AND SCHEMATICS
CU-239-2016-C2-BM-005	C2-BM-005	MECHANICAL SCHEDULE

### **BUILDING ELECTRICAL**

U-239-2016-C2-BE-001	C2-BE-001	LEGEND
U-239-2016-C2-BE-002	C2-BE-002	<i>SITE PLAN</i>
U-239-2016-C2-BE-003	C2-BE-003	HAZARDOUS AREA DETAILS
U-239-2016-C2-BE-004	C2-BE-004	LIGHTING MAIN FLOOR PLAN
U-239-2016-C2-BE-005	C2-BE-005	POWER AND INSTRUMENT FLOOR PLAN
U-239-2016-C2-BE-006	C2-BE-006	SCHEDULES AND DETAILS
U-239-2016-C2-BE-007	C2-BE-007	SCHEMATICS
U-239-2016-C2-BE-008	C2-BE-008	MCC ELEVATION

### **BUILDING-PROCESS MECHANICAL**

U-239-2016-C2-BP-001	C2-BP-001	PROCESS LEGENDS, NOTES
U-239-2016-C2-BP-002	C2-BP-002	PROCESS MAIN FLOOR AND INTERMEDIATE
U-239-2016-C2-BP-003	C2-BP-003	PROCESS SECTIONS
U-239-2016-C2-BP-004	C2-BP-004	PROCESS & INSTRUMENTATION DIAGRAM
U-239-2016-C2-BP-005	C2-BP-005	PROCESS DETAILS

### **LANDSCAPING**

U-239-2016-C2-LS-001	C2-LS-001	TREE REMOVAL PLAN
U-239-2016-C2-LS-002	C2-LS-002	FENCE REMOVAL PLAN
U-239-2016-C2-LS-003	C2-LS-003	WAVERLEY STREET - START TO STA. 1+250 LANDSCAPE PLAN
U-239-2016-C2-LS-004	C2-LS-004	WAVERLEY STREET - STA. 1+250 TO 1+500 LANDSCAPE PLAN
U-239-2016-C2-LS-005	C2-LS-005	WAVERLEY STREET - STA. 1+500 TO 1+870 LANDSCAPE PLAN

U-239-2016-C2-LS-006	C2-LS-006	WAVERLEY STREET - STA. 1+870 TO 2+200 LANDSCAPE PLAN
U-239-2016-C2-LS-007	C2-LS-007	WAVERLEY STREET - STA. 2+200 TO END LANDSCAPE PLAN
U-239-2016-C2-LS-008	C2-LS-008	TAYLOR AVENUE – STA. 1+550 TO 1+850 LANDSCAPE PLAN
U-239-2016-C2-LS-009	C2-LS-009	TAYLOR AVENUE - STA. 1+850 TO 2+200 LANDSCAPE PLAN
U-239-2016-C2-LS-010	C2-LS-010	TAYLOR AVENUE - STA. 2+200 TO 2+510 LANDSCAPE PLAN
U-239-2016-C2-LS-011	C2-LS-011	TAYLOR AVENUE - STA. 2+510 TO 2+790 LANDSCAPE PLAN
U-239-2016-C2-LS-012	C2-LS-012	TAYLOR AVENUE - STA. 2+790 TO 3+130 LANDSCAPE PLAN
U-239-2016-C2-LS-013	C2-LS-013	WILKES AVENUE-HURST WAY - START TO 1+300 LANDSCAPE PLAN
U-239-2016-C2-LS-014	C2-LS-014	WILKES AVENUE-HURST WAY - 1+300 TO END LANDSCAPE PLAN
U-239-2016-C2-LS-015	C2-LS-015	GRANT AVENUE - LANDSCAPE PLAN
U-239-2016-C2-LS-016	C2-LS-016	ENLARGEMENTS
U-239-2016-C2-LS-017	C2-LS-017	ENLARGEMENTS
U-239-2016-C2-LS-018	C2-LS-018	ENLARGEMENTS
U-239-2016-C2-LS-019	C2-LS-019	ENLARGEMENTS AND DETAILS
U-239-2016-C2-LS-020	C2-LS-020	DETAILS – PLANTING AND SITE FURNISHINGS
U-239-2016-C2-LS-021	C2-LS-021	DETAILS – FENCING AND BACKSTOP

## E2. GEOTECHNICAL REPORTS

- E2.1 Test hole logs from the January 2015 AECOM geotechnical report and from the supplemental investigation of November 2016 are provided in the drawings to aid the Contractor's evaluation of the existing soil conditions.
- E2.2 The summary of the test caisson investigation is provided to assist the Contractor in equipment selection and proper construction practices. The test caisson was carried out by Subterranean (Manitoba) Ltd. and supervised by AECOM geotechnical personnel.
- E2.3 The Geotechnical Report dated January 2015, Summary of Test Caisson Investigation dated November, 2016, and Summary of Bedrock Investigation dated November 2016 are contained in Appendix 'A'.
- E2.4 The information presented is considered accurate at the locations and time of drilling as outlined in the Appendix. 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 AECOM geotechnical report and AECOM Summary of Bedrock Investigation memo may be viewed at the Contract Administrator's Office upon request.

## E3. PAVEMENT CORE REPORT

- E3.1 Further to C3.1, the pavement core report is provided to aid the Contractor's evaluation of the existing pavement structures. The Pavement Core Report is contained in Appendix 'C'.

## E4. SHOP DRAWINGS

- E4.1 Description
- This Specification shall revise, amend, and supplement the requirements of CW 1110.
  - The Contractor shall provide all Submittals and Shop Drawings required in the Contract as well as any additional Submittals reasonably requested by the Contract Administrator, at the Contractor's expense.
  - The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work.

- (d) Original drawings are to be prepared by the Contractor, subcontractor, supplier, distributor, or manufacturer, which illustrate the appropriate portion of Work; showing fabrication, layout, setting, or erection details as specified in appropriate sections.

#### E4.2 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) The Contractor shall provide all Submittals and Shop Drawings required in the Contract as well as any additional Submittals reasonably requested by the Contract Administrator, at the Contractor's expense.
- (c) Verify:
  - (i) field measurements;
  - (ii) field construction criteria; and,
  - (iii) catalogue numbers and similar data.
- (d) Coordinate each shop drawing submission with the requirements of the Work and Contract Documents. Shop Drawings of separate components of a larger system will not be reviewed until all related drawings are available.
- (e) Notify Contract Administrator, in writing at time of shop drawing submission, of deviations from requirements of Contract Documents.
- (f) Responsibility for deviations in Shop Drawing submission from requirements of Contract Documents is not relieved by the Contract Administrator's review of submission, unless the Contract Administrator gives written acceptance of specified deviations.
- (g) Responsibility for errors and omissions in the shop drawing submission is not relieved by the Contract Administrator's review of the submittals.
- (h) The Contractor shall make any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Contract Administrator on the previous submission.
- (i) After the Contract Administrator has reviewed and returned the copies, distribute the copies to sub-trades as appropriate.
- (j) Maintain one (1) complete set of reviewed Shop Drawings, filed by Specification section number, at the Site for use and reference by the Contract Administrator and Subcontractors.

#### E4.3 Submission Requirements

- (a) Schedule submittals at least fourteen (14) Calendar Days before dates reviewed submittals 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.
- (b) Submit five (5) paper prints or one electronic PDF of Shop Drawings. The Contractor is advised that for paper copies, the Contract Administrator will retain three (3) copies of all submittals and return two (2) copies to the Contractor.
- (c) Further to CW 1110, all submissions must be in metric units. Where data is in imperial units, the correct metric values shall also be shown on the submissions for Contract Administrator review.
- (d) Accompany shop drawing submissions with a 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; and,
  - (vii) other pertinent data.
- (e) Shop drawing submissions shall include:
- (i) date and revision dates;
  - (ii) project title and bid opportunity number;
  - (iii) name of:
    - ◆ Contractor;
    - ◆ Subcontractor;
    - ◆ supplier;
    - ◆ manufacturer; and,
    - ◆ separate detailer when pertinent.
  - (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; and,
  - (ix) Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements, and compliance with Contract Documents.
- (f) Shop Drawings for the following components shall bear the seal of a Professional Engineer registered in the province of Manitoba:
- (i) Pile Dynamic Analyser (PDA) Testing;
  - (ii) Temporary Shoring;
  - (iii) All Form Details, as requested by the Contract Administrator;
  - (iv) Form Details for Deck Pours;
  - (v) Bearing Layout and Details;
  - (vi) Metal Fabrications, Layout, and Erection Details for steel beam spans;
  - (vii) Metal Fabrication, Layout and Erection Details for Expansion Joints;
  - (viii) Reinforcing Steel Layout and Details;
  - (ix) Pumping Station components:
    - ◆ Metal Fabrications, layout and erection details;
    - ◆ Shoring and dewatering system required for excavations;
    - ◆ Form details for suspended slabs;
    - ◆ Shoring for suspended support walls and grade beams;
    - ◆ Monorail and hoist system;
    - ◆ Reinforcing Steel layout and details;
    - ◆ Pumping Station Superstructure components; and,
    - ◆ Process piping supports.
  - (x) Handrails and Miscellaneous Metals; and,
  - (xi) Forcemain fittings.

#### E4.4 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 will not be paid for 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;
- (e) Only two (2) reviews of Shop Drawings will be made by the Contract Administrator at no cost. Each additional review will be charged to the Contractor at the Contract Administrator's scheduled rates and at the discretion of the Contract Administrator. The Contract Administrator's charges for the additional Work will be deducted from the Contractor's Progress Certificates.

#### **E5. WATER OBTAINED FROM THE CITY**

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

#### **E6. VERIFICATION OF WEIGHTS**

- E6.1 All material which is paid for on a weight basis shall be weighed on a scale certified by Consumer & Corporate Affairs, Canada.
  - E6.1.1 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.
  - E6.1.2 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; and,
    - (d) checking tare weights shown on delivery tickets against a current tare.
  - E6.1.3 No charge shall be made to the City for any delays or loss of production caused by such inspection and verification.
- E6.2 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.
  - E6.2.1 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); and,
    - (d) the time and date of weighing.
- E6.3 Further to clause 3.16.3 of CW 1130 no charge shall be made to the City for any delays or loss of production caused by inspection and verification.

#### **GENERAL REQUIREMENTS**

#### **E7. MOBILIZATION AND DEMOBILIZATION**

- E7.1 Description
  - E7.1.1 General

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

#### E7.1.2 Scope of Work

- (a) The Work under this Specification shall include but not be limited to:
  - (i) mobilizing and demobilizing on-site Work facilities;
  - (ii) supplying, setting up, laying out, and removing site office facilities as detailed in E8;
  - (iii) supplying and installing secure fencing/gates for portions of the laydown areas the Contractor wishes to secure;
  - (iv) maintaining and removing any access roadways as needed into the laydown areas; and
  - (v) traffic control (E10) and traffic management (E11).

#### E7.2 Materials

E7.2.1 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.

E7.2.2 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.

#### E7.3 Equipment

E7.3.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

#### E7.4 Construction Methods

##### E7.4.1 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.

##### E7.4.2 Site Security

- (a) The Contractor has discretion on what areas of the site they wish to secure. This may include the Contractor's lay down area, material storage areas, and/or access roads. These areas may be fenced and gated for security and to discourage pedestrian entrance to construction areas and to control any potential hazard to the public, particularly children. The Contractor shall not fence off areas where public traffic or pedestrians need to travel, such as open roadway lanes or sidewalks/bike paths.

##### E7.4.3 Access Roadway

- (a) The Contractor shall note the laydown areas available within each Phase/Stage of the work on the Staging Drawings referenced in E11. The drawings indicate where accesses can and cannot be constructed from other public right of way.
- (b) When the Contractor wishes to install an access along a laydown border marked "Contractor Laydown Area – Access", they shall make a written request to the Contract Administrator before commencing construction. The Contract Administrator shall have two (2) Business Days to review and respond to the request.
- (c) The Contractor shall maintain any access roadway they install.

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

E7.4.4 Restoration of Existing Facilities

(a) Upon completion of the Work and demobilization, the Contractor shall restore existing facilities to their original condition, to the approval of the Contract Administrator.

E7.5 Measurement and Payment

E7.5.1 Mobilization and Demobilization

(a) "Mobilization and Demobilization" will not be measured. This Item of Work will be paid for at a percentage of the Contract Lump Sum Price, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator. These percentages shall be as follows:

- (i) when Contract Administrator is satisfied that construction has commenced thirty percent (30%);
- (ii) during construction, percentage distributed equally on a monthly basis at the discretion of the Contract Administrator sixty percent (60%); and,
- (iii) upon Total Performance ten percent (10%).

(b) Note that "Mobilization and Demobilization" applies to work in all Parts of the project, but is listed for measurement and payment only under Part P.

**E8. OFFICE FACILITIES**

E8.1 The Contractor shall supply office facilities meeting the following requirements:

- (a) the field office(s) shall be for the exclusive use of the Contract Administrator;
- (b) the field office(s) shall be conveniently located near the site of the Work. If more than one building is used, they shall be located within 10 m of each other, preferably directly adjacent;
- (c) the field office(s combined) shall have a minimum floor area of 80 m<sup>2</sup>, with a height of 2.4 m. Each building shall have two windows for cross ventilation and a door entrance with a suitable lock;
- (d) the field office(s) shall be suitable for all weather use. They shall be equipped with an electric heater and air conditioner so that the room temperature can be maintained between either 16-18°C or 24-25°C;
- (e) the field office(s) shall be adequately lit with fluorescent fixtures and have a minimum of three wall outlets.
- (f) the field office(s) shall be furnished with a combined total of five (5) desks with chairs, one drafting table with a stool, a table with chairs suitable to seat at least fifteen (15) people at a time for meetings, one (1) four-drawer, lockable legal size filing cabinet, and a minimum of fifteen (15) chairs;
- (g) the field office(s combined) shall be equipped with a water cooler and be supplied so as never to run out of water. They shall be equipped with one fridge, one microwave, and one coffee maker;
- (h) a portable toilet shall be located near the field office(s). The toilet shall have a locking door and be for the exclusive use of the Contract Administrator and other personnel from the City; and,
- (i) 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/she deems it necessary.

- E8.2 The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the office facilities.
- E8.3 The office facilities will be provided from the date of the commencement of the Work to the date of Substantial Performance.

**E9. PROTECTION OF TREES**

E9.1 Trees within or adjacent to a construction area must be protected during construction by means of a barrier surrounding a “Tree Protection Zone” (TPZ) as outlined in Sub Sections E9.2 and E9.3.

- E9.1.1 Activities which are likely to injure or destroy the tree are not permitted within the TPZ.
- E9.1.2 Tree pruning or root pruning of City of Winnipeg owned trees may only be done by a Contractor approved by the project’s Qualified Tree Consultant (refer to E9.1.4) or Urban Forestry Branch.
- E9.1.3 No objects may be attached to trees protected by City of Winnipeg by-laws without written authorization by the City of Winnipeg.
- E9.1.4 No City of Winnipeg tree or tree protected by a City of Winnipeg by-law may be removed without the written permission of the City of Winnipeg.

**E9.2 Tree Protection Zone**

E9.2.1 The following is a chart showing optimal distances for determining a tree protection zone (the roots of a tree can extend from the trunk to approximately two to three (2 – 3) times the distance of the drip line). Some site conditions may dictate the need for a smaller TPZ. The City of Winnipeg Urban Forestry Branch must be notified in these instances. Forestry will determine if the smaller TPZ is acceptable in the specific circumstance and advise of any additional tree protection or removal requirements.

Table 9 - 1 – Tree Protection Zones

<b>Trunk Diameter (DBH)</b>	<b>Minimum Protection Distances Required</b>
<10 cm	2.0m
11-40cm	2.4m
41-50cm	3.0m
51-60cm	3.6m
61-70cm	4.2m
71-80cm	4.8m
81-90cm	5.4m
91-100cm+	6.0m

- E9.2.2 Diameter at breast height (DBH) measurement of tree trunk is taken at 1.4 m above ground.
- E9.2.3 Tree Protection Zone distances are to be measured from the outside edge of the tree base towards the drip line and may be limited by an existing paved surface, provided the existing paved surface remains intact throughout the construction work.

**E9.3 Tree Protection Barriers**

- E9.3.1 Trees within tree protection zones shall be protected by means of a “tree protection barrier” meeting the following Specifications:
  - (a) the required barrier is a 1.2 m high orange plastic web snow fencing on 50 mm x 100 mm frame or as directed by the City of Winnipeg Urban Forestry Branch in accordance with the City of Winnipeg Protection of Existing Tree Specifications. The barrier can be lowered around branches lower than 1.2 m. The barrier location can be adjusted to align with curbs and edges at clear path of travel zones;

- (b) trees identified to be at risk by the Contract Administrator are to be strapped with 25 x 100 x 2400 mm wood planks, or suitably protected as approved by the Contract Administrator;
- (c) tree protection barriers are to be erected prior to the commencement of any construction or grading activities on the site and are to remain in place throughout the entire duration of the project. The applicant shall notify the City of Winnipeg prior to commencing any construction activities to confirm that the tree protection barriers are in place;
- (d) all supports and bracing used to safely secure the barrier should be located outside the TPZ. All supports and bracing should minimize damage to roots. No grade change, storage of materials or equipment is permitted within this area. The tree protection barrier must not be removed without the written authorization of the City of Winnipeg;
- (e) excavation shall be performed in a manner that minimizes damage to the existing root systems. Where possible, excavation shall be carried out such that the edge of the excavation shall be a minimum of 1.5 times the diameter (measured in inches), with the outcome read in feet, from the closest edge of the trunk. Where roots must be cut to facilitate excavation, they shall be pruned neatly at the face of excavation; and,
- (f) operation of equipment within the drip line of the trees shall be kept to a minimum required to perform the work required. Equipment shall not be parked, repaired, refuelled; construction materials shall not be stored, and earth materials shall not be stockpiled within the driplines of trees. The drip line of a tree shall be considered to be the ground surface directly beneath the tips of its outmost branches. The Contractor shall ensure that the operations do not cause flooding or sediment deposition on areas where trees are located.

#### E9.4 Utility Construction, Engineering and Capital Construction Projects

- E9.4.1 It is recognized that there are cases where trees are growing overtop existing utilities or beside capital infrastructure. While the guidelines in this section still apply, in these cases some modification to Table 9 - 1 in addition to root pruning may be permitted provided non-open trench methods of construction are employed (as defined in CW2110 and CW2130).
- E9.4.2 Root Pruning will be required to be done under the direction of, and along with, written sign-off by the Project's Qualified Tree Consultant (Refer to E9.5). The objective is to avoid severance of anchor roots, which provide upright support for trees and minimize damage to the tree.
- E9.4.3 Above ground clearance for overhanging branches in the work zone must be anticipated. The utility or its consultant is required to have a Forestry approved tree service raise the crown of all branches to provide adequate clearance for construction equipment.

#### E9.5 Qualified Tree Consultants

- E9.5.1 An arborist certified by the International Society of Arboriculture (ISA) who has a diploma (minimum) in arboriculture or urban forestry.
- E9.5.2 A landscape architect who is a member in good standing of the Manitoba Association of Landscape Architects.

#### E9.6 Measurement and Payment

- E9.6.1 No separate measurement or payment will be made for the protection of trees.

#### E10. **TRAFFIC CONTROL**

- E10.1 Further to clauses 3.6, 3.7 and 3.8 of CW 1130:

- (a) where directed by the Contract Administrator, the Contractor shall construct and maintain temporary asphalt ramps to alleviate vertical pavement obstructions such as manholes and planing drop-offs to the satisfaction of the Contract Administrator. Payment shall be in accordance with CW3410; and,
- (b) in accordance with the Manual of Temporary Traffic Control on City Streets (MTTC), the Contractor ("Construction Agency" in the manual) shall be responsible for placing, maintaining and removing the appropriate temporary traffic control devices as specified by the MTTC or by the Traffic Management Branch of the City of Winnipeg Public Works Department. The Contractor shall bear all costs associated with the placement of temporary traffic control devices by their own forces or subcontractor.

E10.2 Notwithstanding E10.1, in accordance with the MTTC, the Contract Administrator shall make arrangements with the **Traffic Services Branch of the City of Winnipeg** to place, maintain, and remove all **regulatory signs** and traffic control devices authorized and/or required by the Traffic Management Branch in the following situations:

- (a) parking restrictions;
- (b) stopping restrictions;
- (c) turn restrictions;
- (d) diamond lane removal;
- (e) full or directional closures on a regional street;
- (f) traffic routed across a median;
- (g) full or directional closure of a non-regional street where there is a requirement for regulatory signs (turn restrictions, bus stop relocations, etc.) to implement the closure;
- (h) Approved Designated Construction Zones with a temporary posted speed limit reduction. Traffic Services will be responsible for placing all of the advance signs and 'Construction Ends' (TC-4) signs. The Contractor is still responsible for all other temporary traffic control including but not limited to barricades, barrels and tall cones; and,
- (i) The detour roadway shown in Drawing C2-CT-001 to C2-CT-006 (including poly-post delineation along undivided median).

E10.2.1 An exception to E10.2 is the 'KEEP RIGHT/KEEP LEFT' sign (RB-25 / RB-25L) which shall be supplied, installed, and maintained by the Contractor at their own expense.

E10.2.2 Further to E10.2 where the Contract Administrator has determined that the services of the Traffic Services Branch are required, the City shall bear the costs associated with the placement of temporary traffic control devices by the Traffic Services Branch of the City of Winnipeg in connection with the works undertaken by the Contractor.

## E11. **TRAFFIC MANAGEMENT**

E11.1 Further to clause 3.7 of CW 1130, refer to Staging Drawings for the traffic management details of each Stage.

## E12. **REFUSE AND RECYCLING COLLECTION**

E12.1 While access to refuse and/or recycling collection vehicles is restricted, on collection day(s) the Contractor shall move all of the affected property owners refuse and/or recycling materials to a nearby common area, prior to an established time, in accordance with E12.2 to permit the normal collection vehicles to collect the materials. Immediately following recycling collection the Contractor shall return recycling receptacles to the addresses marked on the receptacles.

E12.2 Collection Schedule:

**857 Waverley Street (River Run Condos)**

*Collection Day(s):* **Monday**

*Collection Time:* **6:00 am**

*Common Collection Area:* **City of Winnipeg collection vehicles will access the Condo units from Taylor Avenue and exit on Waverley Street (one way only). Contractor is to take refuse and recycling containers from the north and west side of the street and move to the south and east side of the street for collection.**

E12.3 No measurement or payment will be made for the work associated with this specification.

**E13. SURFACE RESTORATIONS**

E13.1 Further to clause 3.3 of CW 1130, when Total Performance is not achieved in the year the Contract is commenced, the Contractor shall temporarily repair any Work commenced and not completed to the satisfaction of the Contract Administrator. The Contractor shall maintain the temporary repairs in a safe condition as determined by the Contract Administrator until permanent repairs are completed. The Contractor shall bear all costs associated with temporary repairs and their maintenance.

E13.2 Where the Contractor chooses to perform any part of the Work that impacts the existing surface conditions for pedestrian, bicycle and vehicle passage, without promptly completing the final surface works required in Contract, the Contractor shall construct temporary surface restorations meeting the requirements of 3.3 of CW 1130 and to the satisfaction of the Contract Administrator. The Contractor shall maintain the temporary surface restorations in a safe condition until the final surface works are completed by the Contractor according to Contract. The Contractor shall bear all costs associated with temporary surface restorations and their maintenance.

**E14. COORDINATION OF CONSTRUCTION WITH CN**

E14.1 Description

E14.1.1 General Requirements

- (a) The Contractor shall be responsible to meet all Canadian National (CN), constraints, requirements, and safety measures.
- (b) The Contractor shall be responsible for any damage, delay, disruption and/or inconvenience caused to CN by their equipment or operations of Work to the tracks, the railway's operation or their property.
  - (i) CN has the right to shut down any construction activity within its property and near any operated track and remove the contractor from the Site for violations of their safety requirements. The Contractor shall be responsible for any costs and scheduled delays resulting from the violation.
- (c) If any emergency occurs, CN can be contacted through its Emergency CN Police Line 1-800-465-9239. Reference "Waverley Grade Separation, M 3.9 Rivers Sub."
- (d) The Contractor shall follow the requirements of CN as stipulated in the CN Safety Requirements herein in this Bid Opportunity Appendix 'B'. All employees of the Contractor shall obtain the CN Contractor Orientation Identification card and sticker prior to working on Site.
- (e) The Contractor shall provide CN with a twenty-four (24) hour phone number through which the Contractor can be contacted for emergency purposes.



- (f) CN and their contractor(s) will be constructing the shoofly tracks and main tracks as well as removing trackage as required. Full cooperation, including meeting milestone dates with these forces is required.

#### E14.2 Temporary Construction Crossing Permit

E14.2.1 Should CN allow a temporary construction crossing, the Contractor shall be responsible for the application and payment for the temporary construction crossing permit. The Contractor together with the Contract Administrator will meet with the appropriate CN representative and determine the best location for the crossing. A detailed safety plan regarding vehicle and equipment crossing will need to be submitted with the permit. The plan must at a minimum identify procedures, positioning of contractors employee(s) designated to control all movements over tracks and all other requirements as identified in CN Safety Requirements Appendix 'B'.

E14.2.2 On a daily basis the designated Contractor's employee will discuss the days' equipment movement over the crossing with the Protecting Foreman.

E14.2.3 At the end of each working day the Contractor will be responsible to barricade the crossing to stop vehicle/equipment movements across the active rail lines.

E14.2.4 All costs including its construction and operation, liabilities, cleaning up and restoring of Site after removal of the crossing will be the Contractor's responsibility.

#### E14.3 Contractor's Use of Site

E14.3.1 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.

E14.3.2 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.

E14.3.3 All costs, liabilities, cleaning up and restoring of Site after completion of the Project will be the Contractor's responsibility.

#### E14.4 Flag Protection of Work

E14.4.1 The Contractor will not be required to supply flag protection for this Project.

E14.4.2 The CN Protecting Foreman has the total authority over all activities near the track regardless of what work is being performed as per Appendix 'B'.

#### E14.5 Signals and Communication Cables

E14.5.1 The Contractor shall request CN to locate their cables before commencement of any Work.

E14.5.2 The Contractor shall give CN seventy-two (72) hours' notice to locate cables.

E14.5.3 The Contractor shall use extreme caution when working in the vicinity of any signal and communication cables.

E14.5.4 As a result of damage to any cable, fibre optic line or associated equipment by their 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.

#### E14.6 Barricades and Signage

E14.6.1 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.

#### E14.7 Down Time

E14.7.1 The Contractor is advised that for parts of the Work of the Contract in the vicinity of railway there may be unproductive time (also known as down time) related to ongoing CN rail operations and train traffic through the site. The Contractor shall accommodate all CN rail operations and train traffic through the site throughout the performance of the Work. The contractor is advised that 35 to 40 trains currently use this rail line each day. No compensation will be considered for variation in the duration or frequency of CN rail operations and train traffic, nor for down time as a result of these operations.

E14.8 Measurement and Payment.

E14.8.1 No measurement or payment will be made for the work associated with this specification.

**E15. OPERATING CONSTRAINTS FOR WORK IN CLOSE PROXIMITY TO FEEDER MAINS**

E15.1 Description

E15.1.1 This Section details operating constraints for all work to be carried out in close proximity to the City feeder mains and other critical water infrastructure. Close proximity shall be deemed to be any construction activity within a 5 m horizontal offset from the centreline of the feeder main, within 5 m of valve chambers and other appurtenances, and any other infrastructure identified below.

E15.2 The following shall be considered critical pipelines and water infrastructure for this project:

E15.2.1 Wilkes Avenue Feeder Main

- (a) 900 mm Prestressed Concrete Cylinder Pipe (PCCP) (Lined Core) conforming to AWWA Standard C301-64. The Wilkes Avenue Feeder Main was manufactured and installed in 1966.
- (b) The feeder main runs east-west along the Wilkes Avenue as shown on the Drawings.

E15.2.2 Charleswood Feeder Main

- (a) 750 mm Reinforced Concrete Cylinder Pipe (RCCP) water transmission pipe conforming to AWWA C300. The Charleswood Feeder Main was manufactured and installed in 1960.
- (b) The feeder main runs east-west along the Wilkes Avenue as shown on the Drawings.

E15.2.3 Midtown Feeder Main

- (a) 900 mm Prestressed Concrete Cylinder Pipe (PCCP) (Embedded Core) water transmission pipe conforming to AWWA C301-58. The Midtown Feeder Main was manufactured and installed in 1959 in 4.88 m (16.02') pipe lengths. Record information for the Midtown Feeder Main is available upon request.
- (b) The feeder main runs north-south along a right of way east of Waverley Street until Mathers Avenue after which it runs along the Waverley right of way as shown on the Drawings.
- (c) The following Midtown Feeder Main valve chambers are affected by the proposed work:
  - (i) Air Valve Pit at Taylor Avenue in South Boulevard;
  - (ii) Offtake chamber at Mathers Avenue and Waverley Street (Abandoned); and,
  - (iii) Valve Chamber at Grant Avenue and Waverley Street.

E15.2.4 Fort Garry-St. Vital Feeder Main

- (a) 750 mm Prestressed Concrete Cylinder Pipe (PCCP) (Lined Core) conforming to AWWA Standard C301-58. The Fort Garry Feeder Main was manufactured and installed in 1960.
- (b) The feeder main runs east from the W.D. Hurst Pumping Station along Hurst Way.

E15.2.5 South Fort Garry Feeder Main

(a) 900 mm Prestressed Concrete Cylinder Pipe (PCCP) (Lined Core) conforming to AWWA Standard C301-72. The South Fort Garry Feeder Main was manufactured and installed in 1981.

(b) The feeder main runs south along Waverley Street from Hurst Way.

E15.2.6 Miscellaneous feeder main valve chambers located at the W. D. Hurst Pumping Station on Hurst Way as shown on the Drawings.

E15.3 General Considerations for Work in Close Proximity to Critical Water Infrastructure:

- (a) feeder mains are a critical component of the City of Winnipeg Regional Water Supply System and work in close proximity to feeder mains shall be undertaken with an abundance of caution. Feeder mains cannot typically be taken out of service for extended periods to facilitate construction and inadvertent damage caused to the pipe would likely have catastrophic consequences;
- (b) work around feeder mains shall be planned and implemented to minimize the time period that work is carried out in close proximity to the pipe and to ensure that the pipeline is not subjected to excessive construction related loads, including excessive vibrations and/or concentrated or asymmetrical lateral loads during backfill placement;
- (c) large diameter pressure pipe generally has limited ability to withstand increased earth and live loading. Therefore, every precaution must be undertaken to ensure that applied loading during all phases of construction is within accepted loading parameters. PCCP typically fails in a non-ductile mode and has the potential to cause extensive consequential damage to infrastructure if failure should occur; and,
- (d) construction in close proximity to critical infrastructure shall not commence until both the equipment and construction method statements have been submitted, reviewed, and accepted by the Contract Administrator.

E15.4 Submittals

E15.4.1 Submit proposed construction equipment specifications to the Contract Administrator for review a minimum of five (5) Business Days prior to construction. The equipment submission shall include:

- (a) equipment operating and payload weights;
- (b) equipment dimensions, including: wheel or track base, track length or axle spacing, track widths or wheel configurations; and,
- (c) load distributions in the intended operating configuration.

E15.4.2 Submit a construction method statement to the Contract Administrator a minimum of five (5) Business Days prior to construction. The construction method statement shall contain the following minimum information:

- (a) proposed construction plan including excavation locations, haul routes, excavation equipment locations, and loading positions;
- (b) excavation plans, including shoring designs, for excavations occurring in close proximity to feeder mains (within 5 m horizontal of the pipe's centerline) where the excavation to be extended below the top of the feeder mains embedment zone (150 mm above the pipe);
- (c) trenchless construction methodology for feeder main crossings, including: installation methods, means of grade control, means of confirming clear separation between the new LDS and existing feeder main; and,
- (d) any other pertinent information required to accurately describe the construction activities in close proximity to the feeder main and permit the Contract Administrator to review the proposed construction plans.

E15.4.3 Incomplete or partial submissions will not be reviewed and will be returned to the Contractor for re-submission.

E15.4.4 Allow five (5) Business Days for review by the Contract Administrator.

E15.5 Feeder Main Operational Limitations

E15.5.1 Feeder main shutdowns are scheduled based on a number of factors including water demand, weather, reservoir operation, routine maintenance and repair work within the regional distribution system, and other factors. The City shall endeavour to make requested time periods available to the Contractor to schedule his/her work requiring removal of the feeder main from service, without limiting the City's control over the operation of the feeder main to complete other work, maintain adequate water supply and storage of water and maintain the integrity of the infrastructure. The City shall reserve the right to cancel and/or delay these schedule dates at any time, due to any circumstances that could adversely affect the feeder main or water supply including, but not limited to, high water demand, abnormal weather, failures of related water system components, and/or security concerns.

E15.5.2 Scheduling Restrictions:

- (a) Temporary feeder main shutdowns shall be limited to off-peak demand seasons (September 15 to May 15) and low demand hours including evenings or other low demand periods.
- (b) The Midtown Feeder Main cannot be removed from service between April 1, 2017 and November 1, 2017.
- (c) Shutdown of the Midtown Feeder Main for the purposes of the replacement of the existing casing pipe shall be limited to a maximum of 21 Calendar Days measured from the completion of draining by City forces to turn over of system back to the City of Winnipeg for refilling.

E15.5.3 The Contractor shall provide Notice to the Contract Administrator in writing, a minimum of fifteen (15) Business Days prior to requiring the shutdown. The City will endeavour to schedule the shutdown as requested.

E15.6 Pre-Work, Planning and General Execution

E15.6.1 No work shall commence in close proximity to feeder mains, chambers, and critical infrastructure until the equipment specifications and construction method statement have been submitted and accepted, and feeder main locations have been clearly delineated in the field. Work over feeder mains shall only be carried out with equipment that has been reviewed and quantified in terms of its loading implications on the pipe.

E15.6.2 Contact the City of Winnipeg Water and Waste Department, Construction Services Coordinator prior to construction.

E15.6.3 Locate feeder mains and confirm their position horizontally and vertically at the proposed the following locations prior to undertaking work in close proximity to the identified feeder mains. Note exact locations to be identified in the field. Deviations from the following elevations noted on the Drawings shall be reported to Contract Administrator for review prior to proceeding with work:

- (a) Midtown Feeder Main
  - (i) Hurst Way crossing
  - (ii) North of the existing CN railway crossing
  - (iii) Taylor Avenue crossing
  - (iv) Waverley Street at Mathers Avenue, Grant Avenue, and roadway low points between Mathers Avenue and Grant Avenue
- (b) Wilkes Avenue Feeder Main
  - (i) Waverley Street crossing at a minimum of two (2) locations
  - (ii) Wilkes Avenue at western extents of the proposed work
- (c) Charleswood Feeder Main

- (i) Wilkes Avenue at W.D. Hurst Pumping Station and at the western extents of the proposed work
    - (ii) Waverly Street crossing at two (2) locations
  - (d) Fort Garry-St. Vital Feeder Main
    - (i) Near the W.D. Hurst Pumping Station
    - (ii) At the east extents of the proposed work
  - (e) South Fort Garry Feeder Main
    - (i) Waverley Street crossing
- E15.6.4 Visually delineate all critical infrastructure identified herein on Site by use of paint, staking/flagging, construction fencing, snow fencing, or other suitable methods
- E15.6.5 Only utilize construction practices and procedures that do not impart excessive vibratory loads on feeder mains and chambers or that would cause settlement of the subgrade below feeder mains and critical pipelines.
- E15.6.6 Where the existing road structure must be removed, crossing of critical infrastructure shall be prohibited from the time the existing roadway structure is removed until the completion of granular base construction. At all times prior to completion of final paving; reduce equipment speeds to levels that minimize the effects of impact loading to the critical infrastructure.
- E15.6.7 Only equipment and construction practices stipulated in the accepted construction method statement and the supplemental requirements noted herein may be utilized in close proximity to feeder mains, chambers, and other critical infrastructure identified herein.
- E15.6.8 Construction operations should be staged in such a manner as to limit multiple construction loads at one time, (e.g., offset crossings sufficiently from each other, rollers should remain a sufficient distance behind spreaders to limit loads. A reasonable offset distance is 3 m between loads).
- E15.6.9 Granular material, construction material, soil, and/or other material shall not be stockpiled on the pipelines or within 5 m of any feeder main, valve chamber, or other critical infrastructure identified herein.
- E15.6.10 The Contractor shall ensure that all crew members understand and observe the requirements of working near feeder mains, valve chambers, and critical infrastructure. Prior to commencement of on-Site work, the Contractor shall jointly conduct an orientation meeting with the Contract Administer, all superintendents, foreman, and heavy equipment operators to make all workers on the Site fully cognizant of the limitations of altered loading on, the ramifications of inadvertent damage to, and the constraints associated with work in close proximity to feeder mains and critical pipelines. New personnel introduced after commencement of the Project need to be formally orientated as outlined herein. It is recommended that restrictions associated with the crossing, consistent with the Contractor's submitted method statement be posted on Site and near the crossing.
- E15.7 Demolition, Excavation, and Shoring
  - E15.7.1 Use of pneumatic concrete breakers within 3 m of a feeder main, valve chamber, or critical pipeline is prohibited. Pavement shall be full depth sawcut and carefully removed. Use of hand held jackhammers for pavement removal will be allowed.
  - E15.7.2 Offset excavation equipment a minimum of 3 m from the centerline of critical pipelines when undertaking excavations where there is less than 2.4 m of earth cover over the pipeline.

- E15.7.3 Utilize only smooth edged excavation buckets, soft excavation, or hand excavation techniques where there is less than 1.5 m of earth cover over the pipeline. Where there is less than 1.0 m of soil cover above the pipeline, provide full time supervision and complete the excavation utilizing hand excavation or soft excavation methods.
- E15.7.4 Equipment should not be allowed to operate while positioned directly over a feeder main or critical pipeline except where permitted herein, outlined in the reviewed and accepted construction method statement.
- E15.7.5 Excavations within 3 m of the outside edge of a feeder main (hydrovac holes for confirming trenchless installations excluded) and which extend below the top of the feeder main shall utilize shoring methods that precludes the movement of native in-situ soils (i.e., a tight shoring system).
- E15.7.6 Pre-bore all piles to below the invert of critical infrastructure within 5 m (horizontally) of the pipeline's outside edge.
- E15.7.7 Offset pile driving equipment a minimum of 3 m (horizontally) from the centerline of the pipeline during piling operations.
- E15.8 Underground Construction and Trenchless Pipe Installation
- E15.8.1 Install pipes to the grades shown on the Drawings. A minimum clear separation distance (outside to outside of pipe wall) of 500 mm shall be maintained between crossing pipes and the feeder mains.
- E15.8.2 The Contractor shall locate feeder mains and confirm their position horizontally and vertically prior to commencing with any trenchless pipe installations to ensure proper clearances are maintained. Under NO circumstances should blind coring proceed across feeder mains.
- E15.8.3 The Contractor shall visually confirm the location and alignment of the drill rods or jacking pipe (horizontally and vertically) prior to proceeding with the trenchless installation beneath the feeder main. It is recommended that the new pipe alignment be confirmed within 2 m of the outside of the feeder main pipe but no closer than 0.5 m from the outside edge of the pipe.
- E15.8.4 No trenchless methods involving soil displacement (plugs) shall be permitted in the vicinity of the feeder main.
- E15.8.5 Pressure grouting or approved alternative methods shall be used to fill voids caused by the installation or if the bored hole diameter is greater than the outside diameter of the pipe by more than 25 mm.
- E15.8.6 Where excavation is required within the feeder main's embedment zone, the Contractor shall take steps to ensure the granular embedment material surrounding the feeder main remains stable during the work and the feeder main outside of the excavation is not undermined.
- E15.9 Feeder Main Insulation
- E15.9.1 Insulate feeder mains where specified on the Drawings in accordance with CW2110, and as shown on the Drawings.
- E15.9.2 Materials
- (a) High Strength Rigid insulation for below grade: to CAN/ULC S701, Type 4, Styrofoam HI 40 by Dow Chemical, Foamular 400 by Owens Corning, or approved equal in accordance with B8.
  - (b) Rigid insulation shall be installed with the top of the insulation flush with the top of the subgrade.
  - (c) Rigid insulation sheets shall be installed in a staggered pattern to maximise joint overlap.

(d) Insulation for the Midtown Feeder Main shall meet the following:

- (i) Thickness: 100 mm (all locations)
- (ii) Width:
  - ◆ Equal to or less than 1.5 m of soil cover: 3.6 m
  - ◆ Greater than 1.5 m and less than 2.1 m of soil cover: 2.4 m
  - ◆ Equal to or greater than 2.1 m of soil cover: No insulation required

#### E15.10 Subgrade Construction

- E15.10.1 Subgrade and backfill compaction within 3 m (horizontal) of a critical pipeline or valve chamber shall be limited to non-vibratory methods only. Small walk behind vibratory packers will be permitted.
- E15.10.2 Subgrade, sub-base and base course construction shall be kept in a rut free condition at all times. Construction equipment is prohibited from crossing pipelines if the grade is insufficient to support the equipment without rutting.
- E15.10.3 Subgrade conditions should be inspected by personnel with competent geotechnical experience (e.g., ability to adequately visually classify soils and competency of subgrade, subbase, and base course materials). In the event of encountering unsuitable subgrade materials above the feeder main, proposed design revisions shall be submitted to this office for review to obtain approval from the Water and Waste Department relative to any change in conditions.
- E15.10.4 Fill material shall not be dumped directly on pipelines but shall be stockpiled outside the limits noted in these recommendations and shall be carefully bladed in-place.
- E15.10.5 Only use compaction equipment approved by the Contract Administrator to compact fill materials above critical pipelines. Compaction of fill materials shall be completed using static methods only, no vibratory compaction will be allowed within the limits noted in these recommendations.
- E15.10.6 Construction operations shall be staged to minimize the time period between excavation to subgrade and placement of granular subbase materials. Should bare subgrade be left overnight, measures shall be implemented to protect the subgrade against inadvertent travel over it and to minimize the impact of wet weather.

#### E15.11 Subbase and Base Course Construction

- E15.11.1 Subbase or base course materials shall not be dumped directly on pipelines but shall be stockpiled outside limits noted in these recommendations and shall be carefully bladed in-place.
- E15.11.2 Subbase compaction within 3 m horizontal of the centreline of a critical pipeline shall be either carried out by static methods (without vibration) or with smaller approved equipment such as hand held plate packers or smaller roller equipment.

#### E15.12 Paving

- E15.12.1 When constructing asphalt pavements only non-vibratory compaction should be used within 3 m (horizontal) of the center of critical pipelines.

### ROADWORKS

#### E16. CLEARING AND GRUBBING

##### E16.1 Description

##### E16.1.1 General

- (a) This specification covers clearing and grubbing and removal of individual trees.
- (b) Referenced Standard Construction Specifications.

- (i) CW3010 – Clearing and Grubbing.

#### E16.1.2 Definitions

- (a) Clearing consists of cutting off standing trees, brush and scrub at or close to existing grade and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- (b) Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.
- (c) Clearing and Grubbing Areas consist of clumps of standing trees, brush, scrub, and surface debris.
- (d) Individual trees consist of trees larger than 200 mm (caliper) in open grassed areas with no brush or scrub surrounding them.

#### E16.1.3 Protection

- (a) Prevent damage to fencing, trees, natural features, bench marks, existing buildings existing pavement, utility lines, Site appurtenances, water courses, root systems of trees which are to remain.
- (b) Repair damaged items to approval of Contract Administrator. Replace trees designated to remain, if damaged, as directed by Contract Administrator.
- (c) The Contractor shall not remove any trees or perform any clearing and grubbing that has not been clearly marked by the Contract Administrator. If the Contractor removes any tree, regardless of size or species, that was not approved by the Contract Administrator, the Contractor shall supply and install five (5) trees of a species and calliper equal to or greater than that which was removed. The replaced trees shall be installed at a location determined by the Contract Administrator, which may be in or near the Site.
- (d) Protect existing trees and vegetation to remain as per E9.3.1(b) Protection of Trees.
- (e) Limit Site disturbance including earthwork and clearing of vegetation to:
  - (i) 12 m beyond the building perimeter;
  - (ii) 1.5 m beyond road way, walkways, ditches and main utility trenches; and,
  - (iii) 5 m beyond sports fields and parking.
- (f) Maintain access roads to prevent accumulation of construction related debris on roads.

#### E16.1.4 Wood Waste Management and Disposal

- (a) Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber:
  - (i) trim limbs and tops, and saw into saleable lengths for pulpwood, for poles, for ties, and for fuel wood;
  - (ii) stockpile adjacent to Site; and,
  - (iii) owner to have first right of refusal for saleable timber.

#### E16.2 Materials

##### E16.2.1 Soil material for fill:

- (a) soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.

##### E16.2.2 Temporary Erosion and Sedimentation Control

- (a) Provide temporary erosion and sedimentation control as per D21.

##### E16.2.3 Preparation

- (a) Inspect Site and verify with Contract Administrator items designated to remain.



- (b) Locate and protect utility lines: preserve in operating condition active utilities traversing Site.
- (c) Notify Contract Administrator immediately of damage to or when unknown existing utility lines are encountered.

### E16.3 Construction Methods

#### E16.3.1 Clearing

- (a) Clearing includes cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including felled trees, shrubs, scrub and rubbish occurring within cleared areas.
- (b) Clear as directed by Contract Administrator, by cutting at or close to existing grade. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
- (c) Cut off unsound branches on trees designated to remain as directed by Contract Administrator.

#### E16.3.2 Grubbing

- (a) Grub out all stumps and roots from clearing and grubbing areas.
- (b) Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.
- (c) Fill depressions made by grubbing with suitable fill material and to make new surface conform to existing adjacent ground surface.

#### E16.3.3 Individual Tree Removal

- (a) Remove trees, including roots, as noted on construction drawings and as approved by the Contract Administrator.
- (b) Fill depressions made by root removal with suitable fill material and to make new surface conform to existing adjacent ground surface.

#### E16.3.4 Removal and Disposal

- (a) Remove cleared and grubbed materials off site.

#### E16.3.5 Finished Surface

- (a) Leave ground surface in condition suitable for immediate grading operations to approval of Contract Administrator.

#### E16.3.6 Cleaning

- (a) On completion and verification of performance of work, remove surplus materials, excess materials, rubbish, tools and equipment.

### E16.4 Measurement and Payment

E16.4.1 Clearing and Grubbing will be measured on an area basis and paid for at the Contract Unit Price per hectare as "Clearing and Grubbing". The area to be paid for will be the total hectares of Clearing and Grubbing performed in accordance with this specification and accepted by the Contract Administrator.

E16.4.2 Removal of individual trees larger than 200 mm (caliper) shall be measured on a per unit basis and paid for at the Contract Unit Price for "Tree Removal" measured as specified herein for the total number of individual trees removed in accordance with this Specification, accepted and measured by the Contract Administrator.

E16.4.3 Removal of individual trees smaller than 200 mm in caliper size shall be considered incidental to "Clearing and Grubbing".

## E17. BUS STOP FLAG FOUNDATION

### E17.1 Description

E17.1.1 The Work covered under this Item shall include all concreting operations related to construction of cast-in-place concrete foundations for bus stop flags in accordance with this Specification and as shown on the Drawings.

E17.1.2 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.

### E17.2 Materials

#### E17.2.1 General

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

#### E17.2.2 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 A23.1-04.

#### E17.2.3 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 be approved by the Contract Administrator at least seven (7) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such materials shall be rejected by the Contract Administrator and replaced by the Contractor at their own expense.

#### E17.2.4 Patching Mortar

(a) The patching mortar shall be made of the same cementitious 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 one (1) part cement to two (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 and placing.

#### E17.2.5 Cement

(a) Cement shall be Type HS or HSb, high-sulphate-resistant hydraulic cement, conforming to the requirements of CSA Standard A23.1-04.

#### E17.2.6 Concrete

##### (a) General

(i) Concrete repair material shall be compatible with the concrete substrate.

(b) The Contractor shall be responsible for the design and performance of all concrete mixes supplied under this specification. Either ready mix concrete or proprietary repair mortars, where applicable, may be used having the following minimum properties in accordance with CSA A23.1-04:

(i) Class of Exposure: S-1;

- (ii) Compressive Strength @ 56 days = 35 MPa;
  - (iii) Water / Cementing Materials Ratio = 0.4;
  - (iv) Air Content: Category 2 per Table 4 of CSA A23.1-04 (4-7%); and,
  - (v) Cement – shall be as specified in E17.2.5. Mix design for ready mix concrete shall be submitted to Contract Administrator at least two weeks prior to concrete placing operations.
- (c) The workability of each concrete mix shall be consistent with the Contractor's placement operations. Self-compacting concrete may be used for the foundations.
  - (d) Any proposed proprietary repair mortar shall be subject to the approval of the Contract Administrator and must meet or exceed the properties of the ready mix concrete.
  - (e) The temperature of all types of concrete shall be between 15°C and 25°C at discharge. Temperature requirements for concrete containing silica fume shall be between 10°C and 18°C at discharge unless otherwise approved by the Contract Administrator.
  - (f) Concrete materials susceptible to frost damage shall be protected from freezing.

#### E17.2.7

##### Aggregate

- (a) The Contractor shall be responsible for testing the fine and coarse aggregates to establish conformance to these specifications, and the results of these tests shall be provided to the Contract Administrator if requested. All aggregates shall comply with CSA A23.1.
  - (i) Coarse Aggregate
    - ◆ The maximum nominal size of coarse aggregate shall be sized to suit the Contractor's mix design. Gradation shall be in accordance with CSA A23.1, Table 11, Group 1. The coarse aggregate shall satisfy the Standard Requirements specified in CSA A23.1, Table 12, "Concrete Exposed to Freezing and Thawing".
    - ◆ Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; and shall have an absorption not exceeding 2.25%.
    - ◆ 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, and excess of thin particles or any other extraneous material.
    - ◆ Coarse aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than thirty percent (30%).
    - ◆ Tests of the coarse aggregate shall not exceed the limits for standard for requirements prescribed in CSA A23.1, Table 12, for concrete exposed to freezing and thawing.
  - (ii) Fine Aggregate
    - ◆ Fine aggregate shall meet the grading requirements of CSA A23.1, Table 10, Gradation FA1.
    - ◆ Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam, or other deleterious substances.
    - ◆ Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1, Table 12.

#### E17.2.8

##### Cementing Materials

- (a) Cementing materials shall conform to the requirements of CSA A3001.

- (i) Silica Fume
  - ◆ Should the Contractor choose to include silica fume in the concrete mix design, it shall not exceed eight percent (8%) by mass of cement.
- (ii) Fly Ash
  - ◆ Fly ash shall be Type C1 or Type F and shall not exceed twenty-five percent (25%) by mass of cement.
- (b) 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 formation of lumps shall not be used in the Work.

#### E17.2.9 Admixtures

- (a) Air entraining admixtures shall conform to the requirements of ASTM C260.
- (b) Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.
- (c) All admixtures shall be compatible with all other constituents. The addition of calcium chloride, accelerators, and air-reducing agents will not be permitted, unless otherwise approved by the Contract Administrator.
- (d) Appropriate low range water reducing and/or superplasticizing admixtures shall be used in concrete containing silica fume. Approved retarders or set controlling admixtures may be used for concrete containing silica fume.
- (e) An aminocarboxylate based migrating corrosion inhibitor admixture shall be used in concrete that will be used as a repair material that will either be in contact with or adjacent to reinforcing steel in existing concrete. Proposed admixtures shall be subject to the approval of the Contract Administrator.

#### E17.2.10 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.

#### E17.2.11 Concrete Supply

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

#### E17.2.12 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 G30.18, Grade 400 W, Billet-Steel Bars for Concrete Reinforcement. All reinforcing steel shall be new deformed billet steel bars. All bars, including ties, shall be hot-dip galvanized in accordance with CSA Standard G164 for a minimum net retention of 600 g/m<sup>2</sup>. Reinforcing steel supply and installation will be incidental to construction of concrete foundation and no separate payment will be made.

#### E17.2.13 Anchor Bolts, Nuts, and Washers

- (a) Anchor bolts, nuts and washers shall be supplied by the Contract Administrator.

#### E17.2.14 Anchor Bolt Templates

- (a) Anchor bolt templates shall be supplied by the Contract Administrator.
- (b) Anchor bolt templates will be incidental to construction of new concrete foundation and no separate payment will be made.

E17.2.15 Fibre Joint Filler

- (a) Fibre joint filler shall be rot-proof and of the preformed, non-extruding, resilient-type, made with a bituminous fibre such as "Flexcell," and shall conform to the requirements of ASTM Standard D1751, or approved equal in accordance with B8.

E17.2.16 Anti-Graffiti Coating

- (a) Anti-graffiti coating shall be "Professional Water Sealant & Anti-Graffiti System" or approved equal in accordance with B8.

E17.2.17 Waterproofing Membrane

- (a) Waterproofing membrane shall be "Sonoshield HLM 5000 R" or approved equal in accordance with B8.

E17.2.18 Miscellaneous Materials

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

E17.3 Construction Methods

E17.3.1 Location and Alignment of Foundations

- (a) Foundation construction shall not commence until the Contractor has obtained clearance from the appropriate Utility Authorities.
- (b) Foundations 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 foundation shall not differ by more than one percent (1%) from the vertical.

E17.3.2 Buried Utilities

- (a) The Contractor shall exercise extreme caution when constructing the foundations in the vicinity of existing buried utilities and buildings. 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 foundations.
- (b) The proposed locations of the 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 foundations, as determined by the Contract Administrator.

E17.3.3 Excavation

- (a) The Contractor is responsible for determining the excavation method at each foundation location.
- (b) Excavations for foundations shall be made with equipment designed to remove a core of the diameter shown on the Drawings, or hydro-jet excavation to a depth to bypass and/or expose adjacent utilities.
- (c) Upon reaching the required elevation, the bottom of the excavation shall be cleaned as directed by the Contract Administrator in the field.
- (d) All excavated material from the foundations shall be promptly hauled away from the Site to an approved disposal area as located by the Contractor.

- (e) 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 complete.

#### E17.3.4 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.

#### E17.3.5 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.

#### E17.3.6 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.

#### E17.3.7 Placing Anchor Bolts

- (a) The anchor bolts shall be aligned with a steel template supplied by the Contract Administrator matching the bolt holes in the sign structure base plate. **Extreme care shall be used in this operation to ensure bolts are aligned properly.** Placement of anchor bolts without the steel template will not be permitted.
- (b) The threaded portion of the anchor bolts projecting above the top surface of foundation shall be coated with oil, before the concrete is poured, to minimize the fouling of threads splattered by concrete residue.

#### E17.3.8 Placing Metal Bases

- (a) Contractor to install metal bases as supplied by the Contract Administrator following curing of concrete foundations.
- (b) Metal bases are to be installed plumb, level, and flush to the concrete foundation. Contractor to use stainless steel washers to level bases as required.

#### E17.3.9 Forms

- (a) Forms for exposed surfaces that require an "ordinary surface finish" shall be made of good quality plywood, or an approved equivalent, or uniform thickness, with or without a form liner.
- (b) Architectural concrete form liner shall be as specified on the Plans or equivalent as approved by the Contract Administrator.
- (c) Permeable formwork liner shall be Drainoform, Zemdral II, or equivalent as approved by the Contract Administrator.

- (d) Formwork materials shall conform to CSA Standard CAN/CSA-A23.1, and American Concrete Publication SP:4, "Formwork for Concrete".
- (e) No "stay-in-place" formwork or falsework is permitted.
- (f) 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.
- (g) 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".
- (h) Boards used for formwork shall be fully seasoned and free from defects such as knots, warps, cracks, etc., which may mark the concrete surface.
- (i) 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.
- (j) Forms for exposed concrete surfaces that do not require a form liner may be either new plywood or steel as authorized by the Contract Administrator.
- (k) Studding shall be spruce or pine and shall have such dimensions and spacing that they shall withstand distortion from all the forces to which the forms will be subjected. Minimum dimensions shall be 50 mm x 150 mm.
- (l) Walers shall be spruce or pine, with minimum dimensions of 100 mm x 150 mm.
- (m) All forms are incidental to these Works and must be removed by the Contractor once adequate strength and curing of the concrete has been achieved.
- (n) 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.

#### E17.3.10 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 foundation.
- (c) Concrete shall be placed to the elevations as shown on the Drawings. The top surface of the foundation 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.

#### E17.3.11 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.

#### E17.3.12 Construction Joints

- (a) Construction joints shall be located only where shown on the Drawings or as otherwise approved in writing by the Contract Administrator. Construction joints shall be at right angles to the direction of the main reinforcing steel. All reinforcing steel shall be continuous across the joints. Bevelled shear keys, as shown on the Drawings or approved by the Contract Administrator, shall be provided at all joints.
- (b) In lieu of shear keys, the Contractor may roughen the surface as follows. The surface shall be rough, with minimum amplitude of 6 mm. Acceptable procedures to obtain this rough surface are as follows:

- (i) by removing the mortar from between the larger aggregate particles with a water jet and soft brush when the concrete is in a semi-hardened state (green-cut); and,
  - (ii) by first applying a chemical retarder to the surface and then removing the mortar from the larger aggregate particles with a water jet and brush.
- (c) The face of joints shall be cleaned of all laitance and dirt, after which the cementitious grout or an approved bonding agent shall be applied. Forms shall be retightened, and all reinforcing steel shall be thoroughly cleaned at the joint prior to concreting.

#### E17.3.13 Curing Concrete

- (a) The top of the freshly finished concrete foundations shall be covered and kept moist by means of wet polyester blankets immediately following finishing operations and shall be maintained at above 10°C 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 3° in one hour or 20° in twenty-four (24) hours.

#### E17.3.14 Form Removal

- (a) Forms shall not be removed for a period of at least twenty-four (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.

#### E17.3.15 Patching of Formed Surfaces

- (a) Immediately after forms around top of foundation 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 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.

#### E17.3.16 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 10°C 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 their own expense. Also, concrete allowed to freeze prior to the three (3) days will not be accepted for payment.

E17.3.17 Anti-Graffiti Coating

- (a) Anti-graffiti coating shall be applied to all raised planter walls shown on the drawings or identified by the Contract Administrator.
- (b) The anti-graffiti coating shall be applied according to manufactures specifications.
- (c) Maintain anti-graffiti coating on all vertical concrete surfaces for a period of two (2) years.

E17.3.18 Waterproofing

- (a) Waterproofing membrane shall be applied to all new concrete raised planter interior walls and existing concrete columns within the planters which will come into contact with planting soil, as identified on the drawings or by the Contract Administrator. The waterproofing membrane shall be roller applied according to manufactures specifications.

E17.4 Quality Control

E17.4.1 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.

E17.4.2 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.

E17.5 Measurement and Payment

E17.5.1 Bus Stop Flag Foundation

- (a) Construction of bus stop flag foundations will be measured on a unit basis and will be paid for at the Contract Lump Sum Price per foundation for the "Items of Work" listed here below for concrete foundations constructed in accordance with this Specification and accepted by the Contract Administrator.

- (i) Items of Work:
  - ◆ Bus Stop Flag Foundation

E18. **BUS STOP FLAG RELOCATION**

E18.1 Description

E18.1.1 General

- (a) This specification applies to the removal of existing bus stop flag foundation, salvaging and storing the flag, and reinstalling on a new concrete base as identified on the Drawings.

E18.2 Construction Methods

E18.2.1 Removal of Concrete Foundations

- (a) Remove the flag poles and metal base from the concrete foundation and store on site in a clean, dry, safe and secure manner. Salvage all hardware and/or replace with stainless steel hardware if necessary.

- (b) After structure removed, Contractor to remove or demolish concrete foundation, including steel reinforcement to a minimum of 300 mm below the elevation of the surface of the adjacent sidewalk or paving stones.

E18.2.2 Reinstallation of Existing Flag Pole

- (a) Install flag pole, including metal base and hardware on a new foundation constructed as per E18 and the Contract Drawings.

E18.3 Measurement and Payment

E18.3.1 Removal of Concrete Foundation

- (a) Removal of concrete foundations will be measured on a per item basis and paid for at the Contract Unit Price per item for the "Items of Work" listed below. The amount to be paid for will be the total number of each item removed in accordance with this specification and accepted by the Contract Administrator.
  - (i) Items of Work:
    - ◆ Removal of Concrete Foundation

E19. **ROADWORKS EXCAVATION**

E19.1 Description

E19.1.1 General

- (a) This Specification covers the Work related to:
  - (i) Common Excavation (excluding areas under proposed roadways and sidewalks/pathways)
  - (ii) Fill Material
  - (iii) Grading of Boulevards
  - (iv) Grading of Ditches
  - (v) Roadway Excavation (under roadways and sidewalks/pathways)

E19.2 References

E19.2.1 Referenced Standard Construction Specifications

- (a) CW 1130 – Site Requirements
- (b) CW 3110 – Sub-Grade, Sub-Base and Base Course Construction
- (c) CW 3170 – Earthwork and Grading

E19.3 Materials

- (a) Material supplied shall be as per CW 3170 Clause 5 and CW 3110 Clause 2.

E19.4 Construction Methods

E19.4.1 Common Excavation

- (a) As per Specification CW 3170, Clause 9.2(b), Common Excavation shall consist of any excavation (including ditch excavation and boulevard excavation) which yields suitable and/or unsuitable Site material, as determined by the Contract Administrator. Topsoil shall be considered unsuitable Site material.
- (b) If necessary suitable Site material shall be temporarily stockpiled on Site until a location has been prepared for placement.
- (c) As per Specification CW 3110, Clause 3.2.3, dispose of surplus suitable and/or unsuitable Site material in accordance with Specification CW 1130, Clause 3.4.
- (d) Grade the surface after excavation to the elevations below finished grade identified in E45.4.1(b) for allowance for topsoil.

E19.4.2 Fill Material

- (a) Placing of suitable Site material shall include the hauling and placing of suitable Site material within the limits of work.
- (b) Hauling and placing of suitable Site material includes placement of stockpiled suitable site material and/or placement of material hauled directly from Common Excavation.
- (c) Construction methods for placing suitable site material shall be as per Specification CW 3170, Clauses 9.6 and 9.7.
- (d) Includes grading of material to the elevations below finished grade identified in E45.4.1(b) for allowance for topsoil.

#### E19.4.3 Grading of Boulevards

- (a) Grading of Boulevards shall be done in accordance with Specification CW 3110.
- (b) Further to Specification CW 3110, Clause 3.8.4 and Clause 3.8.5 excavate and/or place and compact fill to a depth up to 150 mm to meet the final grade 100 mm below finished boulevard grade.
- (c) Excavation in excess of 150 mm shall be treated as Common Excavation.
- (d) Placement of backfill material over 150 mm in depth required to complete boulevard grading will be treated as Fill Material.
- (e) Grading of Boulevards shall be taken to mean locations where existing boulevards at or near the Project limits, and in typical road rehabilitation areas require re-grading to tie into the proposed grades.

#### E19.4.4 Ditch Grading

- (a) Ditch Grading shall be done in accordance with Specification CW 3110.
- (b) Further to Specification CW 3110, Clause 3.9.3 and Clause 3.9.4, excavate and/or place and compact fill to a depth up to 300 mm to meet the final ditch grade requirements. If sodding of ditches is required, excavate and/or place and compact fill to a depth up to 300 mm to meet the final elevations below finished grade identified in E45.4.1(b) for allowance for topsoil.
- (c) Excavation in excess of 300 mm shall be treated as Common Excavation.
- (d) Placement of backfill material over 300 mm in depth required to complete ditch grading will be treated as Fill Material - Placing of Suitable Site Material.
- (e) Grading of Ditches shall be taken to mean locations where existing ditches at or near the Project limits, and in typical road rehabilitation areas require re-grading to tie into the proposed grades.

#### E19.4.5 Roadway Excavation

- (a) As per Specification CW 3110, Clause 3.2, Excavation shall consist of any excavation for a proposed roadway or pathway structure (including existing ditch excavation and boulevard excavation) which yields suitable and/or unsuitable Site material as determined by the Contract Administrator. Topsoil shall be considered unsuitable Site material.
- (b) If necessary suitable Site material shall be temporarily stockpiled on Site until a location has been prepared for placement.
- (c) As per Specification CW 3110, Clause 3.2.3, dispose of surplus suitable and/or unsuitable Site material in accordance with Specification CW 1130, Clause 3.4.
- (d) Grade the surface after excavation to the sub-grade elevation.

## E19.5 Measurement and Payment

### E19.5.1 Common Excavation

- (a) Common Excavation will be measured on a volume basis and paid at the Contract Unit Price per cubic metre for "Common Excavation". The volume shall be based on the total number of cubic metres excavated from its original position and determined by the method of Average End Areas, accepted and measured by the Contract Administrator.

### E19.5.2 Fill Material

- (a) Fill Material will be measured on a volume basis and paid at the Contract Unit Price per cubic metre for "Fill Material". The volume shall be based on the total number of cubic metres compacted in place in accordance with Specification CW 3170 and accepted by the Contract Administrator, as determined by the method of Average End Areas. No separate payment will be made for material hauled from a suitable Site material stockpile rather than directly from an excavation.

### E19.5.3 Grading of Boulevards

- (a) Grading of boulevards will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Grading of Boulevards". The area to be paid for will be the total number of square metres of boulevards graded in accordance with Specification CW 3110, accepted and measured by the Contract Administrator.

### E19.5.4 Ditch Grading

- (a) Ditch Grading will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Ditch Grading". The area to be paid for will be the total number of square metres of ditch graded in accordance with Specification CW 3110, accepted and measured by the Contract Administrator.

### E19.5.5 Roadway Excavation

- (a) Roadway Excavation will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Roadway Excavation". The volume to be paid for will be the total number of cubic metres of surplus suitable Site and/or unsuitable Site material excavated in its original position and determined by the method of Average End Areas.

## E20. **SIDEWALK WITH INDICATOR STRIP PAVING STONES**

### E20.1 Description

E20.1.1 This Specification shall cover the installation of concrete monolithic curb and sidewalk as identified on the Drawings, including areas under indicator strip paving stones.

E20.1.2 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.

### E20.2 References

#### E20.2.1 Referenced Specifications and Drawings

- (a) The latest version of the City of Winnipeg Standard Construction Specifications
- (i) CW 3310 – Portland Cement Concrete Pavement Works
  - (ii) CW 3325 – Portland Cement Concrete Sidewalk

### E20.3 Materials and Equipment

#### E20.3.1 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.
- (c) Concrete mix design shall comply with Clause 6.2a) of the latest version of the CW 3310.
- (d) All other materials as per Clause 5 of the latest version of the CW 3310.

#### E20.3.2 Equipment

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

#### E20.4 Construction Methods

E20.4.1 Construction shall take place in accordance with the Drawings and CW 3310 and CW 3325.

E20.4.2 Blockouts for all indicator strip paving stones in sidewalk to be constructed as shown on the Drawings. All forming and thickened sections are incidental to the unit price for monolithic curb and sidewalk or 100 mm concrete sidewalk.

E20.4.3 Verify dimensions of unit pavers prior to construction of the blockouts. Gaps between pavers and concrete pavement in excess of 6 mm (1/4") will be rejected.

E20.4.4 Meet existing grades and slopes unless otherwise indicated on the Drawings. Notify the Contract Administrator where this requirement will not result in positive drainage.

E20.4.5 Removal of any existing paving stones shall be incidental to the Work.

#### E20.5 Measurement and Payment

##### E20.5.1 Sidewalk with Indicator Strip Paving Stones

- (a) Constructing concrete sidewalk or monolithic curb and sidewalk with indicator strip paving stones shall be paid for at the Contract Unit Price per square metre for the "Items of Work", measured as specified herein, 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. The area to be paid for shall be the total number of square metres constructed in accordance with this Specification and as measured and accepted by the Contract Administrator.

- (i) Items of Work:

- ◆ 100 mm Concrete Sidewalk; and,
- ◆ Construction of Monolithic Curb and Sidewalk.

#### E21. TRANSIT SHELTER FOUNDATION

##### E21.1 Description

E21.1.1 This Specification shall cover the installation of concrete bus shelter pad foundations as identified 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 Work as hereinafter specified.

##### E21.2 References

E21.2.1 Referenced Specifications and Drawings

- (a) The latest version of the City of Winnipeg Standard Construction Specifications
  - (i) CW 3310 – Portland Cement Concrete Pavement Works
  - (ii) CW 3325 – Portland Cement Concrete Sidewalk

### E21.3 Materials and Equipment

#### E21.3.1 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.

#### E21.3.2 Concrete and Reinforcing Steel

- (a) Concrete mix design shall comply with Clause 6.2a) of the latest version of the CW 3310.
- (b) All other materials as per Clause 5 of the latest version of the CW 3310.

#### E21.3.3 Electrical

- (a) Provide and install new buried electrical service to the proposed bus shelters. Coordinate the 120/240 volt underground service point with Manitoba Hydro.

### E21.4 Construction Methods

#### E21.4.1 Construction shall take place in accordance with the Drawings and CW 3310 and CW 3325.

#### E21.4.2 All forming is incidental to the unit price Bid for the specification.

#### E21.4.3 Verify dimensions of bus shelter pads prior to construction.

#### E21.4.4 Meet existing grades and slopes unless otherwise indicated on the Drawings. Notify the Contract Administrator where this requirement will not result in positive drainage.

#### E21.4.5 Removal of any existing concrete bus shelter pad shall be incidental to the Work.

### E21.5 Measurement and Payment

#### E21.5.1 Transit Shelter Foundations

- (a) Constructing the Transit Shelter Foundations shall be paid for at the Contract Unit price per square metre for "Transit Shelter Foundations", measured as specified herein, 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 describe and all other items incidental to the work. The area to be paid for shall be the total number of square metres of Transit Shelter Foundations constructed in accordance with this specification and as measured and accepted by the Contract Administrator.

## E22. **SUPPLY AND INSTALL HATELIT "C"**

### E22.1 Description

#### E22.1.1 General

- (a) This specification covers the supply and installation of HaTelit "C" in areas of the ATP path along Waverley Street between Victor Lewis Drive and Hurst Way and any other areas required that is accepted by the Contract Administrator.

### E22.2 Materials

E22.2.1 General

- (a) Refer to Appendix 'D' – HaTelit "C"

E22.3 Construction Methods

E22.3.1 General

- (a) Refer to Appendix 'D' – HaTelit "C"

E22.4 Measurement and Payment

- E22.4.1 The supply and installation of the HaTelit "C" will be measured on an area basis and paid for at the Contract Unit Price per square metre for "HaTelit "C". The area to be paid for will be the total number of square metres of HaTelit "C" supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

**E23. SUPPLY AND INSTALL HATELIT "BL"**

E23.1 Description

E23.1.1 General

- (a) This specification covers the supply and installation of HaTelit "BL" in areas of the widened roadway along Grant Avenue and any other areas required that is accepted by the Contract Administrator.

E23.2 Materials

E23.2.1 General

- (a) Refer to Appendix 'D' – HaTelit "BL"

E23.3 Construction Methods

E23.3.1 General

- (a) Refer to Appendix 'D' – HaTelit "BL"

E23.4 Measurement and Payment

- E23.4.1 The supply and installation of the HaTelit "BL" will be measured on an area basis and paid for at the Contract Unit Price per square metre for HaTelit "BL". The area to be paid for will be the total number of square metres of HaTelit "BL" supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

**E24. CONSTRUCTION OF TINTED CONCRETE**

E24.1 Description

E24.1.1 General

- (a) This specification covers the construction of "red" tinted concrete pavement, intended to delineate Transit only lanes (specifically westbound Hurst at Waverley). The tinted concrete is finished at grade and is the width of the travel lane. Care must be taken with consistency in water/cement ratio and finishing as the color can be affected load to load.

E24.2 References

E24.2.1 Referenced Standard Construction Specifications

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

E24.3 Materials and Equipment

#### E24.3.1 Concrete Materials

- (a) The Contractor shall base the tinted concrete mix on a mix design that has been approved for the current construction season by the City of Winnipeg Research and Standards Department.
- (b) The base mix design shall conform to Section 6 of CW 3310 with the following alterations:
  - (i) Type 1 mix as per Section 6.2 of CW 3310.
  - (ii) Slump for hand placement shall be 80 mm +/- 20 mm prior to adding superplasticizers (if needed) to facilitate finishing without adding water to the surface.
- (c) Alterations to the base mix design will be considered by the Contract Administrator if necessary to account for the concrete tint material and finishing operations.

#### E24.3.2 Concrete Tint

- (a) "Red" coloured metal oxide pigment used to permanently color ready-mix concrete.
- (b) Approved Product List
  - (i) Lafarge Red (Premium) supplied through L.M. Scofield Company.
- (c) Contractor to cast one coloured concrete sample minimum 200 mm X 200 mm in area using base concrete mix for approval by Contract Administrator.
- (d) Tinted concrete shall not be placed until sample color has been accepted by the Contract Administrator. The Contractor shall demonstrate that the sample will achieve the approximate color advertised by the pigment supplier using local concrete mix materials.

#### E24.3.3 Superplasticizers

- (a) Superplasticizers shall conform to the requirements of CSA CAN3-A266.5 and CAN3-A266.6, but must be compatible with the air-entraining agent. The agent shall be free of chlorides and shall not affect the air-entraining agent's ability to produce a satisfactory air void system.

#### E24.3.4 Liquid Membrane-Forming Curing Compound

- (a) Curing Compound shall be clear (no pigment), and water based conforming to the requirements of ASTM C309.

#### E24.3.5 Other Materials

- (a) All other materials as per CW 3310.

#### E24.3.6 Floating and Finishing Equipment

- (a) Use only wood or magnesium floats. Bull floats used for initial finishing shall be constructed of wood only.

#### E24.3.7 Other Equipment

- (a) All other equipment as per CW 3310.

#### E24.4 Construction Methods

##### E24.4.1 General

- (a) Concrete formwork, steel reinforcement, placement, curing, and joint sealing as per CW 3310 except as modified in the following clauses.
- (b) Construct formed 50 mm headers to define the lane edge and transverse termination of at-grade coloured concrete where the adjacent pavement is to be asphalt overlaid.
- (c) Clean finishing tools and equipment and let dry prior to finishing. Wet tools will fade the colouring. Wetting of tools during finishing operation is not permitted.



- (d) Place concrete at a consistent slump. No water shall be added on Site. Superplasticizer may be added at a rate suggested by the concrete supplier if additional workability is needed.
- (e) No localized water spray or fogging is permitted to assist in finishing as this will locally fade the colour.
- (f) Clear curing compound only shall be used. The use of water curing or plastic film is not allowed. Plastic film for insulation in cold weather must be approved by the Contract Administrator.

#### E24.5 Measurement and Payment

##### E24.5.1 Construction of Tinted Concrete

- (a) Construction of Tinted Concrete will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Construction of 200 mm Concrete Pavement (Plain-Dowelled, Tinted)". The area to be paid for will be the total number of square metres of tinted concrete supplied and placed at grade, or below an asphalt overlay in accordance with this specification and accepted by the Contract Administrator.

#### E25. **PARTIAL DEPTH PATCHING OF EXISTING JOINTS**

##### E25.1 Description

###### E25.1.1 General

- (a) This specification covers the Partial Depth Patching of existing concrete pavement joints.

##### E25.2 References

###### E25.2.1 Referenced Standard Construction Specifications

- (a) CW 3230 – Full-Depth Patching of Existing Slabs and Joints.
- (b) CW 3410 – Asphalt Concrete Pavement Works.

##### E25.3 Materials

###### E25.3.1 Asphalt Materials

- (a) Asphalt material will be Type 1A supplied in accordance with Sections 5 and 6 of CW 3410.

###### E25.3.2 Tack Coat

- (a) Tack Coat will be undiluted SS-1 emulsified asphalt or approval equal.

##### E25.4 Construction Methods

###### E25.4.1 Planing of Joints

- (a) Plane existing joints designated by the Contract Administrator to a minimum depth of 50 mm and a maximum of depth 90 mm to remove ravelled or deteriorated concrete. Width of joint to be planed will vary with depth.
- (b) Should the depth of joint deterioration exceed the maximum indicated, as determined by the Contract Administrator, the entire joint shall be renewed and paid for in accordance with CW 3230 as a full depth joint repair. Planing completed shall be paid for in accordance with Section 14.7 of this specification.
- (c) Dispose of material in accordance with Section 3.4 of CW 1130.

###### E25.4.2 Placement of Asphalt Material

- (a) Prior to placement of asphalt material, the planed joint shall be swept or blow clean of any loose material.

- (b) Apply Tack Coat uniformly on the entire surface of the planed joint. The application rate shall not exceed 0.23 litres per square metre. The planed joint shall be dry prior to applying the tack coat.
- (c) Place and compact asphalt material in accordance with Section 9.3 of CW 3410 to the satisfaction of the Contract Administrator. The finished elevation of the patch shall be flush with surrounding pavement surface.
- (d) Compact the asphalt material to an average ninety-five percent (95%) of the 75 blow Marshall Density of the paving mixture with no individual test being less than ninety percent (90%).
- (e) Ensure that no traffic is allowed to travel over the patched area until the asphalt has cooled to atmospheric temperature.

## E25.5 Measurement and Payment

### E25.5.1 Partial Depth Planing of Existing Joints

- (a) Partial Depth Planing of Existing Joints will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Partial Depth Planing of Existing Joints". The area to be paid for will be the total number of square metres of joints planed in accordance with this specification, accepted and measured by the Contract Administrator.

### E25.5.2 Asphalt Patching of Partial Depth Joints

- (a) Asphalt Patching of Partial Depth Joints will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Asphalt Patching of Partial Depth Joints". The area to be paid for will be the total number of square metres of joints patched in accordance with this specification, accepted, and measured by the Contract Administrator.

## E26. ASPHALT PATCHING OF MISCELLANEOUS CONCRETE

### E26.1 Description

#### E26.1.1 General

- (a) This specification covers the placement of asphalt patches in various situations to prepare a concrete pavement for subsequent placement of mainline asphalt pavement overlay. This includes patching full depth concrete repairs, cracks and joints, and vertical faults.

### E26.2 References

#### E26.2.1 Referenced Standard Construction Specifications

- (a) CW 1130-R2 - Site Requirements
- (b) CW 3250-R7 – Joint and Crack Maintenance
- (c) CW 3410-R10 – Asphaltic Concrete Pavement Works

### E26.3 Material and Equipment

#### E26.3.1 Asphalt Materials

- (a) Asphalt material supplied shall be as per CW 3250 (Type 1 Asphalt Material).

#### E26.3.2 Equipment

- (a) Equipment as per CW 3410-R10 Clause 8.

### E26.4 Construction Methods

#### E26.4.1 Full Depth Concrete Repairs

- (a) Place asphaltic concrete over the newly constructed joint repair where there is a minimum of 20 mm elevation difference between repair surface and adjacent pavement surface. Remove any loose or debonded asphalt at the joint perimeter and place new asphaltic concrete in these areas as well.
- (b) Dispose of all material in accordance with Section 3.4 of CW 1130-R2.
- (c) Prior to placement of asphaltic concrete patching material, ensure surface is clean and dry.
- (d) Prepare the joint surface with a uniform application of Tack Coat applied in small quantities sufficient to wet the concrete surface.
- (e) Place and compact asphaltic concrete over the joint repair in accordance with CW 3410-R8 Clause 9.3 and to the satisfaction of the Contract Administrator so that the finished elevation of the patch is flush with surrounding asphalt surface.
- (f) Compact the asphalt material to an average ninety-five percent (95%) of the 75 blow Marshall Density of the paving mixture with no individual test being less than ninety percent (90%).
- (g) Ensure that no traffic is allowed to cross the patched area until the asphalt has cooled to atmospheric temperature.

E26.4.2 Crack/Joint Patching

- (a) Construction Methods as per CW 3250-R7 Clause 3.4.

E26.5 Measurement and Payment

- E26.5.1 Asphalt Patching of Miscellaneous Concrete will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Asphalt Patching of Miscellaneous Concrete". The area to be paid for will be the total number of square metres of full depth joints, cracks and joints, and vertical faults patched in accordance with this specification, accepted, and measured by the Contract Administrator.

**E27. PAVING STONES**

E27.1 Description

- E27.1.1 Further to the latest version of the City of Winnipeg Standard Construction Specification CW 3335, this Specification shall cover the:

- (a) Supplying and installing of interlocking paving stones (unit pavers) used in paving pattern/fields and as indicator strips;
- (b) Supplying and installing of sand setting bed.

- 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 other things necessary or and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E27.2 References

E27.2.1 Referenced Specifications and "Drawings"

- (a) The latest version of the City of Winnipeg Standard Construction Specifications
  - (i) CW 3330 – Installation of Interlocking Paving Stones

E27.3 Materials

E27.3.1 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.

#### E27.3.2 Interlocking Paving Stones

- (a) Concrete interlocking paving stones (unit pavers) for indicator strips, supplied by:

Barkman Concrete

Phone: 204-667-3310

Contact: Anthony Militano

- (b) As shown on the Drawings and as follows:

- (i) Charcoal Holland Paver 60x210x210mm

- (ii) Blue Holland Paver 60x105x210mm

- (iii) Natural Holland Paver 60x105x210mm

- (c) Concrete interlocking paving stones (unit pavers) for indicator strips shall be precast concrete pavers conforming to CAN3-A231.2, Further to CAN3-A231.2.6.1.1, where concrete pavers are shipped for installation before the pavers are 28 days old, the average compressive strength of these pavers at the time of delivery to the work site shall be not less than 40 MPA.

#### E27.3.3 Sand

- (a) Clean brick sand as joint filler.
- (b) Clean brick sand as minimum 13 mm depth setting bed.
- (c) Bedding sand shall be fine aggregate as specified in Specification CW 3330.

#### E27.4 Equipment

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

#### E27.5 Construction Methods

##### E27.5.1 Installation of Indicator Strip Paving Stones in Blockouts

- (a) Paving stone type and color as shown on Drawings. Utilize blue pavers for bus stop indicator pavers unless adjacent sidewalk contains indicator strips in a different color. If so, utilize same color as indicator strips.
- (b) Paving stones shall be installed in formed concrete blockouts in accordance with CW 3330, set in locations and patterns as shown on the Drawings. Spaces between joints shall not exceed 3 mm, and shall be uniform and consistent while maintaining true patterns as indicated on the Drawings.
- (c) Contractor to verify the exact dimensions of pavers prior to construction of blockouts in concrete sidewalk.
- (d) Remove and dispose of existing paving stones in existing sidewalks. Any removal and/or disposal shall be incidental to the Work within this Specification.
- (e) Install concrete sidewalk complete with blockouts for paving stones as specified on the Drawings.
- (f) Install sand bed to minimum 13 mm depth as shown on the Drawings.
- (g) Do not compact setting bed prior to installation of pavers.
- (h) Spread only sufficient area which can be covered with pavers same day.
- (i) Remove adjacent pavers in patterns as required to ensure that bricks do not require cutting to fit existing paving pattern.
- (j) Where paving pattern is interrupted by vertical structural elements, pavers must be saw cut 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 until joints are full and remove excess from Site.
- (q) Remove cracked, chipped, broken or otherwise damaged paving materials from Site immediately.
- (r) Upon completion, clean in accordance with manufacture's recommendations.

## E27.6 Measurement and Payment

### E27.6.1 Interlocking Paving Stones

- (a) Interlocking paving stone work will be measured on an area basis and will be paid for at the Contract Unit Price per square metre for "Interlocking Paving Stones", measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in this Specification. The area to be paid for shall be the installed area of paving stones.
- (b) Interlocking Paving Stones:
  - (i) Charcoal Holland Paver 60x210x210mm
  - (ii) Blue Holland Paver 60x105x210mm
  - (iii) Natural Holland Paver 60x105x210mm

## E28. **SUPPLY AND INSTALL DIRECTIONAL TACTILE STRIP**

### E28.1 Description

- E28.1.1 This Specification covers the supply and installation of directional bar tiles in 100mm concrete sidewalks. These are used at bus stops where the sidewalk must cross a multi-use path or bicycle path.

### E28.2 References

#### E28.2.1 Referenced Specifications and Drawings

- (a) The latest version of the City of Winnipeg Standard Construction Specifications
  - (i) CW 3235 – Renewal of Existing Miscellaneous Concrete Slabs
  - (ii) CW 3310 – Portland Cement Concrete Pavement Works
  - (iii) CW 3325 – Portland Cement Concrete Sidewalk

### E28.3 Materials and Equipment

#### E28.3.1 Acceptable Directional Tactile Strip product is:

- (a) 305 mm x 610 mm Cast in Place (Wet Set) with Anchors – Manufactured by ADA Solutions;
- (b) Part # 1224BAR1875Y;
- (c) Flush Mount, Federal Yellow;
- (d) Fasteners: 6 mm Dia. x 38 mm Long SS FH Bolts (Hex Drive) and 6 mm Dia. x 38 mm Long Zinc Inserts; and,

(e) Sealant: Manufacturer recommended.

#### E28.3.2 Equipment

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

#### E28.4 Construction Methods

- (a) Install Wet Set Replaceable units as per manufacturer's recommendations, and as shown on Contract Drawings.
- (b) Where necessary, cut Wet Set Replaceable units accurately using a sixty (60) tooth carbide or diamond blade with a suitable cutting device. No cut unit shall measure less than 250 mm in length. In accordance with manufacture's recommendations, supplemental fasteners and Inserts shall be added as needed when the distance between the cut face of the unit and the original hardware exceeds 100 mm.
- (c) Install Wet Set Replaceable units true to grade, in location, layout pattern as indicated on the Contract Drawings.
- (d) Wet Set Replaceable units shall be set flush into a minimum 65 mm depth of concrete. Vibrate or tamp (with rubber mallet) the Wet Set Replaceable units into the fresh concrete to insure that there are no voids underlying the units and that the units are flush with the adjacent substrate. Temporary weights can be added as necessary in the event of float during initial set of the units.
- (e) Joint Lines between successive Wet Set Replaceable Units: Maintain a 3 mm – 5 mm consistent joint line between successive units.
- (f) Tooled Edge Detail: Maintain a 3 mm – 6 mm tooled edge detail along the perimeter of the Wet Set Replaceable unit installation. Installation of the tooled edge detail facilitates future removal and replacement of the units.
- (g) Protective Plastic Sheet: Particularly in direct sunlight and when temperatures exceed 25 degrees C, remove the protective plastic sheeting from the Wet Set Replaceable units within 48 hours of installation of the unit. Failure to do so will be solely at the Contractors risk and may result in the protective plastic bonding to the unit thus requiring a considerable effort to remove the protective plastic sheeting. If plastic sheeting cannot be removed, it will be at the Contractors expense to replace that unit.

#### E28.5 Measurement and Payment

##### E28.5.1 Directional Tactile Strip

- (a) Directional Tactile Strip shall be measured on a unit basis and paid for at the Contract Unit Price per unit for the item listed here below. The number of units to be paid for shall be the total number of Directional Tactile Strip supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.
- (b) Directional Tactile Strip: 305 mm x 610 mm tiles.

#### E29. **SEALING INTERFACE BETWEEN CONCRETE AND ASPHALT SURFACES**

##### E29.1 Description

E29.1.1 Further to D38.1(e) the Contractor shall seal the interface of the asphalt roadways to concrete curb and gutters one year after construction is completed.

##### E29.2 Materials

E29.2.1 Joint sealant shall be supplied as per CW 3250.

##### E29.3 Construction Methods

E29.3.1 Sealing of the interface shall be completed using joint sealant in accordance with Clause 3.2 and 3.3 of CW 3250.

E29.4 Measurement and Payment

E29.4.1 Sealing the interface of the concrete and asphalt surfaces will be measured on a length basis and paid for at the Contract Unit Price for "Crack Sealing" regardless of the width of the crack. The length to be paid for will be the total number of metres of cracks routed and/or cleaned and sealed in accordance with this specification, accepted and measured by the Contract Administrator.

E30. **CURB AND GUTTER - VARIOUS FORMATS**

E30.1 Description

E30.1.1 General

(a) This specification covers the Work related to the installation of various formats of Curb and Gutter.

E30.2 References

E30.2.1 Referenced Standard Construction Specifications

(a) CW 3310 – Portland Cement Concrete Pavement Works

E30.2.2 Referenced Standard Details and Drawings

- (a) Curb and Gutter – SD-200
- (b) 75 mm Lip Curb – SD-202A
- (c) Modified Barrier Curb – SD-203B
- (d) Pinned Barrier Curb – SD-205
- (e) Safety Curb and Gutter – SD-206B
- (f) Temporary Safety Curb
- (g) All applicable Contract Drawings

E30.3 Materials and Equipment

E30.3.1 Materials

(a) Materials supplied shall be as per CW 3310 Clause 5.

E30.3.2 Equipment

(a) Equipment as per CW 3310 Clause 8.

E30.4 Construction Methods

E30.4.1 Barrier Curb and Gutter

(a) Barrier Curb and Gutter shall be constructed where specified using the SD-200 shape for the curb, and the Contract Drawings for the gutter width and height. Unless directed by the Contract Administrator, the curb and gutter shall be slip formed.

E30.4.2 75 mm Lip Curb and Gutter

(a) 75 mm Lip Curb and Gutter shall be constructed where specified using the SD-202A shape for the curb, and the Contract Drawings for the gutter width and height. Unless directed by the Contract Administrator, the curb and gutter shall be slip formed.

E30.4.3 Modified Barrier Curb and Gutter

- (a) Modified Barrier Curb and Gutter shall be constructed where specified using the SD-203B shape for the curb, and the Contract Drawings for the gutter width and height. Unless directed by the Contract Administrator, the curb and gutter shall be slip formed.

E30.4.4 Pinned Barrier Curb

- (a) Pinned Barrier Curb shall be constructed where specified using the SD-205 shape for the curb, and the Contract Drawings for the gutter width and height. Unless directed by the Contract Administrator, the curb shall be slip formed.

E30.4.5 Safety Curb and Gutter

- (a) Safety Curb and Gutter shall be constructed where specified using the SD-206B shape for the curb, and the Contract Drawings for the gutter width and height. Unless directed by the Contract Administrator, the curb and gutter shall be slip formed.

E30.4.6 Temporary Safety Curb

- (a) Temporary Safety Curb shall be constructed where specified using the SD-206B shape for the curb, and the Contract Drawings for the width and height. Unless directed by the Contract Administrator.

E30.4.7 Curb Ramp and Gutter

- (a) Curb Ramp and Gutter shall be constructed where specified using the Contract Drawings for the curb shape, gutter width and height.

E30.4.8 Where directed by the Contract Administrator to be hand formed, the Contractor shall use wood forms and templates to ensure the curb is shaped properly. Wood forms and templates shall be constructed to allow for the placement of curb and gutter in unison to ensure adhesion of the integral curb.

E30.4.9 Sawcut all curb and gutter types transversely every 3 m.

E30.4.10 Transitions between curb and gutter types as per Contract Drawings.

E30.5 Measurement and Payment

E30.5.1 Curb and Gutter - Various Formats

- (a) Construction of various formats of curb and gutter will be measured on a length basis and will be paid for at the Contract Unit Price per metre for the "Concrete Curbs, Curb and Gutter, and Splash Strips" items below, measured as specified herein, which price shall be payment in full for performing all operations herein described and all other items incidental to the Work included in the specification.
- (b) Transitions between curb and gutter types will be paid for at the more costly Contract Unit Price of the two curb and gutter types.
- (i) Concrete Curbs, Curb and Gutter, and Splash Strips
- ◆ Construction of Barrier Curb and Gutter
  - ◆ Construction of 75 mm Lip Curb and Gutter
  - ◆ Construction of Modified Barrier Curb and Gutter
  - ◆ Construction of Pinned Barrier Curb
  - ◆ Construction of Safety Curb and Gutter
  - ◆ Construction of Temporary Safety Curb
  - ◆ Construction of Curb Ramp and Gutter

E31. **TEMPORARY ASPHALT CURB AND MEDIAN**

E31.1 Description



E31.1.1 This specification covers the supply and installation of temporary asphaltic curb and median to the dimensions and grade specified on the plans or staked on the ground by the Contract Administrator.

E31.2 Material

E31.2.1 Asphalt Materials

(a) Asphalt material will be Type 1A supplied in accordance with Sections 5 and 6 of CW 3410.

E31.2.2 Tack Coat

(a) Tack Coat will be undiluted SS-1 emulsified asphalt or approval equal.

E31.1 Construction Methods

E31.1.1 The surface on which the temporary asphalt curb and or median is to be constructed shall be thoroughly cleaned and a tack coat applied by means of an approved spraying device prior to curb placement.

E31.1.2 The curb material shall be extruded under pressure in a shape to meet the dimensions on the drawings and to obtain minimum density of ninety percent (90%) of the density obtainable for the same material compacted in the laboratory by the 75 Blow Marshall Density method.

E31.1.3 The median material shall be hand placed and shaped to the dimensions on the drawings.

E31.2 Measurement and Payment

E31.2.1 Measurement and Payment for Temporary Asphalt Curb will be on a length basis paid for at the Contract Unit Price per linear metre for "Temporary Asphalt Curb". The length to be paid for will be the total length of Temporary Asphalt Curb supplied and placed in accordance with this specification and accepted by the Contract Administrator.

E31.2.2 Measurement and Payment for Temporary Asphalt Median will be on an area basis paid for at the Contract Unit Price per square metre for "Temporary Asphalt Median". The area to be paid for will be the total area of Temporary Asphalt Median supplied and placed in accordance with this specification and accepted by the Contract Administrator.

E32. **ASPHALT RUMBLE STRIP**

E32.1 Description

E32.1.1 The Contractor shall construct milled in rumble strips along the sidewalk/bike paths as shown on the Drawings.

E32.2 Equipment

E32.2.1 The Contractor shall provide all equipment and labour necessary for the construction of the rumble strips.

E32.2.2 Rumble strips constructed outside of the tolerances shown on the Plans, or exhibiting any defects will be rejected and the Contractor shall be responsible for repairing such work.

E32.2.3 The milling machine used shall either be equipped with an integral sweeping device mounted directly behind the cutter, or a separate sweeping operation shall be conducted as construction of the rumble strips progresses. The Contractor shall pick up and dispose of all debris created from the milling operation.

### E32.3 Measurement and Payment

E32.3.1 Installation of rumble strips shall be measured on a length basis and paid for at the Contract Unit Price for "Asphalt Rumble Strip". The length to be paid for will be the total number of metres of rumble strips constructed in accordance with this specification, accepted and measured by the Contract Administrator.

## E33. PAINTED PAVEMENT MARKINGS

### E33.1 Description

E33.1.1 The work of this section comprises the furnishing of all labour, equipment and materials required to complete the painted pavement markings as shown on the drawings and as hereinafter specified. Painting is limited to parking stalls on private property where work has occurred to remove/install/adjust approaches to public roadways.

E33.1.2 Painting of all public roadways is not included and will be completed by the City of Winnipeg Traffic Services Branch.

### E33.2 Materials

E33.2.1 Paint shall conform to City of Winnipeg specification for reflectorized traffic paint or suitable equivalent for application to asphalt and/or concrete surface.

- (a) CGSB 1-GP-74M + Amdt-May-81, alkyd traffic paint
- (b) High Gloss Traffic Paint (IBIS Products Limited)

E33.2.2 Paint colours shall be:

- (a) Yellow - all centre lines, parking stall lines, painted medians, and handicap symbols illustrated on plan; and,
- (b) White - stop bars, passing lane lines, bicycle symbols, and arrows:
  - (i) CGSB 1-GP-12C + Amdt-Dec-84, yellow 505-308, white 513-301 (MTO Spec. 1710);(White 40-2478, Yellow 40-3057-IBIS Products Limited);
  - (ii) Federal Traffic Paint, Yellow 40-3597 Qual No 80087, White 40-3596 Qual No 80086 (IBIS Products Limited); and,
  - (iii) High Gloss Traffic Paint, Yellow 40-1821 (IBIS Products Limited).

E33.2.3 Thinner to CGSB 1-GP-5M

E33.2.4 Glass Beads: Overlay Type: To CGSB 1-GP-744Amdt-May-81

### E33.3 Construction Methods

E33.3.1 Line painting to be done upon completion of asphalt paving work and curing time. All lines are to be to as per the drawings or as required by TAC standards.

E33.3.2 No markings shall be performed when the temperature is below 10<sup>0</sup> Celsius nor during rainfall or fog, or until the surface is perfectly dry. No markings shall be done if, in the opinion of the Contract Administrator, the conditions are not conducive to provide a top quality result.

E33.3.3 Immediately before application of the paint, the existing surface shall be dry and entirely free from dirt, grease, oil acids, laitance, or other foreign matter which would reduce the bond between the coat of paint and the asphalt/concrete. The surface shall be thoroughly cleaned by sweeping and blowing as required to remove all dirt, laitance and loose materials.

E33.3.4 Suitable chalkline layouts of proposed lines and arcs shall be spotted in advance of the paint application. Control points shall be spaced at such intervals as will ensure accurate location of all markings.

- E33.3.5 When discrepancies between the drawings and the field layout occur, these discrepancies are to be reported to the Contract Administrator for further action before proceeding with the application of paint.
- E33.3.6 The Contractor shall provide an experienced technician to supervise the location, alignment, layout, dimension, and application of the paint.
- E33.3.7 Paint shall be applied at a rate of 200 lineal feet per gallon (60 m per 4.5L) and maintain a uniform lines unless otherwise indicated on specifications drawings.
- E33.3.8 The paint shall be mixed in accordance with the manufacturer's instructions before application. The paint shall be thoroughly mixed and applied to the surface of the concrete with the marking machine. The surface shall receive two (2) coats; the first coat shall be thoroughly dry before the second coat is applied.
- E33.3.9 Glass beads are to be added to paint as per manufacturer's specifications.
- E33.3.10 The paint applicator to be an approved pressure type mobile distributor capable of applying paint in single or double and dashed lines, and that will ensure uniform application and having a positive shut-off.
- E33.3.11 In the application of straight strips, any deviation in the edges exceeding 1/2 inch in 50 feet shall be obliterated and the marking corrected. The width of the markings shall be as designated within a tolerance of five percent (5%). All paintings shall be performed to the satisfaction of the Contract Administrator by competent and experienced equipment operators, labourers, and artisans in a neat and workmanlike manner.
- E33.3.12 Thoroughly clean distribution tank before refilling with paint of different colour.
- E33.3.13 After application of the paint, all markings shall be protected while the paint is drying. The fresh paint shall be protected from injury or damage of any kind. The Contractor shall be directly responsible and shall erect or place suitable warning signs, flags, or barricades, protective screens, or coverings as required. All surfaces shall be protected from disfiguration by spatter, splashes, spillage drippings, of paint or other materials.
- E33.3.14 Parking stall lines will be painted as per drawing and/or as directed by the Contract Administrator. Each stall line will be 75 mm wide and 6.0 m long.
- E33.4 Measurement and Payment
- E33.4.1 Line painting will be measured and paid for on a length basis paid for at the Contract Unit Price per linear metre for "Line Painting". The length to be paid for will be the total length of Line Paint supplied and placed in accordance with this specification and accepted by the Contract Administrator.

#### E34. SIGN SUPPORT CLAMPS

##### E34.1 Description

###### E34.1.1 General

- (a) This Specification covers all operations relating to the installation of new sign support clamps.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E34.1.2 The Contractor shall install all new sign support clamps at the locations as directed by the Contract Administrator. The City shall supply all sign support clamps.

E34.1.3 All costs in connection with the installation of sign support clamps are incidental to the Contract.

## E35. DETOUR TEMPORARY LIGHTING

### E35.1 General

- E35.1.1 The Contractor shall be responsible for coordinating the design and performing the supply and installation of all required Waverley detour roadway and pathway illumination. The Contractor shall be responsible for the design, construction, maintenance and the removal of the Waverley Street temporary detour illumination required for the project.
- E35.1.2 The roadway lighting shall provide illumination for the extent of the travelled portion of the Waverley Street detour in addition to illuminating the adjacent pedestrian pathway as required. Physical limits for the construction of the Waverley Street Underpass detour lighting are from the west side of Waverley Street (southbound) from construction station 1+600 to 1+975 and the north side of Taylor Avenue (westbound) from construction station 1+990 to 2+255.
- E35.1.3 Lighting levels shall be designed to City of Winnipeg Street Lighting Photometric Standards included as Appendix 'E'.
- E35.1.4 The following road classifications and pedestrian conflict levels shall be used for the roadway and intersection lighting:
- (a) Waverley Street: Arterial Street Classification
  - (b) Taylor Ave: Arterial Street Classification
- E35.1.5 The Contractor shall take the design to completion and install the illumination after approval by the Contract Administrator. All street lighting work by the Contractor shall be treated in the same fashion as a Utility. The Contractor shall coordinate and schedule all work for the illumination design to ensure integration with the overall schedule and delivery of all work by the detour opening date.
- E35.1.6 The Contractor shall be responsible for making the necessary provisions in the design and construction of all structures to accommodate the installation of illumination. This may include, but is not necessarily limited to, coordination with Contract Administrator for power supplies, grounding, supports, embedment's, surface work, conduits, and junction boxes.
- E35.1.7 All lighting (including roadway and pedestrian path) shall be vandal-proof.
- ### E35.2 Submission
- E35.2.1 The Contractor shall be responsible for the preliminary illumination design as a technical submission at least thirty (30) working days prior to planned installation. Once reviewed by the Contract Administrator, the Contractor shall take the design to completion.
- E35.2.2 The preliminary illumination layout shall include lighting level calculations and layouts showing conformance to City of Winnipeg requirements for average, maximum ratios, etc. Include all lighting data and assumptions.
- E35.2.3 The Contractor shall submit the following to the Contract Administrator with the technical submission:
- (a) the Manufacturer's certifications that the materials supplied meet the specified requirements; and,
  - (b) lighting calculations, footcandle (lux) layout showing avg/min, max/min etc.
- ### E35.3 Co-ordination with Permanent Lighting and Manitoba Hydro
- E35.3.1 Existing street light poles on Waverley Street which will interfere with the detour and construction of the detour shall be removed by Manitoba Hydro forces. Existing street light poles on Waverley Street between Wilkes Avenue and Taylor Avenue not affected by the detour and the construction of the detour shall remain and be provided with electrical power until the detour roadway and detour temporary roadway lighting is complete and operational.

- E35.3.2 Existing street light poles on Taylor Avenue, both north and south side of Taylor Avenue which will interfere with the detour and the construction of the detour shall be removed in coordination with Manitoba Hydro forces. Existing street light poles on Taylor Avenue not affected by the detour shall remain and be provided with electrical power until the detour roadway and detour temporary roadway lighting is complete and operational.
- E35.3.3 Existing street light davit poles scheduled to be removed for the temporary detour construction shall have the electrical service disconnected and poles and pole bases removed by Manitoba Hydro forces.
- E35.3.4 In sections of roadway where the street lighting is removed to accommodate the construction of the detour, the Contractor shall erect temporary roadway lighting as necessary for the existing lanes of Waverley Street and Taylor Avenue as required to ensure continuous illumination is provided for the existing roadways during detour roadway construction. This temporary street lighting shall be removed once the detour and detour street lighting is operational.
- E35.3.5 Connections to Manitoba Hydro supplied electrical service cabling for street light power and bus shelter power shall be done by Manitoba Hydro forces.
- E35.3.6 Existing permanent street light poles to be removed by Manitoba Hydro.
- E35.3.7 When the detour roadway is operational, the Contractor is to remove any temporary street lighting that was installed as per E35.3.4 if it is no longer required for illumination.
- E35.3.8 When the detour roadway is no longer in use and traffic is moved back to Waverley Street and Taylor Avenue, the detour lighting is to be removed, including pole bases. Lighting is not to be removed until sufficient lighting levels by the permanent lighting installed by Manitoba Hydro is achieved.
- E35.3.9 The Contractor shall work in conjunction with Manitoba Hydro for electrical service points to the existing street light poles and street light poles installed for detour construction.

E35.4 Clear Zone Setback from Roadways

- E35.4.1 Regional Streets are the major routes in the City of Winnipeg and are characterized by higher traffic volumes and speed. On these streets, the application of setbacks and breakaway bases is based on the clear zone concept. Fixed objects such as street lights that are within the clear zone must either be protected or have breakaway bases. Clear zone distances for Regional Streets in the City of Winnipeg are defined in the table below. Note the posted speed for the detour road will be 50 km/hr. The clear zone is measured from the edge of the nearest travelled lane to the fixed object.

Clear Zone Guidelines for Urban Regional Streets

Posted Speed Limit (km/h)	Distance From Curb Free From Unprotected Fixed Objects	
	Minimum (m)	Desired (m)
50	2.5	3.5
60	3.5	5.0
70	6.0	7.5
80	7.5	9.0

E35.5 Abbreviations and Definitions

- E35.5.1 Wherever in these specifications the following abbreviations are used, the intent and meaning shall be as follows:
  - (a) CSA: Canadian Standards Association;
  - (b) NEMA: National Electrical Manufacturers Association; and,
  - (c) EEMAC: Electrical and Electronic Manufacturer's Association of Canada.

## E35.6 Materials

### E35.6.1 General

- (a) All material specified shall be new and built in accordance with EEMAC standards and shall be CSA approved. Material shall also comply with the Functional Design and as required by the Canadian Electrical Code.

### E35.6.2 Wiring

- (a) All wiring within the steel poles to the luminaries shall be minimum #12 Cu. RW90 X-Link. All conductors shall be copper. All overhead wiring between wood poles to be triplex. Contractor to advise pole type in preliminary design submission.
- (b) Wiring type shall be suitable for direct burial. Conductors shall be sized to maintain a maximum of three percent (3%) voltage drop from source to end of circuit.
- (c) Below grade low voltage wiring of maximum 240 volt circuits shall be at a minimum depth of 600 mm below finished grade.
- (d) All Teck cables shall be copper and have 1000 V cross link insulation. Teck cable shall be HL (Hyper Lead) rated.
- (e) . Installation of overhead duplex or triplex cable shall be of sufficient height to enable uninhibited vehicular passage underside overhead lines.

### E35.6.3 Luminaries and Standards (Steel or Wood Poles)

- (a) Only new materials shall be used.
- (b) Steel poles shall be continuously tapered of polygonal cross sections presenting good visual appearance. With the breakaway anchor base mounted in a horizontal plane, the upright pole section shall be in a true vertical position. All materials used shall conform to the latest edition of CSA Standard G40.21M 300W, ASTM Standard A570 Grade D or ASTM Standard A36 as a minimum requirement. Silicon content of the steel shall be less than 0.04 percent for the shafts, whereas for base plates the silicon content shall be either less than 0.04 percent or between 0.15 to 0.25 percent.
- (c) Wood poles shall be Douglas Fir in accordance with Manitoba Hydro standards for this application.

### E35.6.4 Sand Bedding and Backfill

- (a) All bedding sand shall be free of clay, rocks, and organic materials. The sand shall be a Designation 5 Class 10A in accordance with section 400.2.20 (Aggregate Production and Stockpiling).
- (b) At no time shall backfill material containing ice, snow, organic, or frozen material be used. All backfill material will be subject to acceptance by the Contract Administrator.

### E35.6.5 Concrete Bases

- (a) All materials for the construction of pole and cabinet bases and the bases shall be constructed of concrete in accordance with CAN3-A23.1-M90.
- (b) Anchor bolts shall be in accordance with the requirements of the pole or base manufacturer.
- (c) Concrete base to be oriented in the proper direction to allow the easy entrance of the underground cables into the plastic pipe pre-installed in the concrete base.

### E35.6.6 Frangible Bases (Breakaway Couplings)

- (a) All required frangible bases for light standards consistent with City of Winnipeg Technical Guidelines & Practices – Breakaway couplers on City of Winnipeg Street Light Poles CD 300-10. A reaction plate shall be installed between the concrete base and the break-away base.

### E35.6.7 Site Lighting Distribution and Metering Enclosure and Components

- (a) The enclosures shall be a weatherproof NEMA 4 enclosure design complete with padlockable door, hinged on one side, separate external compartment for Manitoba Hydro incoming power cabling connection and metering. The enclosure shall be of sufficient size to house panel boards, disconnects, breakers, lighting contactors, control transformers, splitters, controls, and an externally mounted power supply meter socket. The enclosure shall be CSA approved with components installed. The entire system in the enclosure shall be concealed in conduit or other acceptable means. Exposed wiring will not be accepted.
- (b) Panel boards shall be commercial or industrial grade complete with main circuit breaker. Breakers shall be bolt in style only to match panels. Acceptable manufacturers are Square D, Eaton, or approved equal in accordance with B8.
- (c) Main disconnect shall be commercial or industrial grade NEMA one (1) breaker enclosure suitable for service entrance. Acceptable manufacturers shall Square D, Eaton, or approved equal in accordance with B8.
- (d) Lighting contactors shall have a minimum of 600 volt rated contacts and 120 volt operating coil. Acceptable manufacturers shall be Westinghouse, Allen Bradley, Square D, or approved equal in accordance with B8.
- (e) Control transformer (if required) shall be 2000 VA rated and mounted in NEMA 1 enclosure. The transformer shall have voltage ratings and phases as required.
- (f) Control circuit disconnect (if required) shall be rated at 15 amp and shall be mounted in a NEMA 1 enclosure. Voltage ratings and phases shall be as indicated on the Contractor's Preliminary Design. Acceptable manufacturers shall be Square D, Eaton, or approved equal in accordance with B8.
- (g) Hand-Off-Auto switch shall be a three-position selector switch with capabilities to override photocell and shall be mounted in a NEMA 1 enclosure.
- (h) Photocell shall be rated 1500 watt, 120 volt, drift free minimum turn on level of 1.5 foot candles. It shall be integrally wired into distribution enclosure and shall be of vandal proof design.

#### E35.6.8 Luminaires

- (a) Temporary roadway pole mounted luminaire shall be either High Pressure Sodium or LED type. The LED fixture colour temperature shall be maximum 4000K.
- (b) Luminaire fixture voltage to be compatible with Manitoba Hydro standard roadway light fixture service voltage.
- (c) Rated luminaire wattage shall be actual, accounting for any reduction in efficiency due to sub-optimal loading of driver(s).
- (d) Operating temperature rating shall be between -40 C and +50 C.
- (e) LED Luminaire manufacturer shall submit reliability reports indicating that the manufacturer of the LED (chip, diode, or package) has performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows:  
Luminaires shall have locality-appropriate governing mark and certification.
- (f) Luminaire shall be listed for wet locations.
- (g) Internal luminaire conductors shall have insulation rated to exceed the maximum temperature inside the luminaire.
- (h) A means shall be provided for grounding the noncurrent-carrying metal parts of the luminaire.

#### E35.6.9 LED Driver

- (a) Rated maximum case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures indicated in section 2.1.A above.
- (b) Shall accept voltage indicated. Shall accept 50/60 Hz. Shall have a minimum Power Factor (PF) of 0.90

E35.6.10 Serviceability

- (a) The serviceable portion of the luminaire shall be equipped with a latch to secure the access door and permit access to serviceable components. The latch shall be operable with protective gloves but without tools.
- (b) Resistance to the elements.
- (c) Transmissive optical components shall be thermally suited for the application and shall consist of UV-stable polycarbonate, acrylic or glass.
- (d) Mechanical design of protruding external surfaces (heat sink fins) for thermal management shall facilitate hose-down cleaning and discourage debris accumulation.
- (e) Thermal management shall be passive, not active (no fans, pumps, or liquids).

E35.6.11 Overhead Power Conductors

- (a) Overhead conductors used to span between street light poles to be aluminium composition AAC type for duplex, triplex or quadplex conductor multiconductor configuration.
- (b) Ungrounded overhead conductors to have overcurrent protection.

E35.6.12 Conduit

- (a) The Contractor shall supply electrical conduit for the lighting system as required, including all necessary elbows, adapters and fittings.
- (b) Lighting conduits embedded in concrete shall be PVC.

E35.6.13 Junction Boxes and Outlet Boxes

- (a) The Contractor shall supply junction boxes and outlet boxes of the type and sizes as required.

E35.7 Construction Methods

E35.7.1 Excavation

- (a) All buried obstructions are not necessarily shown on the reference drawings and the locations of those indicated are approximate only. The Contractor shall determine the location of all buried obstructions and shall notify the appropriate authorities and obtain all necessary permits prior to excavating.
- (b) The Contractor shall furnish all materials and labour and supplies necessary for the completion and maintenance of grade and line of the street light cables and conduit including water control if found to be necessary.

E35.7.2 Overhead Line Installation

- (a) Vertical clearance for overhead conductor to meet CEC 22.1-15.
- (b) Poles subjected to angular or unbalanced loading due to tension of overhead lines to have pole guying installed.
- (c) Overhead street lighting power cables over track rails not permitted.

E35.7.3 Placing of Conduit

- (a) All conduits shall be placed as required and acceptable to the Contract Administrator.
- (b) The conduit to be placed in concrete shall be firmly anchored in place to prevent movement during placing of the concrete. Extreme care shall be exercised when placing concrete to prevent damage to the conduit. The open ends of the conduits shall be suitably capped to protect the conduit from damage and prevent the entry of concrete or gravel in the ends.

E35.7.4 Service Points



- (a) Electrical power for the temporary roadway and pedestrian walkway lighting to be provided by the Contractor in the form of metered electrical service provided by Manitoba Hydro. Provide a minimum of two service points, one for the north/south Waverley Street Detour, and one service point for the east/west Taylor Avenue detour roadway.

E35.7.5 Quality Management

- (a) The Contractor shall allow the Contract Administrator unhindered access to the work and shall assist the Contract Administrator in carrying out any visual inspection.

E35.8 Measurement and Payment

E35.8.1 Waverley Street Detour Temporary Roadway Lighting

- (a) Constructing the Detour Temporary Lighting shall be paid for at the Contract Unit Price as a Lump Sum for "Detour Temporary Lighting", measured as specified herein, 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.

**E36. CRASH ATTENUATION BARRIERS**

E36.1 Description

- E36.1.1 The Work covered under this item shall include all operations related to the supply, fabrication, delivery and installation of the Crash Attenuation Barriers and associated materials in accordance with NCHRP Report 350 Test Level 3.
- E36.1.2 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 the Work as hereinafter specified. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- E36.1.3 Site specific requirements for installation of Crash Attenuation Barriers will be in accordance with drawings C2-CS-072, C2-CS-074 and C2-CS -083. General supply, loading, hauling, unloading, storing and installing is as per Manufacturer's recommended procedures.
- E36.1.4 The Contractor shall provide manufacturers product data sheet and Shop Drawings prior to supply and installation. The Shop Drawings will be subject to acceptance by the Contract administrator.

E36.2 Materials

- E36.2.1 Materials shall be supplied in accordance with the manufacturer's product manual and in accordance with NCHRP Report 350.
- E36.2.2 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this specification.
- E36.2.3 Approved products are:
  - (a) Quadguard II and associated hardware by Trinity Highway Products; and,
  - (b) Tau-II by Barrier Systems.
- E36.2.4 Appurtenances including but not limited to posts, neoprene spacer blocks, Quadbeam panels, and associated hardware shall be in accordance with NCHRP Report 350

E36.3 Construction Methods

- E36.3.1 The Crash Attenuation Barriers shall be installed in accordance with the manufacturer's installation manual.

- E36.3.2 Refer to:
- (a) Quadguard Installation Manual, see Appendix 'F'; and,
  - (b) Tau II Assembly Manual, see Appendix 'F'.
- E36.3.3 Related items, including concrete foundations, reinforcing steel, Quadbeam panels, posts, neoprene spacer blocks ,connection hardware, excavation, granular levelling materials and compaction is as per the Contract Drawings.
- E36.4 Measurement and Payment
- E36.4.1 Supply and Installation of each Crash Attenuation Barrier, including all product materials, concrete foundations, reinforcing steel, Quadbeam panels, posts, neoprene spacer blocks ,connection hardware, excavation, granular levelling materials and compaction will be measured for payment on a Lump Sum basis and paid for at the Contract Unit Price for "Supply and Installation of Crash Attenuation Barrier".

## E37. CRASH ATTENUATION BARRELS

### E37.1 Description

- E37.1.1 The Work covered under this item shall include all operations related to the supply, fabrication, delivery and installation of the new Crash Attenuation Barrels and associated materials in accordance with NCHRP Report 350.
- E37.1.2 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 the Work as hereinafter specified. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- E37.1.3 Site specific requirements for installation of Crash Attenuation Barrels will be in accordance with drawings C2-CT-007 and C2-CT-078. General supply, loading, hauling, unloading, storing and installing is as per Manufacturer's recommended procedures.
- E37.1.4 The Crash Attenuation Barrel manufacturer product data sheet shall be submitted to the Contract Administrator for approval prior to supply and installation.

### E37.2 Materials

- E37.2.1 Materials shall be supplied in accordance with the manufacturer's product manual and in accordance with NCHRP Report 350.
- E37.2.2 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this specification.
- E37.2.3 Approved products are:
- (a) Big Sandy Impact Attenuator Sand Barrels by Traffix Devices Inc.; and,
  - (b) Fitch Sand Barrel System by Quixote Transportation Safety Inc.
- E37.2.4 Sand required for the barrels shall contain a minimum of five percent (5%) rock salt (NaCl), by weight.

### E37.3 Construction Methods

- E37.3.1 The Crash Attenuation Barriers shall be installed in accordance with the manufacturer's installation manual.
- E37.3.2 Refer to:
- (a) Traffix Big Sandy Installation Manual, see Appendix 'G'; and,
  - (b) Energite FITCH Assembly Manual, see Appendix 'G'.

- E37.3.3 The Contractor shall be responsible for loading, and unloading as well as storing of the crash attenuation barrels. The Contractor shall supply all necessary equipment for loading, hauling, unloading, and storing of the components.
- E37.3.4 Prior to commencing installation of the protection at a location, the Contractor shall verify that it can be installed in strict accordance with the Drawings. Should there be a conflict between a proposed location and any facility the Contract Administrator shall be notified immediately.
- E37.3.5 Barrels associated with the roadway detour shall be relocated by the Contractor between Phase I and Phase II. Relocation shall include all necessary equipment, materials, labour, safe storage and related operations required to relocate the barrels to the satisfaction of the Contract Administrator.
- E37.3.6 Crash Attenuation Barrels associated with the roadways detour are to be salvaged and delivered to city yards as directed by the Contract Administrator after the detour is removed.

E37.4 Measurement and Payment

- E37.4.1 Supply and installation of Crash Attenuation Barrels, and all related appurtenances will be measured on a unit basis and paid for per barrel at the Contract Unit Price in accordance with this Specification, accepted and measured by the Contract Administrator.
- E37.4.2 The unit price for "Supply and Place Crash Attenuation Barrels" will be payment in full for the supply and delivery of the barrels to site, placement and filling of barrels, relocation of barrels associated with the roadway detour and all related operations as herein described and all other items incidental to the work included, accepted and measured by the Contract Administrator.
- E37.4.3 Relocation of barrels associated with the roadway detour shall be considered incidental to the Work.

E38. **W-BEAM GUARDRAIL SYSTEM**

E38.1 Description

- E38.1.1 The Work shall consists of:
- (a) supply and installation of roadside hazard protection meeting the AASHTO Manual for Assessing Safety Hardware (MASH) Test Level 3 or *NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features*, including:
    - (i) W-Beam guardrail (Midwest Guardrail System) with steel posts and neoprene spacer blocks; and,
    - (ii) end treatments.
  - (b) supply, loading, hauling, unloading, storing and installing of roadside hazard protection guardrail, guardrail end treatment, posts, and all related appurtenances in accordance with the Drawings and Manufacturer's recommended installation procedures;
  - (c) field drilling, threading and cutting bolts, as required; and,
  - (d) supply, placing and compacting backfill material.

E38.2 Materials

- E38.2.1 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this specification.
- E38.2.2 Guardrails and posts shall be stored in neat regular piles, on blocks or built up platforms, in order to avoid damage or contamination, and for ease of checking, handling, and inspection.

E38.2.3 Testing, Inspection 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 for any materials taken by the Contract Administrator for testing purposes.
- (b) Materials which fail to meet these specifications will be rejected, and shall be replaced or repaired at no additional cost.

E38.2.4 Guardrails and Terminal Elements

- (a) All guardrail sections and other components shall match the design profiles and dimensions of the AASHTO/ARTBA hardware requirements.
- (b) The guardrails and terminal elements shall be manufactured from open hearth, electric furnace or basic oxygen semi-spring steel sheet, all in general accordance with the AASHTO Standard Designation M180 and shall conform to the Drawings provided in the contract and in the AASHTO-AGC-ARTBA publication "A Guide to Standardized Highway Barrier Hardware".
- (c) Guardrails shall be punched for splice and post bolts in conformity with AASHTO Standard to the designated number of and centre to centre spacing of posts. If holes are punched after galvanizing, the galvanizing around the hole shall be repaired in accordance with the latest edition of CSA Standard G164-M92 (R2003) or ASTM A780/A780M-09.
- (d) Guardrails shall have minimum yield strength of 345 MPa, minimum tensile strength of 483 MPa, and minimum elongation of twelve percent (12%) in 50 mm length.
- (e) The thickness of guardrails and terminal elements shall be manufactured according to Table 2 (Class A Type II) of AASHTO Standard M180 with nominal base metal thickness of 2.67 mm, galvanized finished thickness of 2.82 mm, with a tolerance of 0.23 mm.
- (f) Sheet width for the W-beam guardrail shall be 483 mm with a permissible tolerance of minus 3 mm.
- (g) All guardrails and terminal elements shall be hot dip galvanized according to CAN/CSA A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- (h) All welding for the fabrication of terminal elements shall conform to the requirements of CSA W59M. All welders, welding operators and tackers shall be approved by the Canadian Welding Bureau in their particular category.
- (i) A copy of the producer's certificate, conforming to Section 16 of CSA G40.20M, for each of the mechanical and chemical tests, including impact tests, shall be provided to the Contract Administrator upon request.
- (j) Terminal ends to be ET-31 by Trinity Highway Products, LLC as indicated on Drawings or approved equal in accordance with B8.

E38.2.5 Steel Posts

- (a) Steel posts shall be W150 x 14.
- (b) Steel for posts and hardware shall conform to CAN/CSA Standard G40.21 Grade 350W or ASTM Standard A36 and shall be hot dip galvanized after fabrication conforming to ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

E38.2.6 Neoprene Spacer

- (a) Spacers shall be King Blocks by Trinity Highway Products, LLC or approved equal in accordance with B8.

E38.2.7 Bolts, nuts, washers and other appurtenances

- (a) All bolts, nuts and washers shall be according to ASTM A307 and shall be hot dip galvanized conforming to the current edition of ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

#### E38.2.8 Markings

- (a) Each guardrails shall be marked with the following information:
  - (i) Name, trademark, or brand of the manufacturer.
  - (ii) Identification symbols or code for heat.
  - (iii) Week number and year of production.
- (b) Markings shall be clearly and permanently stamped in the valley of the centre corrugation, placed at the location clear of the splice overlap, and shall not be obscured after installation. The height of the letters and numerals shall be within the range of 19 to 32 mm.

#### E38.3 Construction Methods

##### E38.3.1 Handling and Storage of Materials

- (a) All materials shall be handled in a careful and workmanlike manner and the sections and ends shall be stored on blocks or built-up platforms.
- (b) Bolts and malleable washers shall be stored separately in suitable bins for inspection, checking and handling.

##### E38.3.2 Site Inspection

- (a) Prior to commencing installation of the protection at a location, the Contractor shall verify that it can be installed in strict accordance with the Drawings. This shall include contacting all utilities and other owners of underground facilities in order to ensure that the proposed location of the posts is not in conflict with existing or proposed utilities and installations.
- (b) Should there be a conflict between a proposed location and any facility the Contract Administrator shall be notified immediately.

##### E38.3.3 Assembly and Installation

- (a) All materials and parts shall be assembled and installed in accordance with the manufacturers' requirements and recommended procedures, refer to Appendix 'H'

##### E38.3.4 Post Installation

- (a) Holes for the posts shall be 300 mm in diameter and be excavated by auger.
- (b) Excavated material which is unsuitable for use as backfill shall be replaced with granular material meeting the requirements of Section 2.2 of Specification CW 3110 for base course material.
- (c) Crushed limestone base course is not allowed for use.
- (d) The posts shall rest directly and solidly on the bottom of the hole.
- (e) After the post is installed, it shall be backfilled. Backfill shall be thoroughly compacted, using pneumatic tampers, in layers not exceeding 150 mm. Unsuitable material at the bottom of the holes excavated shall be replaced with granular material at the Contractor's expense, as directed by the Contract Administrator.
- (f) The Contractor shall thoroughly compact the bottom of the holes.
- (g) Surplus excavated material and debris shall be removed from the Site.

##### E38.3.5 Guardrail Installation

- (a) Guardrail shall be accurately set to the required depth and alignment, in a manner resulting in a smooth continuous installation, as shown on the Drawings or as directed by the Contract Administrator. Permissible tolerance for plumb and grade of posts shall be 6 mm.

- (b) Any guardrail material requiring field modification to fit shall be reported to the Contract Administrator for its acceptance of the modification prior to the Work being carried out.
- (c) Modification by flame cutting method is prohibited.
- (d) Modification by cold cutting method with a suitable drill press is allowed.
- (e) Field guardrail modification is considered incidental to the Work. Adequate edge distances of guardrail material shall be maintained during the modification process. All exposed steel areas shall be patched with two coats of zinc-rich paint.
- (f) Guardrail laps shall be in the direction of traffic flow.
- (g) Bolts shall be tightened to a torque of 100Nm.
- (h) The Contractor shall take all necessary precautions to eliminate damage to galvanizing. Minor abrasions shall be repaired by re-galvanizing. The method to be used for repair of any damage shall be accepted by the Contract Administrator before such Work is commenced. The Contractor shall repair or replace components to the satisfaction of the Contract Administrator.

E38.3.6 ET-31 End Treatment

- (a) The ET-31 end treatment, or approved equal in accordance with B8 and meeting MASH Test Level 3, shall be installed as indicated on the Drawings. Installation of the ET-31 end treatment shall be completed in accordance with the Specifications and the manufacturer's recommendations.

E38.3.7 Cleaning

- (a) After installation of the rail system has been completed, the entire rail system shall be thoroughly cleaned to the satisfaction of the Contract Administrator.

E38.4 Measurement and Payment

- E38.4.1 Supply and installation of roadside hazard protection guardrail, posts, and all related appurtenances will be measured on a length basis and paid for at the Contract Unit Price for the "Steel Beam Guardrail". The length to be paid for will be the total number of metres of Steel Beam Guardrail in accordance with this Specification, accepted and measured by the Contract Administrator.
- E38.4.2 Supply and installation of ET-31 end treatments, associated posts and appurtenances will be measured on a unit basis and paid for at the Contract Unit Price for the "ET-31 End Treatment". The amount to be paid for will be the total number of units installed in accordance with this Specification, accepted and measured by the Contract Administrator.

## LANDSCAPING

### E39. SITE FURNISHINGS

#### E39.1 Description

##### E39.1.1 General

- (a) This Specification covers all operations relating to the supply and installation of benches and waste receptacles along the Active Transportation pathway.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

#### E39.2 Materials

##### E39.2.1 General

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

E39.2.2 Site Furniture shall be:

- (a) Bench: Tache Style Composite Bench with Arm Rests, as per SCD-121A, Product #52501085, or substitute approved in accordance with Substitution procedures.
- (b) Trash Receptacle: Metal Slat Type, as per SCD-119, Product #52501063BLK with Wire Basket, Product #52501058, or substitute approved in accordance with Substitution procedures.
  - (i) Contact for Bench and Trash Receptacle:  
Aaron Lennon, 204-986-5505  
Supervisor of Central Repair/Manufacturing Facility  
City of Winnipeg  
Fleet Management Agency Division  
Public Works Department  
215 Tecumseh St.  
Winnipeg, MB R3E 3S4  
Email: [ALennon@winnipeg.ca](mailto:ALennon@winnipeg.ca)

E39.3 Construction Methods

E39.3.1 Benches and Trash Receptacles

- (a) Install benches and trash receptacles with in-ground mountings as indicated on the Construction Drawings.

E39.4 Measurement and Payment

E39.4.1 Benches and Trash Receptacles

- (a) Benches and trash receptacles will be measured on a unit basis and paid for at the Contract Unit Prices, each, for "Bench" and "Waste Receptacle", which prices shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.

E40. **FENCING**

E40.1 Description

E40.1.1 General

- (a) The work covered under this item shall include all operations related to supply and installation of:
  - (i) New chain link fencing;
  - (ii) Chain link baseball backstop; and,
  - (iii) New ornamental fencing.
- (b) The work 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.

E40.2 Submittals

E40.2.1 Shop Drawings

- (a) The Contractor shall submit to the Contract Administrator for review and approval, at least Ten (10) Business Days prior to the scheduled commencement of any fabrication, the proposed Shop Drawings showing fabrication details of:

- (i) All chain link gates;
- (ii) Chain link baseball backstop; and,
- (iii) New ornamental fencing.

#### E40.2.2 Sequencing

- (a) The new chain link fences around 830 Waverley, 900 Waverley, and 877 Wilkes need to be installed prior to removal of the existing fences. At no time shall there be discontinuous fencing around the properties.

#### E40.3 Materials

##### E40.3.1 General

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

##### E40.3.2 Fencing

- (a) Rise of Oriental Sun Ltd. – 1390 Grant Avenue
- (i) Chain link fencing to be 1.83 m in height and supplied in accordance with CW 3550.
  - (ii) Double chain link gate to be 6.1 m wide and supplied in accordance with CW 3550.
- (b) Reh-Fit Centre – 1390 Taylor Avenue
- (i) Chain link fencing to be 1.22 m in height and supplied in accordance with CW 3550.
  - (ii) Chain link fencing to be 1.83 m in height and supplied in accordance with CW 3550.
- (c) Storageville – 830 Waverley Street
- (i) Chain link fencing to be 1.83 m in height with barb wire and supplied in accordance with CW 3550.
  - (ii) New ornamental fencing to match existing ornamental fence. Existing ornamental fence was supplied and installed by Wallace and Wallace, 90 Lawson Crescent, Winnipeg MB, 204-452-2700.
- (d) Linden Christian School – 877 Wilkes Avenue
- (i) Chain link fencing to be 1.83 m in height and supplied in accordance with CW 3550.
  - (ii) Chain link gate to be 1.22 m wide and supplied in accordance with CW 3550.
  - (iii) Chain link baseball backstop and supplied in accordance with CW 3550.
- (e) Ralph Cantafio Soccer Complex - 900 Waverley Street
- (i) Chain link fencing to be 3.66 m in height with barb wire and supplied in accordance with CW 3550.
  - (ii) Chain link gate to be 1.22 m wide by 2.44 m height as per the Drawings and supplied in accordance with CW 3550.

#### E40.4 Construction Methods

##### E40.4.1 Chain Link Fence

- (a) Install new chain link fencing to the limits shown in the Drawings in accordance with CW 3550.



- (b) Install chain link baseball backstop as per Drawings and in accordance with CW 3550.

E40.4.2 New Ornamental Fence

- (a) Install new ornamental fencing as per manufacturer's specifications.

E40.5 Measurement and Payment

E40.5.1 Chain Link Fence

- (a) Chain Link Fencing will be measured for payment on a linear basis and paid for at the Contract Unit Price per metre for "Chain Link Fencing 1.22 m height" and "Chain Link Fencing 1.83 m height" which prices shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator.
- (b) Chain Link Fencing with Barb Wire will be measured for payment on a linear basis and paid for at the Contract Unit Price per metre for "Chain Link Fencing 1.83 m height with Barb Wire" and "Chain Link Fencing 3.66 m height with Barb Wire" which prices shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator.
- (c) Chain Link Gates will be measured for payment on a per unit basis and paid for at the Contract Unit Price per unit for "Double Vehicular Gate 6.1 m wide x 1.83 m high", "Man Gate 1.22 m wide x 1.83 m high" and "Man Gate 1.22 m wide x 2.44 high" which prices shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator.
- (d) Chain Link Baseball Backstop will be measured for payment on a per unit basis and paid for at the Contract Unit Price per unit for "Chain Link Baseball Backstop" which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator.
- (e) New Ornamental Fencing will be measured for payment on a linear basis and paid for at the Contract Unit Price per metre for "New Ornamental Fencing" which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator.

E41. **REMOVAL, SALVAGE AND INSTALLATION OF FENCING**

E41.1 Description

E41.1.1 General

- (a) The Work shall include all operations related to removals, salvage and installation of fencing as shown on the Contract Drawings in accordance with this Specification.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E41.1.2 References

- (a) Standard Construction Specifications CW 3550 - Chain Link Fencing.

E41.2 Materials

E41.2.1 General

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

E41.2.2 Miscellaneous Metal

- (a) Miscellaneous Metal to match salvaged and existing fences in appearance and material.

E41.2.3 Wood

- (a) Wood posts, rails and pickets to be pressure treated wood to match existing wood fence in appearance and material.

E41.3 Construction Methods

E41.3.1 Removal, Salvage and Installation of Ornamental Fence

- (a) Storageville's (830 Waverley Street) existing ornamental fence designated for removal shall be carefully removed and salvaged. All ornamental fencing components and all hardware shall be salvaged for reuse.
- (b) The post holes remaining following the removal of the fencing shall be backfilled and compacted to the satisfaction of the Contract Administrator. All concrete rubble shall be removed and disposed of by the Contractor.
- (c) In the event of damage to any materials by the Contractor, the Contractor shall immediately notify the Contract Administrator and make all repairs or replacements necessary, at their own expense, to the satisfaction of the Contract Administrator
- (d) Install ornamental fence in accordance with Manufacturer's specification using salvaged materials.
- (e) Ornamental fence shall be installed prior to removal of existing temporary chain link fence to maintain security at 830 Waverley Street.

E41.3.2 Removal, Salvage and Installation of Wood Fence

- (a) A partial section of River Run's wood fence designated for removal shall be carefully removed and salvaged.
- (b) Posts to be removed and disposed of by the Contractor.
- (c) The sections to be removed and salvaged will be identified and approved by the Contract Administrator prior to removal.
- (d) The post holes remaining following the removal of the fencing shall be backfilled and compacted to the satisfaction of the Contract Administrator. All concrete rubble shall be removed and disposed of by the Contractor.
- (e) In the event of damage to any materials by the Contractor, the Contractor shall immediately notify the Contract Administrator and make all repairs or replacements necessary, at their own expense, to the satisfaction of the Contract Administrator
- (f) Install wood fence at same location.
- (g) New fence posts shall be supplied and installed to match the removed posts.
- (h) The Contractor has the option of replacing the wood fence with all new material. If the Contractor chooses to replace wood fence with all new material, the Contractor is to dispose of removed fence off site.

E41.4 Quality Control

E41.4.1 Inspection

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

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

E41.4.2 Access

- (a) The Contractor shall have limited access to both properties. The Contractor is to notify the Contract Administrator a minimum of 48 hours in advance to arrange for access to the properties.

E41.5 Measurement and Payment

E41.5.1 Removal, Salvage and Installation of Ornamental Fence

- (a) The removal, salvaging and installation of Ornamental Fence will be measured on a linear basis and paid for at the Contract Unit Price per metre for "Remove, Salvage and Install Ornamental Fence", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.
- (b) The cost of miscellaneous metal and backfilling post holes will be considered incidental to the Works of this Specification. No measurement and payment will be made for this Work.

E41.5.2 Removal, Salvage and Installation of Wood Fence

- (a) The removal, salvaging and installation of Wood Fence will be measured on a linear basis and paid for at the Contract Unit Price per metre for "Remove, Salvage and Install Wood Fence", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.

E42. **REMOVAL AND DISPOSAL OF FENCING**

E42.1 Description

E42.1.1 General

- (a) This specification covers the removal and disposal of existing chain link fencing.
- (b) The work 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.

E42.2 Construction Methods

E42.2.1 Sequencing

- (a) The chain link fencing designated to be removed at Rise of Oriental Sun Ltd., Linden Christian School, Storageville and Winnipeg Soccer Complex shall not be removed until new chain link fencing has been installed and approved by the Contract Administrator.

E42.2.2 Protection

- (a) Prevent movement, settlement or damage of adjacent lands. Make good damage caused by demolition.

E42.2.3 Removal of Existing Chain Link Fence

- (a) The Contractor shall remove chain link fencing as indicated on the Drawings including any gates, posts, concrete post foundations associated with fencing. The post holes remaining following the removal of the fencing shall be backfilled and compacted to the satisfaction of the Contract Administrator. All concrete rubble shall be removed by the Contractor.

E42.2.4 Disposal of Existing Chain Link Fence

- (a) The Contractor shall be responsible for removing fencing, debris and waste from the Work area and disposing off Site.

E42.3 Measurement and Payment

E42.3.1 Removal and Disposal of Chain Link Fence

- (a) The removal and disposal of existing chain link fencing will be measured on a per linear basis and paid for at the Contract Unit Price per metre for "Chain Link Fence Removal". The length to be paid for will be the total number of metres of chain link fence removed and disposed in accordance with this specification, accepted and measured by the Contract Administrator.

E42.3.2 Backfilling post holes, removing and disposing of fence posts, concrete post foundations and concrete rubble shall be considered incidental to "Chain Link Fence Removal" and no separate measurement or payment will be made.

**E43. CRUSHED LIMESTONE PATH**

E43.1 Description

E43.1.1 General

- (a) This specification supplements City of Winnipeg Standard Construction Specification CW 3150 "Gravel Surfacing".
- (b) Referenced Standard Construction Specifications:
  - (i) CW 3110 "Sub-grade, Sub-base and Base Course Construction"; and,
  - (ii) CW 3130 "Supply and Installation of Geotextile Fabrics".

E43.2 Materials

- (a) Geotextile shall be non-woven, Armtec 200, or approved equal in accordance with B8.
- (b) Base course shall be 20mm down crushed limestone.
- (c) Surfacing shall be 6mm down crushed limestone.

E43.3 Construction Methods

E43.3.1 Subgrade preparation

- (a) Excavate as required and ensure that the subgrade is at the proper level for the pathway construction. Work includes the satisfactory disposal of unsuitable Site material such as silts, rock, rubble, rubbish and surplus suitable Site material. Subgrade compaction shall be accordance with CW 3110.
- (b) Do not disturb existing surrounding trees.
- (c) Disposal of material shall be understood to mean the hauling of all unsuitable material from the Site and the unloading in a legal manner acceptable to the Contract Administrator.
- (d) The Contractor is responsible for determining and setting all new finish grade elevations as noted on the construction drawings.
- (e) Where fill is required to bring the subgrade up to the proper subgrade elevation use compacted clay fill.

E43.3.2 Installation of Geotextile Liner

- (a) Geotextile liner to be constructed in accordance with CW 3130.

E43.3.3 Installation of Crushed Limestone Path

- (a) Crushed limestone path to be constructed as follows: 150 mm base course in accordance with sections 3.3 and 3.4 of CW 3110 and 25 mm surface in accordance with section 3.2 of CW 3150.
- (b) Install material to the depth and design indicated on the Construction Drawings. Install only on clean unfrozen surface, properly shaped and compacted.
- (c) Paths shall have a minimum one percent (1%) and maximum two percent (2%) constructed cross slope, so no ponding of water occurs over the full width of path. Cross slope to drain in positive direction of existing slopes.

E43.4 Measurement and Payment

E43.4.1 Crushed Limestone Path

- (a) Supply and installation of crushed limestone path shall be measured on an area basis and paid for at the Contract Unit Price per square metre for the "Crushed Limestone Path", which price shall be payment in full for supplying all materials and performing all operations herein specified, and all other items included in the work of this specification.

E44. **INFIELD GRANULAR**

E44.1 Description

E44.1.1 General

- (a) This specification supplements City of Winnipeg Standard Construction Specification CW 3150 "Gravel Surfacing".

E44.2 Reference

E44.2.1 Referenced Standard Construction Specifications:

- (a) CW 3110 "Sub-grade, Sub-base and Base Course Construction"

E44.3 Materials

E44.3.1 Infield granular mix shall consist of natural sand and crushed limestone.

E44.3.2 Gradation Requirements:

- (a) Fine Sand

Metric Sieve Size	% Passing
5,000	100
2,500	90-100
435	70-90
315	60-80
80	0-3

E44.3.3 Crushed limestone

- (a) 6 mm to dust crushed limestone with a minus 80M.M.S. proportion not exceeding thirty-five percent (35%).

E44.4 Construction Methods

E44.4.1 Mixing requirements

- (a) A mixture of sixty percent (60%) limestone and forty percent (40%) sand in accordance to the gradation requirements.
- (b) Thoroughly bucket mix the two materials together at the stated ratio to create a uniform blend of product.

E44.4.2 Final Screening

- (a) After mixing is completed, all material must then be final screened through a 3mm slotted screener.
- (b) Final gradation requirements for specified material, one hundred percent (100%) passing 3 mm slotted screen.

E44.4.3 Subgrade preparation

- (a) Excavate as required and ensure that the subgrade is at the proper level for the infield and surrounding area. Work includes the satisfactory disposal of unsuitable site material such as silts, rock, rubble, rubbish and surplus site material. Subgrade compaction shall be accordance with CW 3110.
- (b) Disposal of material shall be understood to mean the hauling of all unsuitable material from the site and the unloading in a legal manner acceptable to the Contract Administrator.
- (c) Where fill is required to bring the subgrade up to the proper subgrade elevation use compacted clay fill.

E44.4.4 Installation of Infield Granular

- (a) Install material to the depth and design indicated on the Construction Drawings. Install only on clean unfrozen surface, properly shaped and compacted.
- (b) Infield and surrounding area shall have a minimum one percent (1%) and maximum one and a half percent (1.5%) constructed cross slope, so no ponding of water occurs over the full width of the infield. Cross slope to drain in positive direction of existing slopes.

E44.5 Measurement and Payment

E44.5.1 Infield Granular

- (a) Supply and installation of infield granular shall be measured on an area basis and paid for at the Contract Unit Price per square metre for the "Infield Granular", which price shall be payment in full for supplying all materials and performing all operations herein specified, and all other items included in the work of this specification.

**E45. TOPSOIL, SOIL AMENDMENTS, GROWING MEDIUM AND FINISH GRADING**

E45.1 Description

E45.1.1 General

- (a) This Specification shall amend and supplement City of Winnipeg Standard Specification CW 3540 "Topsoil and Finish Grading for Establishment of Turf Areas" and covers all operations relating to the supply, preparation and placement of topsoil and growing medium, including preparation of existing grade, finish grading and fertilizer application for restoration seeding.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E45.2 Quality Control

E45.2.1 Testing and Samples:

- (a) Submit to the Contract Administrator analyses of soil base to be used in creating growing medium, obtained for at least three separate samples taken from each area of the site. The analysis shall be carried out by a qualified soil testing laboratory and shall include the percentage of organic material by weight, as well as recommendations for fertilizers and/or other soil ameliorants.
- (b) Soil testing shall determine N, P, K, Na, Cl, Ca, Mg, organic matter, C.E.C., pH, bulk density and C/N ratio.
- (c) Deliver and store fertilizer in waterproof bags showing weight, analysis and name of manufacturer.

### E45.3 Materials

#### E45.3.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- (b) Imported topsoil and fertilizer shall conform to CW 3540.
- (c) Peatmoss shall be derived from partially decomposed species of Sphagnum Mosses, elastic and homogenous, brown in colour; free of decomposed colloidal residue, wood, sulphur and iron or other deleterious material which could affect healthy plant growth; containing a minimum sixty percent (60%) organic matter by weight, and moisture content not exceeding fifteen percent (15%). Shredded particles may not exceed 5 mm in size. Minimum pH value of peat, 4.5; maximum, 7.0.
- (d) Sand shall be medium to coarse textured silica sand to CSA A82.56-M1976, well washed and free of impurities, chemical or organic matter.
- (e) Bonemeal shall be raw bonemeal, finely ground with a minimum analysis of three percent (3%) nitrogen and twenty percent (20%) phosphoric acid.
- (f) Fertilizer: chemical fertilizers shall have N-P-K compositions as recommended by an agricultural soil testing laboratory approved by the Contract Administrator, provided for each of the following:
  - (i) sod with imported topsoil;
  - (ii) seeding with soil amendments; and,
  - (iii) horticultural trees and shrubs with growing medium.
- (g) Chemical Herbicide Application: Roundup or similar chemical herbicide approved by Agriculture Canada. Use only with the approval of the Contract Administrator.
- (h) Wood Chip Mulch:
  - (i) Wood chip mulch shall be a clean bark or wood chip free of leaves, branches, non-organic material, wood preservatives, diseased wood, and other extraneous material.
  - (ii) Mulch shall consist of chips not less than 15 mm nor larger than 75 mm in size and not more than twenty (20) mm thick.
  - (iii) The Contractor shall supply a wood chip mulch sample to the Contract Administrator for approval prior to installation.
- (i) Plastic Edger
  - (i) Use heavy-duty 125 mm deep black PVC garden edging with rolled top.

### E45.4 Construction Methods

#### E45.4.1 Preparation of Existing Grade

- (a) Preparation of the existing grade shall conform to CW 3540
- (b) Rough grading in all areas is as per E19. Rough grading for the following areas shall be within:

- (i) 50 mm below proposed finished grade for seeded areas with soil amendments;  
and,
- (ii) 100 mm below proposed finished grade for sod and topsoil.

E45.4.2 Imported Topsoil

- (a) Installation of imported topsoil in areas to receive sod, including placing topsoil, applying fertilizer and finish grading shall conform to CW 3540.
- (b) Install imported topsoil to 75 mm compacted depth in areas to be sodded >600 mm and in areas to be sodded < or = 600 mm strips.

E45.4.3 Soil Amendment Seed Mix

- (a) Soil amendment Seed Mix, shall consist of a mix of sixty percent (60%) peat moss and forty percent (40%) sand, loose by volume.
- (b) Cross-cultivate the entire area of soil base that is to receive soil amendments to a depth of 150 mm. Redo areas where equipment used for hauling and spreading has re-compacted sub-grade.
- (c) Spread 30 mm of peat moss and 20 mm sand over the area of soil amendments.
- (d) Roto-till or disc the peat moss and sand into the top 100 to 125 mm of base material and mechanically roll to obtain a level surface.
- (e) Grade to eliminate rough spots and low spots and to maintain positive drainage.
- (f) Consolidate seedbed to required bulk density using equipment approved by the Contract Administrator. Leave surfaces smooth, uniform and firm against deep foot-printing.

E45.4.4 Growing Medium for Planting Trees and Shrubs in Planting Beds

- (a) For planting trees and shrubs
  - (i) The planting soil shall consist of a screened clay textured or loam textured dark soil. A fertile, friable material (neither of heavy clay nor of a very light sandy composition) containing by volume, a minimum of four percent (4%) for clay loams and two percent (2%) for sandy loams to a maximum twenty-five percent (25%) organic matter (peat, rotted manure or composted material) and capable of sustaining vigorous plant growth. The pH shall range from 6.0 to 8.0.

E45.4.5 Construction of Planting Beds

- (a) Final planting bed locations shall be laid out by the Contractor and reviewed with the Contract Administrator in the field prior to installation of trees and shrubs.
- (b) Excavate planting beds to a depth of 450 mm.
- (c) Create planting bed growing medium, loosely compacted, 450 mm deep in planting beds with a smooth top surface to match surrounding contours. Level planting bed growing medium by hand around existing and newly planted trees and shrubs.

E45.4.6 Wood Chip Mulch

- (a) Supply and install 50 mm deep and must not be placed within 80 mm of the trunks of trees.

E45.4.7 Heavy Duty Plastic Landscape Edger

- (a) Install 125 mm heavy duty plastic landscape edging with rolled top to separate planting beds from sod or seeded areas.

E45.5 Measurement and Payment

E45.5.1 Preparation of Existing Grade

- (a) Preparation of the existing grade shall be incidental to the construction of seed bed and planting beds. No measurement and payment will be made for this Item of Work.



- E45.5.2 Imported Topsoil and Fine Grading for Sod
- (a) Imported topsoil and finish grading for sod will be considered incidental to the Works of this Specification (Sodding). No measurement and payment will be made for this Item of Work.
- E45.5.3 Soil Amendments for Seed Mix
- (a) Soil amendment for Seeding, shall be measured on an area basis and paid for at the Contract Unit Price per square metres of soil base incorporating peat moss and sand for "Soil Amendments for Seeding and", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.
- E45.5.4 Planting Beds Growing Medium
- (a) Construction of planting beds with growing medium shall be measured on an area basis and paid for at the Contract Unit Price per square metre of 450 mm depth planting bed constructed complete with 450 mm depth planting soil mixture (depth is allowing for settlement), for "Planting Beds with Growing Medium (450 mm depth)", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.
- (b) There will be no separate measurement for planting soil mixture used in planting individual trees and shrubs that are not planted in beds.
- E45.5.5 Supply and application of fertilizers will be incidental to imported topsoil and fine grading and soil amendments for seed mix.
- E45.5.6 Wood Chip Mulch
- (a) Supply and installation of wood chip mulch shall be made on an area basis and paid for at the Contract Unit Price per square metre placed at the specified depth for "Wood Chip Mulch (50 mm depth)", which payment shall be considered compensation in full for the supply of all materials and the performing of all operations necessary to complete the Work as specified including any items incidental to the Work of this specification.
- E45.5.7 Heavy Duty Plastic Landscape Edger
- (a) Supply and installation of Heavy Duty Plastic Landscape Edger shall be measured on a linear basis and paid for at the Contract Unit Price per metre placed for "Heavy Duty Plastic Landscape Edger", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.
- E46. **SODDING**
- E46.1 Description
- E46.1.1 General
- (a) This specification shall amend and supplement City of Winnipeg Standard Construction Specification CW 3510 "Sodding", and covers all operations relating sod supply and installation, including preparation of finish grade, watering and rolling, and 30-day maintenance.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.
- E46.2 References

- E46.2.1 Referenced Standard Construction Specifications
- (a) CW 3510 Sodding
  - (b) CW 3540 Topsoil and Finish Grading
- E46.2.2 Referenced Standard Details
- (a) SD-243- Sodding Details
- E46.3 Materials
- E46.3.1 General
- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- E46.3.2 Turf Grass Sod
- (a) Turf grass sod shall conform to CW 3510.
  - (b) Sod shall be a mixture of ninety-five percent (95%) Kentucky bluegrass, using equal proportions of any three Class 2 cultivars, and five percent (5%) Creeping Red fescue.
  - (c) Topsoil and fine grading shall conform to CW 3540 (see E43-Topsoil, Soil Amendments, Growing Medium, and Finish Grading).
- E46.4 Construction Methods
- E46.4.1 Installation of Topsoil and Finish Grading, Preparation of Finish Grade, Placement of Sod, Watering and Rolling and 30-Day Maintenance
- (a) Install 75 mm topsoil in accordance with E45 Topsoil, Soil Amendments, Growing Medium and Finish Grading.
  - (b) Finish grading, sod placement, watering and rolling and 30-day maintenance shall conform to CW 3510-R9 and SD-243.
  - (c) Install one width of sod, 600 mm, along all sidewalk and Active Transportation pavements (outside sodded areas).
- E46.5 Measurement and Payment
- E46.5.1 Turf Grass Sod
- (a) Turf Grass Sod will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Items of Work", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.
    - (i) Items of Work:
      - ◆ Sodding width greater than 600 mm (c/w 75 mm imported topsoil)
      - ◆ Sodding width less than or equal to 600 mm (c/w 75 mm imported topsoil)
- E46.5.2 Payment for each item of work for supply and installation of sod shall include 30-day maintenance before acceptance in accordance with CW 3510.
- E46.5.3 Payment shall be in accordance with the following:
- (a) seventy-five percent (75%) of quantity following supply and placement of sod including topsoil depth as specified in Form B.
  - (b) twenty-five percent (25%) of quantity following termination of the thirty (30)-day maintenance period before acceptance.

## E47. SEEDING

### E47.1 Description

E47.1.1 Further to CW 3520 and CW3540, this specification shall cover sub-grade preparation and the supply and placement of Seed with hydro mulch.

E47.1.2 Hydro mulch shall be applied with seeding in all areas to be seeded.

E47.1.3 Seeding of CN embankments will occur after rail is in use, as directed by the Contract Administrator.

### E47.2 Materials

#### E47.2.1 Seed

(a) Turf grass seed mix shall conform to CW 3520 and shall be a mixture of the following species:

- (i) sixty percent (60%) Kentucky bluegrass (*Poa pratensis*), including equal proportions of any three Class 1 or 2 cultivars;
- (ii) thirty percent (30%) Creeping Red fescue (*Festuca rubra*), and
- (iii) ten percent (10%) Perennial ryegrass (*Lolium perenne*), using any of the recommended cultivars.

#### E47.2.2 Fescue Over-seed Mix

(a) The Fescue Over-seed mix shall be a blend of fifty percent (50%) of Creeping Red fescue or Audubon or Aberdeen Red fescue and fifty percent (50%) Fulfs or Nuttals Alkaligrass (*Puccinellia* spp.).

#### E47.2.3 Cover Crop

(a) Use Annual ryegrass as a cover crop (nurse crop) in all areas to be seeded.

#### E47.2.4 Hydro Mulch

(a) As per CW 3520 Clause 5.6.

E47.2.5 Soil amendments, topsoil and finish grading shall be in accordance with CW 3540-R5 and as per Topsoil, Planting Soil, Soil Amendments, Growing Medium and Finish Grading Specification.

E47.2.6 Hydro-mulch: mulch, water and tackifier shall be in accordance with CW 3520.

E47.2.7 Herbicides and insecticides shall be in accordance with CW3520 and E51 Chemical Control of Vegetation.

### E47.3 Equipment

E47.3.1 Scarification equipment shall be suitable for the area being scarified, shall be capable of scarifying the sub-grade to the specified depth and shall be accepted by the Contract Administrator. For confined areas a toothed bucket may be acceptable. For larger areas tilling equipment may be required.

### E47.4 Construction Methods

#### E47.4.1 Seed Mix

- (a) Soil amendments shall be as per E45 Topsoil, Soil Amendments, Growing Medium and Finish Grading.
- (b) Seeding and hydro mulching and maintenance shall be in accordance with CW 3520.

#### E47.4.2 Fescue Over-seed Mix

(a) Over-seed with fescue over-seed mix in sod areas > 600 mm in width, 90 days after sod installation, or as instructed by the Contract Administrator, using a slit seeder or drill seeder.

(b) Over-seed at a rate of 0.75 kg/100 m<sup>2</sup> (75kg/hectare)

E47.4.3 Hydro Mulch

(a) As per CW 3520 Clause 9.5 and 9.6.

E47.5 Measurement and Payment

E47.5.1 Seed Areas

(a) Seeded areas will be measured on an area basis for each type of seed mix type and paid for at the Contract Unit Price per square metre for the "Items of Work" listed here below, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, CW3510-R9, and accepted and measured by the Contract Administrator.

(b) Items of Work

(i) Seeding

- ◆ Seed Mix
- ◆ Fescue Over-seed Mix

E47.5.2 Payment for Seeding shall be in accordance with the following:

- (a) sixty-five percent (65%) of quantity following supply and placement; and,
- (b) remaining thirty-five percent (35%) of quantity following termination of the Maintenance Period.

E47.5.3 Nurse or Cover Crop Seeding

(a) Nurse or Cover Crop Seeding: there will be no separate measurement for nurse or cover crop seeding. Seeding of a nurse crop will be incidental to other seeding operations

E47.5.4 Herbicides and Insecticides

(a) Herbicides and Insecticides: there will be no separate measurement for materials, equipment and operations related to the use of herbicides and insecticides.

**E48. TREES, SHRUBS AND GROUNDCOVERS**

E48.1 Description

E48.1.1 General

- (a) This specification covers all operations relating to the supply and installation of nursery-grown trees, shrubs and groundcover plantings in areas indicated on the Drawings, including preparation, digging, transport and planting, and maintenance.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E48.1.2 Nomenclature

(a) Nomenclature of specified nursery stock shall conform to the International Code of Nomenclature for Cultivated Plants and shall be in accordance with the approved scientific names given in the latest edition of Standardized Plant Names. The names of varieties not named therein are generally in conformity with the names accepted in the nursery trade.

### E48.1.3 Source Quality Control

- (a) All nursery stock supplied shall be nursery grown and of species and sizes as indicated on the Drawings. Nursery stock shall be No. 1 Grade material in accordance with the current edition of The Canadian Nursery and Landscape Association's (CNLA) "Canadian Standards for Nursery Stock"
- (b) Any nursery stock dug from native stands, wood lots, orchards, or neglected nurseries, which have not received proper cultural maintenance, shall be designated as "collected plants". The use of "collected plants" will not be permitted unless approved by the Contract Administrator.
- (c) The Contractor shall notify Contract Administrator of source of plant material at least seven (7) days in advance of shipment.
- (d) Acceptance of plant material at source does not prevent rejection of same plant material on site prior to or after planting operations.
- (e) Imported plant material must be accompanied with necessary permits and import licenses. Conform to federal and provincial regulations.

### E48.1.4 Shipment and Pre-Planting Care

- (a) Coordinate shipping of plants and excavation of holes to ensure minimum time lapse between digging and planting.
- (b) 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 balls, especially of large trees, during lifting.
- (c) Protect foliage and root balls to prevent loss of moisture during transit and storage.
- (d) Remove broken and damaged roots with sharp pruning shears, making clean cuts.
- (e) Keep roots moist and protect from sun and wind. Trees and shrubs shall be planted within 24 hours of delivery to Site; water well.

### E48.1.5 Replacement

- (a) Tree plantings shall be warranted for a period of two (2) years from the time the tree stock and shrub plantings have been inspected and approved. Refer to Plant Material Warranty E50.

## E48.2 Materials

### E48.2.1 General

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

### E48.2.2 Water

- (a) Water shall be potable and free of minerals that may be detrimental to plant growth.

### E48.2.3 Trunk Protection and Tree Support

- (a) Tree protection shall be a 100 mm x 600 mm long section of plastic weeping tile material.
- (b) Tree support stakes shall be T-rail iron stakes 40 x 40 x 5 x 1540 mm long, primed with 1 brush coat of zinc rich plant paint to CGSN 1-GP-191B. Stakes shall be uniform in style and colour.
  - (i) Other products may be used with prior permission in writing from the Contract Administrator.
- (c) The guying straps shall be of a material that is non-abrasive to the tree to prevent girdling injury:

- (i) Hose-covered wire, flexible belting or any strong, soft wide strips of material is acceptable.

E48.2.4 Root Ball Burlap

- (a) Root ball burlap shall be 150 g Hessian burlap.

E48.2.5 Plant Material

- (a) All plant material specified for this Project shall be containerized and/or ball and burlap nursery stock and hardy to Canadian Plant Hardiness Zone 3a.
- (b) Comply with latest edition of The Canadian Nursery and Landscape Association's (CNLA) "Canadian Standards for Nursery Stock"
- (c) Nursery stock shall be No. 1 grade trees, shrubs and vines.
- (d) All containerized whips and herbaceous plant material shall have a minimum of one full year's growth. Roots shall be healthy, reaching the sides of the containers, and developed such that the root ball can be kept intact during transplanting. Roots shall not encircle each other to the extent of inhibiting plant growth.
- (e) Any plants designated as nursery stock but dug from native stands, wood lots, orchards, or neglected nurseries that have not received proper cultural maintenance, shall be designated as "collected stock". Collected stock is not permitted.
- (f) Use trees, shrubs and groundcovers with structurally sound, strong fibrous root systems, and free of disease, insects, defects or injuries, including rodent damage, sun scald, frost cracks, abrasions or scars to the bark. Plants must have been root pruned regularly, but not later than one growing season prior to arrival on site.
- (g) All parts of the plants shall be moist and show live, green cambium tissue when cut.
- (h) At least one (1) plant of each variety supplied shall bear a tag showing both the botanical and common name of the plant.

E48.2.6 Additional Plant Material Qualifications:

- (a) Imported Plant Material
  - (i) Plant material obtained from areas with milder climatic conditions from those of site acceptable only when moved to site prior to the breaking of buds in their original location and heeled-in in a protected area or placed in cold storage until conditions suitable for planting. Obtain Contract Administrator's approval to use imported plant material.
- (b) Cold Storage
  - (i) Approval required for plant material that has been held in cold storage.
- (c) Container-Grown Stock
  - (i) Acceptable if containers large enough for root development. Trees and shrubs 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.
- (d) Balled and Burlapped Plant Material
  - (i) Balled and burlapped deciduous trees are to meet the standards of the most recent edition of The Canadian Nursery and Landscape Association's "Canadian Standards for Nursery Stock".
- (e) Tree Spade Dug Material
  - (i) Obtain approval of the Contract Administrator for digging plant material with mechanized digging equipment, hydraulic spade or clam-shell type. This type of digging is typically not acceptable for boulevard tree plantings. Dig root balls to meet the most recent edition of The Canadian Nursery and Landscape Association's "Canadian Standards for Nursery Stock".
- (f) Substitutions

- (i) Substitutions to plant material as indicated on the Plant List will not be permitted unless written approval has been obtained as to type, variety and size prior to award of Contract. Plant substitutions must be of similar species and of equal size to those originally specified.

### E48.3 Construction Methods

#### E48.3.1 General

##### (a) Workmanship

- (i) The Contractor shall stake out location of trees, shrubs and planting beds as per the Drawings. Obtain Contract Administrator's approval prior to excavating.
- (ii) The Contractor shall obtain clearances from all utilities, with respect to underground lines located in the areas to be excavated, prior to commencing planting operations.
- (iii) The Contractor shall coordinate planting operations; keep the site clean and planting holes drained, and immediately remove soil or debris spilled onto pavement.

##### (b) Planting Time

- (i) Plant material noted for spring planting only must be planted in dormant stage.
- (ii) Plant only under conditions that are conducive to health and physical conditions of plants.
- (iii) The Contractor shall provide the Contract Administrator with a planting schedule at least two weeks prior to planting operations. Extending planting operations over long period using limited crew will not be accepted.

##### (c) Excavations

- (i) Shrub beds: excavate to minimum depth of 450 mm, as indicated on the Drawings. Individual shrubs shall be planted in 450 mm deep holes backfilled with planting soil mixture.
- (ii) Trees: excavate to depth such that the root flare is exposed and flush with finished grade, with a surface width of two times the diameter of the root ball. Backfill around trees with planting soil mixture.
- (iii) The sides of all tree pits shall be scarified to the depth of one shovel blade and width of one shovel blade.
- (iv) Provide drainage for planting holes in heavy soil if natural drainage does not exist. Have method approved.
- (v) Protect the bottoms of excavations against freezing.
- (vi) Remove water that enters excavations prior to planting. Ensure source of water is not ground water.

##### (d) Planting

- (i) Trees shall be placed on undisturbed soil and to a depth so that the root flare is exposed and flush with finished grade.
- (ii) For shrubs, loosen bottom of planting hole to depth of 150 to 200 mm. Cover bottom of each excavation with minimum of 150 mm of planting soil mixture.
- (iii) Trees, shrubs and groundcovers shall be set plumb in the planting hole. Orient plant material to give best appearance in relation to structures, roads and walkways.
- (iv) Place shrub and groundcover material to depth equal to depth they were originally growing in nursery or in locations collected.
- (v) Ball and burlap root balls: once the tree has been set in its final position, burlap on the root ball shall be folded back from the top 1/3 of the root ball. Do not pull burlap or rope from under root ball.
  - ◆ If a wire basket has been used, it shall be cut off from the top 1/3 of the root ball.

- ◆ All twine shall be removed from the root ball.
- ◆ With container stock, remove entire container without disturbing root ball.
- ◆ All non-biodegradable wrappings must be removed.
- (vi) Tamp planting soil mixture around root system in layers of 150 mm 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 been completely penetrated into soil, complete backfilling.
- (vii) Excavate 200 mm depth an additional 600 mm beyond planting pits around the perimeter of all tree planting pits, and fill with planting soil mixture.
- (viii) Construct 75 mm deep saucers around the outer edge of planting pits to assist with maintenance watering.
- (e) Tree spade excavated materials:
  - (i) Tree spade planting shall be permitted only by approval of the Contract Administrator.
  - (ii) Dig tree pit with same mechanical equipment as used to dig plant material. Ensure hole dug is upright as possible. Place in hole a mixture of 40 L of planting soil and fertilizer mixed with water to soupy consistency. This will be forced up sides of ball as root ball is placed in hole.
  - (iii) Loosen bottom of planting hole to depth of 150 to 200 mm. Cover bottom of each excavation with minimum 150 mm topsoil mixture.
- (f) Pruning
  - (i) Only prune trees, shrubs and groundcovers to remove broken stems. Postpone pruning of those trees where heavy bleeding may occur, until in full leaf. Employ clean sharp tools and make cuts in accordance with the "ANSI A300 (Part 1)-2001 Pruning standards entitled, "Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance – Standard Practices (Pruning)" (revision and re-designation of ANSI A300-1995) (includes supplements) or most recent versions as available and in accordance with "Best Management Practices: Tree Pruning" (2002), which is a companion publication to the ANSI A300, or more recent version as available".
- (g) Trunk Protection and Tree Support
  - (i) Slice open the plastic weeping tile material and place it around the base of each tree trunk.
  - (ii) Place tree supports as indicated on Landscape Detail Drawings.
  - (iii) The guying straps shall be attached in accordance with the Landscape Detail Drawings. Where wire is used, ensure ends are twisted tight, protruding ends are unacceptable.
- (h) Wood Chip Mulch
  - (i) All planting beds shall be covered with a 50 mm depth of wood chip mulch to the limits shown on the planting details.
  - (ii) Wood chip mulch shall extend under all tree limbs, but shall not be installed within 150 mm of the tree trunk.
  - (iii) The saucers of all trees not planted in beds shall be covered with a 75 mm depth of wood chip mulch.

#### E48.3.2

#### Commencement of Maintenance Period

- (a) Immediately after the completion of the tree and shrub plantings, the Contractor is to seek acceptance by the Contract Administrator prior to commencement of the two year Long Term Scheduled Maintenance period.
- (b) In situations where commencement of the two year Long-Term Scheduled Maintenance period is not granted by the Contract Administrator before the end of a growing season, the Maintenance Period will commence on May 15 of the following year or such date as is mutually agreed upon by all parties.



E48.3.3 Maintenance

(a) Watering

- (i) Plant material shall be watered once a week for first four weeks following installation, and once every second week, thereafter.
- (ii) Watering must be done slowly to ensure that water does not run away from the root zone and so the top 300 mm of the soil around the root system of the tree are well saturated.
- (iii) Use a low-pressure open flow nozzle and hose (turf boulevards and parks).
- (iv) The water stream must not gouge out a hole in the soil or mulch.
- (v) Ensure adequate moisture in root zone at freeze-up.

(b) Weeding

- (i) Keep mulched shrub beds and tree saucers weed-free by manually removing weeds during the maintenance period.

(c) Insects and Diseases

- (i) Spray plants to combat pests and diseases. Use organic chemical insecticides approved by Agriculture Canada.

(d) Adjustments

- (i) Make adjustments requested by the Contract Administrator, including straightening trees, tightening guy wires and removing tree stakes.

(e) Maintenance Period

- (i) Following acceptance of tree and shrub plantings, by the Contract Administrator, the two (2)-year Long-Term Scheduled Maintenance begins. Refer to E49 Long-Term Scheduled Maintenance of Plant Material and Planting Beds.

E48.4 Measurement and Payment

E48.4.1 Trees, Shrubs and Groundcovers

- (a) Supply and installation of trees, shrubs and groundcovers will be measured on a unit price basis for each tree, shrub and groundcovers listed under "Plant Material", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.

E48.4.2 Wood Chip Mulch

- (a) Supply and installation of wood chip mulch in the saucers of trees not planted in beds will be considered incidental to the Works of this Specification. No measurement and payment will be made for this Item of Work.

E49. **LONG TERM SCHEDULED MAINTENANCE OF PLANT MATERIAL AND PLANTING BEDS**

E49.1 Description

E49.1.1 This specification covers all operations relating to the maintenance of plant material and planting beds following acceptance of the Work by the Contract Administrator.

- (a) 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.

E49.2 Materials

E49.2.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- (b) The Contractor shall provide all necessary materials and equipment including: additional topsoil, soil ameliorates, mulches, fertilizers and pesticides, and pruning tools, water trucks, hoses, water metres and any other items necessary for the maintenance of the areas indicated in this specification.

### E49.3 Construction Methods

#### E49.3.1 Provision of Maintenance Personnel

- (a) The Contractor shall provide all necessary personnel for the ongoing maintenance operations.

#### E49.3.2 Capability of Personnel

- (a) Maintenance personnel should have at least one year of experience in arboriculture/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.
- (b) The maintenance foreman shall be familiar with plant identification.

#### E49.3.3 Maintenance Period

- (a) Maintain plantings for a period of two (2) years from the date of acceptance of the tree and shrub plantings, by the Contract Administrator. Note: Completion shall not occur after October 15, or before May 15 of any year.

#### E49.3.4 Maintenance Schedule

- (a) Provide the Contract Administrator a Schedule of Proposed Maintenance Activities for the two-year scheduled maintenance period, based on the requirements outlined herein. The scheduled maintenance period shall not commence until the schedule has been reviewed by the Contract Administrator.

#### E49.3.5 Recording Maintenance Operations

- (a) The Contractor shall provide a detailed maintenance log, including but not limited to the following: hours of labour undertaken, number of personnel employed and equipment used. The log will itemize watering, spraying and any other maintenance work. Contractor shall submit logs monthly at regularly scheduled meetings with the Contract Administrator. Maintenance log will be included in payment for the maintenance work

#### E49.3.6 Traffic

- (a) Do not conduct maintenance operations during peak traffic periods (Monday to Friday from 07:00 to 09:00 and from 15:30 to 17:30).

#### E49.3.7 Maintenance of Trees, Shrubs, and Planting Beds

- (a) Maintain trees, shrubs, vines and planting beds as indicated in Trees, Shrubs and Ground Covers Specification - maintenance clause.
- (b) Watering Trees, and Shrubs
  - (i) Newly planted trees, and shrubs require water to become established; however, watering too often can kill a plant. During the summer, if temperatures are fairly high and there has been no rainfall, water approximately once a week.
  - (ii) Contractor shall determine the need for watering by taking soil tests weekly with a one-inch auger. Take a test sample from both the planting soil and from the tree root balls 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.

- (iii) Testing shall be undertaken at a minimum of 10 sites per week at a minimum of 10 m between sites. The installed plant material and bioengineering shall not be allowed to dry out to the detriment of the viability of the plant material. Contractor shall monitor and submit lots to the Contract Administrator monthly. Contractor shall water-in plant material works in late fall during the scheduled maintenance period.
- (iv) Administer watering:
  - ◆ Watering must be done slowly to ensure that water does not run away from the root zone and so the top 300 mm of the soil around the root system of the tree are well saturated
  - ◆ Use a low-pressure open flow nozzle and hose (turf boulevards and parks).
- (v) The water stream must not gouge out a hole in the soil or mulch.
- (vi) Thoroughly soak coniferous trees prior to winter freeze-up.
- (c) Fertilizing, Pruning and Spraying Deciduous Trees and Shrubs
  - (i) Because of the specialized nature of such operations, employ a qualified local arborist.
- (d) Pruning Deciduous Trees and Shrubs
  - (i) Prune in accordance with the “ANSI A300 (Part 1)-2001 Pruning standards entitled, “Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance – Standard Practices (Pruning)” [revision and re-designation of ANSI A300-1995 (includes supplements)] or most recent versions as available and in accordance with “Best Management Practices: Tree Pruning” (2002), which is a companion publication to the ANSI A300, or more recent version as available”.
- (e) Cultivation
  - (i) Cultivate only as required to reconstruct planting beds or tree saucers, or to remove significant weed growth.
  - (ii) Do not cultivate around plants with a shovel or spade which can penetrate too deeply and cause root injury. Cultivate with a hoe or similar tool. When using a hoe never penetrate soil more than 50 mm. Maintain natural elevation of the surrounding area when cultivating. Create a gentle saucer to contain water around the tree root zone.
  - (iii) Avoid pyramiding soil around the base of any plant as this causes water to drain away and will encourage undesirable top root growth.
  - (iv) The boundary between the adjacent sod and soil saucer should be crisp and well formed.
  - (v) Restore wood chip mulch when cultivation completed.
- (f) Spraying
  - (i) Spray trees and shrubs to control insect pests and diseases. Use horticultural compounds approved by Agriculture Canada, which are specific for the problem to be contained.
- (g) Straightening
  - (i) Straighten trees as required or as directed by the Contract Administrator
- (h) Mulching Wood Chip
  - (i) Add wood chip mulch to planting areas as required to maintain an even fresh surface.
- (i) Weeding
  - (i) Hand weed and lightly rake a minimum of once per month, or as determined by the Contract Administrator, to remove competition for installed plant material/undesirable plant material. Dispose of undesirable material off-site.

- (ii) The Contractor shall be responsible for any fines or weed control notices issued for the planting areas. All such notices shall be dealt with by the Contractor in a timely fashion. Copies of any fines and notices shall be provided to the Contract Administrator within five (5) working days of receipt by the Contractor.

- (j) Dispose of waste material at a recognized solid waste disposal site.

#### E49.4 Measurement and Payment

##### E49.4.1 General Maintenance of Trees, Shrubs and Planting Beds

- (a) General Maintenance of Trees, Shrubs and Planting Beds will be measured on an annual basis and paid for at the Contract Unit Price per year for the "General Maintenance of Plant Material and Planting Beds" listed below, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.
- (b) Two-year general maintenance of trees, shrubs, and planting beds, including: fertilizing, pruning, spraying for insects, disease control, cultivation, care of guy wires and turnbuckles, straightening, mulching and watering, will be measured twice each season, typically in July and October, for a six month annual growing season from April 15 to October 15 each year.
- (c) Note that "General Maintenance of Plant Material and Planting Beds" applies to work in Part A through F, but is listed for measurement and payment only under Part B.

#### E50. PLANT MATERIAL WARRANTY

##### E50.1 Description

###### E50.1.1 General

- (a) This Specification covers the provision of warranty for all plant material itemized on the Plant List:
  - (i) Plant Material shall be under warranty for two full years.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

###### E50.1.2 Timing

- (a) Warranty shall commence upon acceptance of installed plant material.

###### E50.1.3 Warranty

- (a) The Contractor hereby warrants that the plant material as itemized on the Plant Lists and on the Drawings will remain free of defects for the maintenance period indicated for each area of the Contract.

###### E50.1.4 End-of-Warranty Inspection

- (a) Contract Administrator reserves the right to extend the Contractor's warranty responsibilities for an additional year, at the end of the designated warranty period for the appropriate area, if at that time plant material leaf development and growth are not sufficient to ensure future survival.

###### E50.1.5 Replacement

- (a) During the warranty period, remove from site any plant material that has died or failed to grow satisfactorily, as determined by the Contract Administrator and replace with healthy plant material of the same species and size.
- (b) Replace plant material in the following spring or fall as directed.

- (c) Extend warranty on replacement plant material for an additional period until the end of the specified warranty period or for one full growing season, whichever is the longer period.
- (d) Continue such replacement and warranty until plant material is acceptable.
- (e) Trees determined by the Contract Administrator to have been damaged by vandalism shall be replaced and such replacement trees will be paid for at the Contract Unit Prices for the species indicated on the Drawings.

## E50.2 Measurement and Payment

### E50.2.1 Warranties on Plant Material

- (a) Warranties on plant material will be incidental to "Plant Material." No measurement and payment will be made for these Items of Work.

## E51. CHEMICAL CONTROL OF VEGETATION

### E51.1 Description

#### E51.1.1 General

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

#### E51.1.2 Safety Requirements

- (a) Comply with Federal and Provincial, pesticide control regulations. Provide Material Safety Data sheets (MSDS) for all chemicals to be used.
- (b) Obtain Provincial Pesticide Applications License and any other permits and licenses necessary to complete work.
- (c) Comply with label directions on the use of herbicide products.
- (d) Comply with label directions as to ambient temperature ranges for application.

#### E51.1.3 Delivery and Storage

- (a) Deliver, store and maintain packaged materials with manufacturer's seals and labels intact.
- (b) Prevent damage, adulteration and soiling of material during delivery, handling and storage.
- (c) Store material in accordance with label directions, including those on maximum and minimum storage temperatures.
- (d) Store herbicide products in original containers as supplied by manufacturer and keep sealed until used.
- (e) Store herbicide products in sheltered, well ventilated, controlled access location.
- (f) Do not store herbicides near feeds and food stuffs, agricultural plants, seeds, fungicides, insecticides, fertilizers or other agricultural chemicals.
- (g) Identify storage area as pesticide storage facility for fire protection purposes.
- (h) Post in a prominent place a list of medical and fire department telephone numbers.
- (i) Post in a prominent location on the outside of the storage area a list of products stored. Provide a copy of this list to fire department. Keep list up to date.

### E51.2 Materials

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

#### E51.2.1 Herbicides

- (a) Select appropriate herbicides to achieve specified control requirement. Refer to Manitoba Guide to Chemical Weed Control.
- (b) Herbicide products used must be registered for such use by Agriculture Canada under Pest Control Products Act.
- (c) Do not use herbicides containing sodium chlorate.

#### E51.2.2 Adjuvants

- (a) Adjuvants shall be compatible with herbicide product used.

#### E51.2.3 Spray Equipment

- (a) Tank Spray: Do not use airblast, mist or fog sprayer. Sprayer unit to meet the following requirements.
  - (i) Sprayer shall have adjustable height boom, hose and handgun for spot treatments, strainers and nozzles to produce spray pattern compatible with job.
  - (ii) Tank shall be equipped with continuous agitation device.
  - (iii) Pressure gauge and regulator shall be capable of maintaining uniform pressure between 100 and 450 kPa.
- (b) Backpack Sprayer
  - (i) Sprayer shall have hose and handgun for spot treatment.
- (c) Equip spray tank loading pipe with check valve located within 1 m of pump or hydrant to prevent siphoning from spray tank resulting in contamination of water source.

### E51.3 Construction Methods

#### E51.3.1 General

- (a) Notice of Spray Operation
  - (i) Post areas to be treated with signs placed at each road access and 100 m intervals around perimeter.
  - (ii) Indicate on signs that spray program is being implemented.
  - (iii) Put signs in place prior to commencement of spray operation and retain in place for twenty-four (24) hours after spray operation is completed for each particular area.
- (b) Environmental Protection
  - (i) Application may continue only when wind velocities range between 2 and 10 km/h.
  - (ii) Do not spray when air turbulence will prevent uniform application.
  - (iii) Do not apply herbicides within 65 m of wells, rivers, streams, lakes, marshes or other environmentally sensitive areas unless otherwise sanctioned by Provincial Permit.
  - (iv) In case of herbicide spill, notify Contract Administrator and Manitoba Environment verbally immediately and subsequently in writing.
  - (v) Do not allow drifting beyond target area. Use mechanical method to minimize herbicide drift.
  - (vi) When spraying adjacent to desirable vegetation, use sprayer fitted with a protective hood suitable to prevent contamination or provide protective covering for such vegetation while spray is in progress.
  - (vii) Do not apply soil sterilises to slopes greater than 3 to 1 where killing vegetation would lead to erosion problems.

- (c) Application of Herbicides
  - (i) Treat areas as indicated by Contract Administrator with appropriate herbicides.
  - (ii) Calibrate equipment to achieve manufacturer's recommended application rates.
  - (iii) Confine herbicide application to areas as indicated to achieve specified control requirements.
  - (iv) Space successive passes to provide uniform coverage of treated area.
  - (v) Use flagmen or other aids as necessary to indicate successive passes.
  - (vi) Where roots of desirable vegetation run under treatment area, use contact herbicides.
  - (vii) Ensure formulation and rate of sterility will not lead to leaching outside treatment area.
  - (viii) Retreat areas in accordance with label directions until specified control requirements are achieved.
  - (ix) Use flags or other aids as necessary to indicate successive passes
- (d) Control Requirements
  - (i) For weed control, achieve within thirty (30) days of treatment, minimum of ninety percent (90%) kill of target plants without damaging installed plant material or adjacent plant material to be retained.
  - (ii) For soil sterilization, achieve within twelve (12) months of treatment, one hundred percent (100%) kill of vegetation.
- (e) Waste Disposal
  - (i) Triple-rinse empty herbicide containers with dilutant and add rinsate to spray mixture in tank.
  - (ii) Puncture and crush glass plastic metal containers making them unsuitable for further use.
  - (iii) Dispose of containers in accordance with Provincial requirements.
  - (iv) Do not rinse or wash spray tanks and equipment on site.
- (f) Report
  - (i) Within seven (7) days of work completion, submit to Contract Administrator a written report containing following information:
    - ◆ full name and PCP Registration number of herbicide products used including adjuvants;
    - ◆ types and makes of application equipment used;
    - ◆ total amount of herbicide applied and rate of application expressed in kilograms of active ingredients per square metre and in kilograms of product per square metre;
    - ◆ dates and times treatment commenced and terminated each day;
    - ◆ summary of daily weather conditions during treatment;
    - ◆ number of square metres completed each day;
    - ◆ description of disposal techniques, total number of containers discarded for each chemical, exact location of disposal site;
    - ◆ names of drivers, mixers and applicators; and,
    - ◆ copies of Provincial Applicator's License and Pesticide Project Application Permit.

#### E51.4 Measurement and Payment

##### E51.4.1 Chemical Control of Vegetation

- (a) Broad scale application of chemical herbicides to seeded areas will be measured on an area basis and paid for at the Contract unit price per 100 m<sup>2</sup> per application for "Chemical Application of Herbicide" which will be payment in full for the supply of all labour, equipment and materials and performing all operations herein described, and all other items included in the Work of this specification.

E51.4.2 Spot Weed Control

- (a) Application of chemical herbicides to control excessive weed growth in sod areas and in planting beds or around trees, following completion of planting operations will be incidental to "Long Term Scheduled Maintenance of Plant Material and Planting Beds". No measurement and payment will be made for this Item of Work.

E52. **REMOVAL OF 53' TRAILER**

E52.1 Description

E52.1.1 General

- (a) 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.
- (b) The Work shall include the removal of the Linden Christian School's 53' (foot) trailer, which is in the way of the construction of the shoofly tracks. It will also include any refuse or discarded items by Linden in the immediate vicinity of the trailer.
- (c) The location of the 53' (foot) trailer is in the NW corner of the Linden Christian School field just to the west of the existing baseball diamond infield.

E52.2 References

- (a) Removals are in accordance with Standard Construction Specifications:
  - (i) CW 1110 - General Instructions
  - (ii) CW 1120 – Existing Services, Utilities, and Structures.
- (b) The National Building Code of Canada 2010 Volume 2, Part 8 – Safety Measures at Construction and Demolition Sites.
- (c) Manitoba Workplace Safety and Health Act, and all applicable National, Provincial, and Municipal regulations.

E52.3 Construction Methods

E52.3.1 Execution

- (a) Inspection
  - (i) Inspect Site with Contract Administrator and verify extent and location of items designated for removal, disposal, salvage and items to remain.
  - (ii) Items to be salvaged for Linden are to be placed on the south side (Linden side) of the fence immediately south of the trailer.
  - (iii) Contractor shall determine means and methods to remove 53' trailer and other items, including how to transport materials off site.
  - (iv) Notify and obtain approval of Contract Administrator before starting removal.
- (b) Removal
  - (i) Remove 53' trailer to permit construction of new Work as indicated.
  - (ii) Do not sell or burn materials on Site.
- (c) Disposal of Removed Material
  - (i) The Contractor shall be responsible for removal of debris and waste from the Work area to an appropriate solid waste disposal area.

E52.4 Measurement and Payment



E52.4.1 Removal of 53' Trailer

- (a) The Removal of the 53' (foot) trailer will not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for the "Removal of 53' Trailer", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.

**E53. CASH ALLOWANCE FOR IRRIGATION SYSTEMS**

E53.1 Description

E53.1.1 The Cash Allowance for Irrigation Systems is intended to be used for modifications to existing landscaping irrigation systems encroaching on public lands or within private lands as directed and authorized by the Contract Administrator.

E53.1.2 The City reserves the right to delete any or all of the Cash Allowance from the Contract if the Work intended to be covered by the Cash Allowance is not required, or if the Works intended are found to be more extensive than the provisional Cash Allowance.

E53.2 References

E53.2.1 Referenced Standard Construction Specifications

- (a) CW 3530-R3 – Manual Irrigation System

E53.3 Construction Methods

E53.3.1 All irrigation modifications shall be made in accordance to Standard Construction Specification CW 3530 – Manual Irrigation System

- (a) All private irrigation systems found in public lands to be cut back so all irrigation systems are on private lands.
- (b) Modify, extend, or remove existing irrigation pipe and sprinkler heads to adequately cover the revised landscaped portions of the property with sprinkler heads.
- (c) The Contractor shall restore private lands to their existing condition unless otherwise agreed upon between the City and Contractor.
- (d) The Contractor shall ensure that all irrigation systems modified shall be in working order after modifications.

E53.4 Measurement and Payment

E53.4.1 Cost of modifications shall be evaluated by the methods outlined in C7.4, and a Change Order prepared by the Contract Administrator. The cost of the Change Order will be paid on the Progress Estimate and deducted from the "Cash Allowance for Irrigation Systems". If the valuation of the authorized work exceeds the Value of the Cash Allowance, the Contract Value will be adjusted by the shortfall.

**UNDERPASS STRUCTURE**

**E54. SUBDRAIN SYSTEMS**

E54.1 Description

E54.1.1 General

- (a) This Specification covers all operations relating to the supply and installation of the subsurface drainage system located behind each abutment, including leads and connections to catchbasins.
- (b) The Work includes all operations relating to the supply and installation of the drain systems located on the superstructure deck.

- (c) 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.

## E54.2 Material and Equipment

### E54.2.1 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.

### E54.2.2 Drain Pipes, Fittings, and Accessories

- (a) Perforated and non-perforated drain pipes, fittings, and other accessories and appurtenances for the superstructure deck and abutment substructure drain pipe system, shall conform to the requirements of the City of Winnipeg Standard Construction Specification CW 3610-R5 and requirements CSA G401-14, for Corrugated Steel Pipe (CSP). Corrugated steel drain pipe shall be perforated and non-perforated, aluminized Type 2, 1.6 mm gauge, complete with filter sock and with the 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 2130-R12 and CW3120-R4.

### E54.2.3 Drainage Fabric

- (a) Drainage fabric shall be in accordance with CW3120-R4 or as accepted by the Contract Administrator in accordance with B8.

### E54.2.4 Drainage Material

- (a) Drainage material shall be in accordance with Specification CW 3120-R4.

### E54.2.5 Equipment

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

## E54.3 Construction Methods

### E54.3.1 Subdrain Systems

- (a) Install a perforated drain pipe system on the superstructure deck, and at each abutment in accordance with CN requirements and CW 3120-R4. The supply and installation of this drain pipe system shall include the drain pipe, connections, all required fittings, drain pipe backfill materials, and the drainage 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.

## E54.4 Measurement and Payment

### E54.4.1 Subdrain Systems

- (a) The supply and installation of the subsurface drainage system will not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for the "Supplying and Placing Subsurface Drainage", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.
- (b) The supply and installation of the drain systems located on the superstructure deck will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Supplying and Placing Subsurface Drainage".

## E55. STRUCTURAL EXCAVATION

### E55.1 Description

E55.1.1 This Specification covers all operations relating to the following:

- (a) excavation required to construct the abutments, piers, and superstructure; and,
- (b) excavation and backfill required for foundation replacement.

E55.1.2 The Works also include the following items, which are incidental to the Work.

- (a) Preparation of the base of excavations.
- (b) The design, fabrication, erection, and removal of all temporary shoring, and such temporary protective measures as may be required to construct the Works.
- (c) The off-site disposal of surplus and unsuitable material.
- (d) Dewatering and or precipitation removal of the excavations as may be required for construction of the structures in the dry.

E55.1.3 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.

### E55.2 Submittals

- (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 excavations on the Site the following:
- (b) Detailed design calculations and Shop Drawings for all shoring that is signed, sealed, and dated by a Professional Engineer experienced in shoring design and licensed to practice in the Province of Manitoba in accordance with E4.

### E55.3 Materials

#### E55.3.1 General

- (a) Protection
  - (i) The Contractor shall provide protection to ensure no damage to existing facilities and equipment, including railway infrastructure, and utilities.
- (b) Excavation
  - (i) 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 workmanship-like manner, to the satisfaction of the Contract Administrator.
  - (ii) 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 City for any materials taken by the Contract Administrator for testing purposes.
  - (iii) 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, augured material for the vertical drains, abandoned utilities, existing timber or other culverts and structures, or all other material of whatever character which may be encountered.

(b) Foundation Replacement

(i) Well graded crushed limestone, conforming to the following gradation:

CANADIAN METRIC SIEVE SIZE	PERCENT OF TOTAL DRY WEIGHT PASSING EACH SIEVE
50,000	100%
5,000	25% - 80%
80	5% - 18%

E55.3.2 Equipment

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

E55.4 Construction Methods

E55.4.1 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, suitable fill material placed on site where required as approved by the Contract Administrator or 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 existing stock piles, or trenches within the right-of-way, the Contractor shall, on completion of the Work, backfill the trenches to the elevation of the original ground existing at the time of excavation and compact the backfill material, all at their 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.
- (f) During construction the Contractor may be required to dewater excavations. Dewatering of excavations shall be completed in accordance with D22.
- (g) No measurement and payment of dewatering of excavation will be made and shall be considered incidental to the Work.
- (h) Foundation Replacement
- (i) Notify the Contract Administrator immediately if it appears that unsuitable material is present at the final base of excavation. Unsuitable material include soft spot, wet areas, frozen soil, organic material, fill soil, silt pockets, debris, etc.,. The Contract Administrator will review the suitability of the foundation material and may specify replacement of the material.
- (ii) If replacement is required, remove the specified depth of unsuitable material and replace with specified crushed granular material compacted to a minimum of ninety-five percent (95%) standard Proctor Maximum Dry Density.
- (iii) If the foundation is made unsuitable due to improper construction activities, the Contractor shall replace the affected area to the satisfaction of the Contract Administrator at Contractor’s own cost.
- (iv) No measurement and payment of foundation replacement will be made and it shall be considered incidental to the Work.

**E55.5 Measurement and Payment**

E55.5.1 The excavation required for the construction of abutments, piers, and superstructure will not be measured. They will be paid for at the Contract Lump Sum Price for "Structural Excavation", 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.

**E56. STRUCTURAL BACKFILL**

**E56.1 Description**

E56.1.1 This Specification covers all operations relating to the following:

- (a) backfilling required to construct the piers and abutments.

E56.1.2 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.

**E56.2 Materials**

**E56.2.1 General**

(a) Protection

- (i) The Contractor shall provide protection to ensure no damage to existing facilities and equipment, including railway infrastructure, and utilities.

(b) Backfilling

- (i) 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.
- (ii) 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 their own expense.
- (iii) 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.
- (iv) All granular backfill for the Bridge, including levelling base fill shall be clean and free from organic material and in accordance with CW 2030-R7.
- (v) All granular backfill for the Bridge shall be Type 1 Material in accordance with 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

- (vi) Non-granular cohesive material shall be highly plastic clay (exhibiting putty-like properties with considerable strength when dry) and non-organic. Material with very high swelling potential such as bentonite clay will not be permitted. When proposed material characteristics are in question, the Contract Administrator may require the Contractor to classify the material using Test Method ASTM D2487 – Classification of Soils for Engineering Purposes. Non-granular cohesive material shall have a minimum Plasticity Index of 40. The non-granular cohesive material shall be free of rocks and stones.
- (vii) Excavated material may be used for backfilling provided it meets the above requirements. Excavated granular material intended to be used for backfilling must not be contaminated by top soil or organic materials.

#### E56.2.2 Equipment

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

#### E56.3 Construction Methods

##### E56.3.1 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 in accordance with B8.
- (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 allowed free 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 their own expense, to the satisfaction of the Contract Administrator.

#### E56.4 Measurement and Payment

E56.4.1 The backfilling required for the construction of abutments will not be measured. They will be paid for at the Contract Lump Sum Price for "Structural 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.

#### E57. TEMPORARY SHORING, EXCAVATION, DEWATERING AND MONITORING

##### E57.1 Description

E57.1.1 The design, fabrication, erection, and removal of all temporary shoring, and such temporary protective measures as may be required to construct the Works.

E57.1.2 The Work covered under this item shall include all operations relating to structural excavation, installation, and removal of shoring systems required to construct the Underpass Structure including dewatering procedures for the duration of the construction period as specified herein.

E57.1.3 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.

##### E57.1.4 Definitions

- (a) "Open Excavation" means a temporary unsupported excavation with side slopes cut at safe inclination.
- (b) "Supported Excavation" means a temporary excavation supported by an acceptable shoring system.
- (c) Geotechnical Report and the geotechnical design criteria may be viewed at the Contract Administrator's Office upon request.

##### E57.2 References

###### E57.2.1 References and Building Codes

- (a) All applicable sections of the latest 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.
- (b) All applicable guidelines of the latest CN Design Criteria for the Shoring Walls.

##### E57.3 Submittals

- (a) Prepare and submit Shop Drawings for all excavation, shoring, work pads, access ramps and staging.
- (b) Prepare and submit a Structural Excavation and Shoring Safe Working Plan to the Contract Administrator a minimum of two (2) weeks prior to commencing Work on Site. This shall include an Excavation Staging Plan.
- (c) Prepare and submit a monitoring plan including notification and action plan to monitor CN detour track displacement, shoring and excavation displacement during abutment and pier excavations to the Contract Administrator a minimum of two (2) weeks prior to commencing Work on Site.
  - (i) CN will determine if shoofly tracks line and level require corrective action.

##### E57.4 Materials

###### E57.4.1 General

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

E57.4.2 Concrete

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

E57.4.3 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.

E57.4.4 Timber Lagging

- (a) As specified in the CN design criteria for the shoring walls.

E57.5 Construction Methods

E57.5.1 Condition and Protection of Railway Tracks

- (a) The railway tracks at the boundary of the Work area are recently constructed detours to facilitate the proposed construction activities.
- (b) The track detours have a limited capacity to withstand excavations necessary for the proposed construction. Ensure that Work activities do not jeopardize the stability or impact the performance of the tracks.
- (c) The Contractor will monitor CN detour tracks displacement as well as the displacement of shoring system and displacement of soil behind the shoring wall during excavation works as per the approved monitoring plan, and may require modifications to the construction sequence or introduce additional requirements to maintain acceptable track performance. Acceptable track performance will be determined by CN.
  - (i) Cost of CN shoofly tracks line and level corrective action will be the Contractor's responsibility.

E57.5.2 General Staging and Construction Requirements

- (a) Construct the Underpass Structure generally in accordance with the requirements identified on the Drawings.
- (b) Groundwater depressurization and construction dewatering systems as described in E104 shall be in place and complete with approved water disposal procedures prior to the commencement of any excavation or shoring operations.
- (c) 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.
- (d) 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.
- (e) Complete excavations in accordance with the approved Excavation Plan and to the elevations and dimensions shown on the Excavation Plan or to adjusted elevations as directed by the Contract Administrator in order to obtain a firm, stable foundation.
- (f) Dewater excavations so that construction of the underpass is completed in the dry. Keep the bottom of excavations free from excessive moisture or free-flowing water.
- (g) Undertake dewatering in accordance with the Water Management Plan as described in D22 and accepted by the Contract Administrator.



- (h) Handle, store and dispose of excavated materials in accordance with the Environmental Protection Plan as described in D21 and accepted by the Contract Administrator.

#### E57.5.3 Excavation Plan

- (a) Prepare the plan to confirm constructability and assess potential interference with other construction activities.
- (b) Coordinate the progress of the excavation with the groundwater depressurization Work and with the results of the monitoring program.
- (c) Protect cut slopes against surface water and rainfall and keep covered at all times by a protective layer of approved super duty tarp or geosynthetic product.

#### E57.5.4 Excavation Shoring Requirements

- (a) Design of shoring and excavations shall be accompanied by a design statement sealed by a Professional Engineer registered in the Province of Manitoba

#### E57.5.5 Performance Monitoring

- (a) Monitoring plan including notification and action plan to monitor CN detour track displacement during the excavation of abutment and piers shall be accompanied by a design statement sealed by a Professional Engineer registered in the Province of Manitoba. This will include determination of the threshold values, selections of adequate devices and sufficient coverage in terms of frequency of readings. Displacement of CN detour track, slope for open excavations, shoring and the soil behind the shoring will be monitored using an adequate geotechnical instrumentation and surveys or equivalent. Monitoring plan will only be considered acceptable if approved in writing by the Contract Administrator.
- (b) Instrumentation locations will be determined by the Contractor to minimize potential interference with construction activities.
- (c) The Contractor is advised that it may be necessary to limit equipment movement in the vicinity of the monitoring work. The Contractor shall make every effort to coordinate the monitoring with the construction operations so as to minimize disruption of the Work.
- (d) Take all necessary precautions to prevent damage to geotechnical instrumentation. Repair or replace to the satisfaction of the Contract Administrator instrumentation that becomes damaged or unreliable as a result of construction operations.
- (e) It may become necessary during the Work to install additional geotechnical instrumentation. Notify the Contract Administrator of the installation of this instrumentation.
- (f) The Contractor shall review excavation progress and may revise construction sequencing and timing and / or introduce staging and waiting periods as required based on performance monitoring results.
- (g) Ensure that all personnel understand and observe the requirements of (c) and (d). Prior to commencement of on-site work, the Contractor's superintendent, foremen and heavy equipment operators shall attend an orientation meeting that will outline restrictions for working on and around the tracks and excavations. The Contract Administrator reserves the right to have personnel removed from the Site for failure to comply with these restrictions.
- (h) Protection of the Works
  - (i) Be responsible for protection of the Works during the duration of the Contract. This shall include but may not be limited to maintaining dewatering systems on completed works, providing fencing and security.

#### E57.6 Measurement and Payment

##### E57.6.1 Temporary Shoring, Excavation, Dewatering and Monitoring

- (a) The temporary shoring, excavation, dewatering and other associated works will not be measured. This Item of Work will be paid for in the Contract Lump Sum Price for "Temporary Shoring, Excavation, Dewatering and Monitoring", performed in accordance with this Specification and accepted by the Contract Administrator.
- (b) Railway protection, development of the excavation plan and performance monitoring will not be measured. This Item of Work will be paid for in the Contract Lump Sum Price for "Temporary Shoring, Excavation, Dewatering and Monitoring", performed in accordance with this Specification and accepted by the Contract Administrator.

## E58. **ROCK-SOCKETED CAISSONS**

### E58.1 Description

#### E58.1.1 General

- (a) This Specification covers all operations relating to the supply and installation of rock-socketed caissons for the piers including but not limited to overburden drilling, rock coring, water control, rock-socket inspection, supply and installation of steel casings, splicing of steel casings, galvanizing of steel casings, supply and placement of concrete and reinforcing steel, removal of temporary steel casings and disposal of excavated material.
- (b) A test caisson was advanced at a redundant pile to examine the feasibility of construction and assist in the selection of adequate equipment and proper construction practices. Summary of the test caisson investigation and the site observations related to the drilling challenges is attached in Appendix 'A'.
- (c) Supplying and installation of steel casing tips.
- (d) 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.
- (e) All Works within the CN Right of Way or where construction equipment and materials may be at risk of entering the Right of Way must be coordinated and performed as outlined in E14.

#### E58.1.2 Definitions

- (a) Overburden: All material encountered above the bedrock including imported fill and native soils.
- (b) Weathered Rock Zone: Weathered rock encountered above the sound bedrock including voids and soil filled cavities which would require permanent steel casing to support the caisson hole.
- (c) Sound Rock: Rock which may contain fractures but a casing is not required to support the caisson hole.

#### E58.1.3 Provisional Pay Items

- (a) Base tender Lump Sum Price on number of caissons shown on the Drawings including all labour and material required to install rock-socketed caissons to Elevations as per Contract Drawings.
- (b) Provide unit price for additional length of rock-socket into sound bedrock, including coring, rock removal, reinforcing and concrete.
- (c) Provide unit price for additional length of the steel casing only into weathered rock zone.
- (d) Provide unit price for reduced length of rock socket into bedrock, including a reduction of coring, rock removal, reinforcing and concrete to be credited to the City.

#### E58.1.4 Elevations on Drawings

- (a) 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.

## E58.2 Submittals

- (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 tremie concrete operations the proposed tremie concrete procedures.

## E58.3 Materials

### E58.3.1 General

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

### E58.3.2 Handling and Storage

- (a) Storage of materials shall be in accordance with CSA Standard CAN/CSA A23.1. Materials damaged by careless or negligent handling or storage by the Contractor shall be replaced at the Contractor's expense.

### E58.3.3 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 their own expense.

### E58.3.4 Steel Casings

- (a) Steel casings shall be as follows:
  - (i) 1219 mm diameter x 19 mm thick permanent casing as indicated on the Drawings, conforming to the requirements of ASTM A252 Grade 3. For pier caissons, steel casings shall be hot dip galvanized for the top 6.5 m of pile length;
  - (ii) when mill test certificates originate from a mill outside of Canada or the United States of America, the Contractor shall have the information on the mill test certificate tested and verified by independent testing by a Canadian laboratory. This laboratory shall be certified by an organization accredited by the Standards Council of Canada to comply with the requirements of OSO/IEC 17025 for the specific tests or types of tests required by the material standard specified on the mill test certificate; and,
  - (iii) splicing of the steel casings shall be with full penetration welds. Welding, welder qualifications, pre-qualification of weld details and inspection of the welds shall conform to the requirements of the AASHTO/AWS Bridge Welding Code D1.5 and CSA W59 (latest editions).
- (b) Galvanizing shall be in accordance with ASTM A123/A123M to a minimum net retention of  $610^{\circ} \text{ g/m}^2$  to the limits identified herein and on the Drawings and painted with polyurethane paint to match concrete color to the requirements of the Specification E66.
- (c) Steel Casing Tips

- (i) The Contractor shall supply and install outside fit, open-end cutting shoe for the pier caissons such as Versa-Steel 200 Series, or equivalent as approved by Contract Administrator in accordance with B8.
- (ii) The Contractor shall submit to the Contract Administrator for review and approval, connection details and weld procedures for the pipe pile open-end cutting shoe in accordance with the details shown on the Drawings. Applicable welding procedures shall be stamped as approved by the Canadian Welding Bureau.

E58.3.5 Concrete

- (a) The concrete shall conform to the Specification E61.
- (b) The concrete shall be placed by the tremie method.

E58.3.6 Reinforcing Steel

- (a) The reinforcing steel shall conform to Specification E62 of this Specification.

E58.4 Equipment

E58.4.1 All equipment shall be of a type accepted by the Contract Administrator and shall be kept in good working order.

E58.4.2 Tremie Equipment

- (a) The tremie pipe shall consist of a tube, having a diameter of not less than 250 mm, 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.

E58.5 Construction Methods

E58.5.1 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 alignment.
- (b) Alignment shall not deviate more than two percent (2%) of caisson length out of plumb and not more than 75 mm off centre at the top of caisson.

E58.5.2 Cut-off of Steel Casings

- (a) The casings shall be set to the elevations shown on the Drawings.
- (b) All costs associated with the casing cut-offs shall be incidental to the Work.

E58.5.3 Rock-Socketed Caisson Installation

- (a) The Contractor shall install shaft holes and permanent steel casings to diameters indicated on the Drawings at each caisson location. The steel casings shall be advanced into bedrock to the depth indicated on the Drawings or as determined by the Contract Administrator.
- (b) The Contractor may determine that temporary steel casings are required in addition to the permanent casings shown on the Drawings.
- (c) The Contractor shall install rock sockets using core barrels to diameters indicated on the Drawings. The sockets shall be advanced into sound bedrock to the depth indicated on the Drawings or as determined by the Contract Administrator. Ensure loose material is removed and the caisson is free of foreign material. Any water or material removed from the caisson holes shall be collected and removed from site and properly disposed of at Contractor's own expense.

- (d) Following the excavation of the rock sockets to the required depth, the Contractor is required to provide evidence to the Contract Administrator that the socket is in an acceptable condition. A remote television inspection with video link to the surface or other similar inspection means will be required to demonstrate that the specified condition of the completed sockets have been met, to the satisfaction of the Contract Administrator.
- (e) The inspection shall consist of the following. Inspection shall be performed in each rock socket with the Contract Administrator and Contractor present. The inspection shall be capable of showing all vertical and bottom faces of the rock socket. If, following the inspection by an approved method, in the opinion of the Contract Administrator the rock socket for any given caisson has not penetrated a continuous section of sound bedrock of the depth and quality suitable for rock socket installation, the Contractor will be required to extend the length of the socket until this condition is satisfied or as directed by the Contract Administrator.
- (f) If the rock socket is found to have loose material or foreign matter inside, the material shall be removed by the Contractor to the satisfaction of the Contract Administrator. Additional inspections will be required following cleaning operations or further drilling of the rock sockets as directed by the Contract Administrator.
- (g) The Contractor shall maintain accurate records of the bedrock strata elevation, tip elevations, casing depth, and socket length for each caisson. At the completion of these works, three (3) copies are to be submitted to the Contract Administrator.
- (h) The Contract Administrator may require extension of the steel casings into bedrock and 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. The Contract Administrator may also reduce the length of rock sockets at the time of installation based on the quality of rock as determined by the Contract Administrator.
- (i) 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 tremie concrete to the top of caisson elevation.
- (j) Supply, installation and removal of temporary steel casings if required for installation of caissons are incidental to the Work.

#### E58.5.4 Cleaning the base of the caisson shaft and downhole video monitoring

- (a) The Contractor shall construct rock sockets for piles using core barrels to diameters indicated on the Drawings. The sockets shall be advanced into sound bedrock to the depth indicated on the Drawings or as determined by the Contract Administrator. Core barrel should be used to retrieve the rock cores in-order to be inspected by geotechnical engineer to assess the competency of the bedrock.
- (b) Upon final excavation, and prior to pouring the concrete, the entire shaft base shall be cleaned, all loose or sediment materials shall be removed and the base of the caisson shall be free of foreign material. An air lift pump or any other effective method of cleaning shall be used and moved around the base of the excavation to ensure the base of the shaft is cleaned effectively and to the satisfaction of the Contract Administrator. Any water or material removed from the caisson holes shall be collected and removed from the site and properly disposed of at Contractor's own expense.
- (c) Following the excavation of the rock sockets to the required depth, the Contractor is required to provide evidence to the Contract Administrator that the socket is in an acceptable condition. A remote television inspection with video link to the surface or other similar inspection means will be required to demonstrate that the specified condition of the completed sockets have been met, and/or to the satisfaction of the Contract Administrator.
- (d) All costs associated with televised inspection at each rock socket location shall be incidental to the Work.

#### E58.5.5 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 m<sup>3</sup>/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:
  - (i) free movement of the discharge end over the entire top surface of the Work; and,
  - (ii) rapid lowering when necessary to retard or stop the flow of concrete.
- (e) 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.
- (f) 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.
- (g) Where tremie concrete is used, in addition to the heating and hoarding requirements in E61 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.

#### E58.5.6 Heating and Hoarding

- (a) The Contractor shall make provisions for heating the concrete, in accordance with E61.5.19. All costs associated with heating and hoarding shall be incidental to the Contract Unit Price for "Supply and Install Rock-Socketed Caissons".

#### E58.6 Measurement and Payment

##### E58.6.1 Supply and Install Rock-Socketed Caissons

- (a) Supply and install rock-socketed caissons will not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for "Supply and Install Rock-Socketed Caissons", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.

##### E58.6.2 Added Length of Rock-Socket

- (a) Added length of rock-socket shall be measured on a length basis and paid for at the Contract Unit Price per linear metre for "Added Length of Rock-Socket", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.

##### E58.6.3 Added Length of the Steel Casing into Weathered Rock Zone

- (a) Added length of the steel casing into weathered rock zone shall be measured on a length basis and paid at the Contract Unit Price per linear metre for "Added Length of the Steel Casing into Weathered Rock Zone", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, accepted and measured by the Contract Administrator.

**E58.6.4 Subtracted Length of Rock-Socketed Caisson**

- (a) A subtracted length of rock-socketed caisson shall be measured on a length basis and payment will be credited to the City at the Contract Unit Price per linear metre for "Subtracted Length of Rock-Socketed Caisson" which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.

**E58.6.5 Steel Casing Tips**

- (a) Supplying steel casing tips will be measured on a unit basis and the number to be paid for will be the total number of steel casing tips supplied as accepted by the Contract Administrator.  
Supplying steel casing tips will be paid for at the Contract Unit Price per pile tip for "Supply of Steel Casing Tips", for performing all operations herein described and all other items incidental to the Work included in this Specification.
- (b) Installation of steel casing tips will be measured on a unit basis and the number to be paid for will be the total number of steel casing tips installed as accepted by the Contract Administrator.
- (c) Installation of steel casing tips will be paid for at the Contract Unit Price per tip for "Installation of steel casing tips", for performing all operations herein described and all other items incidental to the Work included in this Specification.

**E59. SUPPLY AND DRIVING STEEL H PILES**

**E59.1 Description**

E59.1.1 This Specification shall cover all operations related to the pre-boring for piles, supplying, handling, hauling, storing, supplying and installing pile tips, aligning and driving, splicing, and cutting off of piles at the required elevations for steel bearing piles.

E59.1.2 Steel piles, steel "H" piles, and "H" Piles shall be considered one and the same for the Drawings and this Specification.

E59.1.3 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 other things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

**E59.2 References**

E59.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) CAN/CSA G40.20M/G40.21M, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- (b) CSA W59, Welded Steel Construction (Metal Arc Welding).
- (c) AASHTO/AWS D1.5M/D1.5 Bridge Welding Code.
- (d) CN Guidelines for Design of Railway Structures
- (e) City of Winnipeg's Approved Products List.

**E59.3 Submittals**

E59.3.1 The Contractor shall submit the following to the Contract Administrator:

- (a) copies of Mill Test Certificates showing chemical analysis and physical tests for piling material. Piling material without this certification will be rejected;

- (b) details of the proposed pile driving system and manufacturer's specifications and catalogue for all mechanical hammers to be used to perform preconstruction wave equations analysis and determine adequacy of the driving system and hammer and the preliminary pile driving criteria;
- (c) certificate of mass for gravity or drop hammers. If this certificate is not available, the gravity or drop hammers shall be weighed in the presence of the Contract Administrator. Hammers so weighed shall have the exact mass marked on them. Gravity hammers shall weigh at least 1.5 ton but in no case shall the mass of the hammer be less than the combined mass of the pile and pile cap;
- (d) proof of certification for the welders conducting the Work (if applicable). All welders shall satisfy one of the following requirements:
  - (i) welders qualified in accordance with the requirements of ASHTO/AWS D1.5M/1.5;
  - (ii) valid Canadian Welding Bureau (CWB) Welding ticket; or
  - (iii) valid "Welder's Licence" as issued by the Mechanical and Engineering Division, Department of Labour and Manpower, Province of Manitoba, with a minimum of 5 years of experience welding on steel structures.
- (e) welding procedures specific to the Work.

#### E59.4 Materials

##### E59.4.1 General

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

##### E59.4.2 Handling and Storage of Materials

- (a) Piling shall be handled, hauled and stored in a manner that avoids damage to the piling materials. Loading and unloading shall be by crane, loader or other appropriate hoisting equipment.
- (b) 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.
- (c) 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 their own expense.

##### E59.4.3 Steel "H" Piles

- (a) Steel "H" Piles shall be structural HP 360 x 132 steel members manufactured in accordance with CAN/CSA-G40.20M/G40.21M, Grade 350W.

##### E59.4.4 Pile Tips

- (a) Pile tips shall conform to CAN/CSA-G40.20M/G40.21M Grade 300W. Pile tips shall be Hard-Bite Point Model No. HP-77750-B.

##### E59.4.5 Splice Plates

- (a) Splice plates shall conform to the requirements of CAN/CSA G40.21M, Grade 350W.

##### E59.4.6 Welding

- (a) The Contractor is responsible for supplying all welding materials. All welding materials shall conform to the requirements of Welded Steel Construction (Metal Arc Welding).
- (b) All welding shall conform to the latest CSA Standard W59, electric arc method.

#### E59.5 Construction Methods



#### E59.5.1 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. Piles shall be driven vertically unless shown otherwise on the Drawings, and shall not deviate more than two percent (2%) out-of-plumb. Battered piles shall be driven to the battered specified on the Drawings, and shall not deviate more than two percent (2%) from the batter specified. Piles shall not be more than 75 mm off centre measured at cut-off elevation.
- (b) Piles shall not be jacked or pulled into their final positions.

#### E59.5.2 Driving of Piles

- (a) Piles shall be driven to the depths and in accordance with the pile driving criteria indicated in the Geotechnical Report, on the Drawings or as directed by the Contract Administrator.
- (b) All pile driving points shall be welded by the Contractor prior to commencement of pile driving operations, incidental to the works of this Specification.
- (c) The piles shall be driven to the approximate tip elevations as shown on the Drawings except when required by the Contract Administrator, the piles shall be driven to a factored capacity (ULS) of 1500 kN based on pile dynamic analyser (PDA) test. Prior to the pile construction, the acceptability of the pile driving system and the required set criteria shall be determined by the wave equation analysis. The set criteria shall be confirmed during construction by E60.
- (d) 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.
- (e) 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.
- (f) For pile installation monitoring purposes, the Contractor shall paint markings on each pile at 0.25 m intervals, with a label at each 1.0 m interval, starting from the toe of the pile.
- (g) Pile driver leads shall be used to support the piles while they are being driven and shall be braced to the supporting crane so as to hold the piles securely and accurately in the required position during driving. 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. Battered piles shall be driven with incline leads.
- (h) The heads of the steel piles shall be squared 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.
- (i) 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.
- (j) Driving of all piles shall be continuous without intermission until the pile has been driven to final elevation.
- (k) 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 install the piles as directed by the Contract Administrator. Abandoned pile will be paid in accordance with this Specification.

- (l) Preboring will not be allowed unless it is approved in writing by the Contract Administrator.
- (m) 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.
- (n) The Contractor shall ensure the safety of all personnel during pile driving operations.
- (o) The Contractor is responsible for the means, methods, and necessary precautions to manage vibration generated during pile driving. This may include modifying the driving sequence or introducing additional requirements to maintain acceptable vibration levels. The Contractor is responsible for all nuisance, noise, damage, and legal claims resulting from noise/vibration generated through piling or other construction activities.
  - (i) Further to (o), note that the Contract Administrator will be monitoring ground vibration due to CN train passage on the shoofly tracks in the vicinity of the StorageVille facility (830 Waverley Street). This will involve spot measurements at StorageVille before construction commences while the trains are travelling along the mainline, and spot measurements when the trains are travelling along the shoofly. This is to establish existing (baseline) vibration levels which are beyond the Contractor's control. The Contract Administrator will not be monitoring ground vibration due to construction activities such as pile driving. The Contract Administrator will install ground vibration measurement instrumentation in the vicinity of StorageVille. Instrument locations will be determined by Contract Administrator and communicated to the Contractor to minimize potential interference with construction activities.
  - (ii) Further to (i), the Contractor is advised that it may be necessary to limit equipment movement in the vicinity of the instrumentation. The Contract Administrator will make every effort to coordinate the monitoring with the construction operations so as to minimize disruption to the Work

### E59.5.3

#### Splicing of Piles and Installing Pile Tips

- (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, in accordance with the welding procedures, Shop Drawings and the following:
  - (i) the butting ends of the driven pile and its extension or the pile and the pile tip shall be cut square to give reasonable bearing between the matting surfaces;
  - (ii) all butting surfaces shall be one hundred percent (100%) butt welded;
  - (iii) the butting surface of the extension piece shall be bevel cut at 45° to facilitate a full-penetration butt weld. Temporary clamping plates may be used as required;
  - (iv) 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;
  - (v) 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;
  - (vi) the piles shall not have more than one splice per pile unless otherwise approved by the Contract Administrator;
  - (vii) splices shall be located such that no more than fifty percent (50%) of the piles are spliced at the same elevation;
  - (viii) material to be welded shall be preheated in accordance with CSA W59;

- (ix) when the air temperature is below 0 °C, all materials to be welded shall be preheated to 100 °C for a distance of 80 mm beyond the weld and shall be sheltered from the wind; and,
- (x) when the air temperature is below -18°C, welding will not be permitted unless suitable hoarding approved by the Contract Administrator is in place.

#### E59.5.4 Defective Piles

- (a) The pile driving procedures shall not subject the piles to excessive and undue abuse producing deformation of the steel. Manipulation of piles to force them into proper position will not be permitted.
- (b) Piles damaged by improper driving, or driven out of proper location, or driven below the cut-off elevation, shall be corrected by one of the following methods accepted by the Contract Administrator:
  - (i) the piles shall be withdrawn and replaced by new, if necessary, longer piles; or
  - (ii) replacement piles shall be driven adjacent to defective or low piles; or
  - (iii) the piles shall be spliced or built up, as otherwise provided herein, or a sufficient portion of the footing extended to properly embed the piles. All piles, pushed up by the driving of adjacent piles or by any other cause, shall be driven down again.
- (c) In the case of required penetration and bearing capacity are not obtained, the Contractor shall provide a hammer of greater energy, as applicable, or when accepted by the Contract Administrator, resort to pre-drilling.

#### E59.5.5 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 as specified on the Drawings or as directed by the Contract Administrator. The top of all piles shall be neatly cut off (true and level) at the cut-off elevation.
- (b) Unless determined otherwise by the Contract Administrator, cut offs shall become the property of the Contractor and shall be removed from the Site.

#### E59.5.6 Steel 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 E59.5.3.

### E59.6 Quality Control

#### E59.6.1 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 approval that may have been previously given.
- (b) The Contractor shall provide a detailed survey of all of the pile locations for a pile cap (foundation) and provide that to the Contract Administrator prior to cutting off any piles for that pile cap.
- (c) The Contractor shall replace any piles, or add additional pile(s), for piles that do not meet the specified refusal criteria or do not meet the following tolerances: +/-2% out of alignment for battered piles, +/-2% out of plumb for vertical piles, and 75 mm off centre of the specified locations. Any modifications required to the pile cap, due to piles out of tolerance or due to required additional piles to compensate for out of tolerance piles, shall be carried out as specified by the Contract Administrator at the Contractor's own costs.

#### E59.6.2 Access

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

#### E59.6.3 Pile Driving Records

- (a) The Contract Administrator will keep a record of each and every pile driven. The records shall give the date, time, size, 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.

### E59.7 Measurement and Payment

#### E59.7.1 Steel Bearing Piles

- (a) Supplying steel bearing piles will be measured in linear metres of piling. The number of linear metres to be paid for will be the total number of linear metres of piling unloaded and stockpiled at the Site as authorized by the Contract Administrator.

The supply of steel bearing piles will be paid for at the Contract Unit Price per linear metre for "Supplying Steel Piles", 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.

- (b) Driving steel bearing piles will be measured in lineal metres of piling. The length to be paid for will be the total number of lineal metres driven, less fifty percent (50%) of the total number of lineal metres of piling cut off after driving. Cut offs will be measured by the Contract Administrator in the presence of the Contractor.

Driving steel piles will be paid for at the Contract Unit Price per linear metre for "Driving Steel Piles", 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.

- (c) Pre-Boring of piles will be considered incidental to the supplying and driving steel bearing piles and no separate measurement will be made of this work.

#### E59.7.2 Pile Tips

- (a) Supplying steel H pile tips will be measured on a unit basis and the number to be paid for will be the total number of pile tips supplied as accepted by the Contract Administrator.
- (b) Supplying steel H pile tips will be paid for at the Contract Unit Price per pile tip for "Supply of Steel H Pile Tips", for performing all operations herein described and all other items incidental to the Work included in this Specification.
- (c) Installation of steel H pile tips will be measured on a unit basis and the number to be paid for will be the total number of steel H pile tips installed as accepted by the Contract Administrator.  
Installation of steel H pile tips will be paid for at the Contract Unit Price per pile tip for "Installation of Steel H Pile Tips", for performing all operations herein described and all other items incidental to the Work included in this Specification.

#### E59.7.3 Splicing Steel Bearing Piles

- (a) Splicing steel bearing piles will be measured on a unit basis and the number to be paid for will be the total number of splices performed by the Contractor and as accepted by the Contract Administrator.

- (b) Splicing of steel bearing piles will be paid for at the Contract Unit Price for “Splicing Steel H Piles”, for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

## E60. PILE DYNAMIC ANALYSER (PDA) TESTING

### E60.1 Description

- E60.1.1 The dynamic testing shall be performed by the Contractor to monitor and confirm hammer and driving system performance, assess pile installation stresses and integrity, as well as to evaluate pile capacity. The Contractor shall secure the services on an independent Dynamic Testing Consultant with demonstrated experience in similar projects. Dynamic testing shall be performed on at least six (6) piles, three (3) at each abutment.
- E60.1.2 The steel piles selected for PDA testing will become part of the permanent piling for the substructure units.
- E60.1.3 Dynamic testing involves attaching two strain transducers and two accelerometers to the pile approximately three (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.

### E60.2 References

- E60.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
  - (a) ASTM D-4945-12, “Standard Test Method for High Strain Dynamic Testing of Deep Foundations”; and,
  - (b) Specification E59.

### E60.3 Submittals

- E60.3.1 At least fourteen (14) days prior to driving the test piles, the Contractor shall submit Specifications for the pile driving equipment to the Contract Administrator.

### E60.4 Equipment and Personnel

- E60.4.1 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.
- E60.4.2 The PDA testing equipment shall conform to the requirement of ASTM D-4945-12, “Standard Test Method for High Strain Dynamic Testing of Deep Foundations”. An engineer with documented experience shall operate the Pile Driving Analyzer in the field. A Geotechnical Engineer registered to practice in the Province of Manitoba with at least five years related experience shall carry out the analysis of the PDA data and seal the engineering reports.
- E60.4.3 The Contractor shall provide the pile driving equipment, operators, labour 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.

### E60.5 Construction Methods

- E60.5.1 Execution
  - (a) Construction Access

- (i) Prior to lifting the pile to be dynamically tested, the Contractor shall provide a minimum of one (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.
- (ii) 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.
- (iii) The Contractor must take good care to ensure that no damage is done to the dynamic monitoring transducers, cables, or equipment.

#### E60.5.2

#### Testing Procedures

##### (a) Preconstruction Wave Equation Analyses

- (i) 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.
- (ii) 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.
  - ◆ Maximum allowable driving stresses (tension and compression) for Steel Piles:=  $0.90 f_y$
- (iii) 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 20 blows per 25 mm) or driving stresses exceed the maximum allowable limits.

##### (b) Dynamic Testing Program

- (i) 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 seven (7) days, to evaluate the setup effect on pile capacity. The recommended setup waiting period will be determined from this testing program.
- (ii) The re-strike driving sequence shall be performed with a warmed up hammer and shall consist of striking the piles for about 10 blows to 20 blows or until the pile penetrates an additional 50 mm, whichever occurs first.
- (iii) 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.

##### (c) Dynamic Testing Reports

- (i) Within one (1) 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.
- (ii) The Dynamic Testing Consultant shall prepare and submit a written report not later than seven (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 a Geotechnical Engineer registered in Manitoba with at least five (5) years related experience.
- (iii) The Contract Administrator may request additional analyses at selected pile penetration depths.

#### E60.6 Measurement and Payment

- E60.6.1 The Works in this section shall not be measured and it will be paid for as the Contract Lump Sum Price for the "Pile Dynamic Analyser (PDA) Testing", 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 and accepted by the Contract Administrator.

### E61. **STRUCTURAL CONCRETE**

#### E61.1 Description

##### E61.1.1 General

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

##### E61.1.2 Scope of Work

- (a) Supplying and placing structural concrete for the abutments, including foundation, backwall, and wingwalls;
- (b) Supplying and placing concrete for Rock-Socketed Caissons;
- (c) Supplying and placing structural concrete for the pier caps;
- (d) Supplying and placing structural concrete for the deck including trainman's walkways;
- (e) Supplying and placing structural concrete for the shoulder and median traffic barriers, their footing slabs and cap slabs (not including roadway shoulder slabs);
- (f) Supplying and placing structural concrete for the slope protection paving;
- (g) Supplying and placing structural concrete for the Pumping Station;
- (h) Supplying and placing masonry fill;
- (i) Quality control tests of all concrete supplied.

#### E61.2 Submittals

E61.2.1 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, sequence of operations and materials to be used.

E61.2.2 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](http://www.mrmca.com)). In addition, the mix design statement must indicate the expected method of placement (buggies, chute, or pump) and 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 and may be used as information related to supplementary testing and investigation of suspected defective concrete. The City of Winnipeg will advise the Supplier if the information needs to be released to third parties. 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;
  - (viii) quantity of other admixtures;
  - (ix) certification that all concrete constituents are compatible; and
  - (x) certification that the concrete mix(es) will meet the specified concrete performance criteria requirements.
- (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 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.

E61.2.3 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-S6-14, 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 A23.2-17A.
  - (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.



- (xi) 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.
  - (xii) All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.
  - (xiii) 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.
  - (xiv) 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. False work 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 false work, 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.

E61.2.6 Screed for Deck Slab Concrete

- (a) Plans for anchoring support rails shall be submitted to the Contract Administrator for review and acceptance at least fourteen (14) 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.

E61.2.7 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 fourteen (14) 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 fourteen (14) Days prior to scheduled commencement of concrete placement, the proposed concrete placement schedule for all other structural concrete placements of this Specification.

E61.2.8 Temperature Management Plan

- (a) Provide the Contract Administrator with a Temperature Management Plan for all mass concrete at least twenty (20) Business Days prior to the scheduled commencement of concrete placement.
- (b) Mass concrete is defined as all structural concrete with a minimum thickness of 1m or more.
- (c) 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.

- (d) 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.

**E61.3 Materials**

**E61.3.1 General**

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

**E61.3.2 Handling and Storage of Materials**

- (a) Storage of materials shall be in accordance with CSA Standard CAN/CSA-A23.1.

**E61.3.3 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 61 – 1.

<b>TABLE 61 – 1: REQUIREMENTS FOR HARDENED CONCRETE</b>							
<b>Type of Concrete</b>	<b>Location</b>	<b>Nominal Compressive Strength [MPa]</b>	<b>Class of Exposure</b>	<b>Air Content Category</b>	<b>Max Aggregate Size</b>	<b>Special Requirements</b>	<b>Post Residual Cracking Index</b>
Type 1	Foundations	35 @ 28 Days	S-1	1	20 mm	No slag and/or fly ash	-
Type 2	Caissons	35 @ 28 Days	S-1, C1	1	20 mm	No slag and/or fly ash	-
Type 3	Abutments	35 @ 28 Days	S-1	1	20 mm	No slag and/or fly ash	-
Type 4	Pier Caps, Deck, Trainman's Walkway	35 @ 28 Days	C-1	1	20 mm	No slag and/or fly ash	-
Type 5	Traffic Barriers including Footing and Caps, Slope Paving	35 @ 28 Days	C-1	1	20 mm	Corrosion Inhibitor and Synthetic Fibres	0.15
Type 5	Structural Concrete for Pumping Station	35 @ 28 Days	S-1, C-11	1	20 mm		-
Type 6	Masonry Fill	20 @ 28 Days	N	-	10mm	Max Slump 150mm	-

**E61.3.4 Working Base Concrete**

- (a) Working base concrete shall be placed in the locations as shown on the Drawings.
- (i) Working base concrete shall be concrete meeting the requirements of CAN/CSA A23.1 with minimum nominal compressive strength (f'c) of 20 MPa at 28 days.

**E61.3.5 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. Current (less than 18 months old) test data evaluating the potential alkali-silica reactivity of aggregates tested in accordance with CSA A23.2-14A or CSA A23.2-25A is required.
  - (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, Table 10, FA1, be graded uniformly and not more than three percent (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, Table 12.
- (c) Coarse Aggregate - Standard
- (i) The maximum nominal size of coarse aggregate shall be 20 mm and meet the grading requirements of CSA A23.1, Table 11, Group I. Coarse aggregate shall be uniformly graded and not more than two percent (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 three percent (3%).
  - (ii) The aggregate retained on the 5 mm sieve shall consist of clean, hard, tough, durable, angular particles with a rough surface texture, and shall be free from organic material, adherent coatings of clay, clay balls, an excess of thin particles or any other extraneous material.
  - (iii) Course aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than thirty percent (30%).
  - (iv) Tests of the coarse aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1, Table 12, for concrete exposed to freezing and thawing.
  - (v) Blast furnace slag coarse aggregate will not be permitted.

#### E61.3.6

##### 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.

#### E61.3.7

##### Cementitious Materials

- (a) Cementitious materials shall conform to the requirements of CSA-A3001 and shall be free from lumps. Normal Portland cement types GU or GUB, or sulphate resistant types HS or HSb shall be supplied unless otherwise specified on the Drawings.
- (b) Should the Contractor choose to include a silica fume admixture in the concrete mix design, where permitted, the substitution of silica fume shall not exceed eight percent (8%) by mass of cement.
- (c) Should the Contractor choose to include fly ash in the concrete mix design, when permitted, the fly ash shall be Class C1 or F and the substitution shall not exceed thirty percent (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.

E61.3.8 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 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.

E61.3.9 Corrosion Inhibitor

- (a) Corrosion inhibitor shall be MCI 2005 NS, or equal as accepted by the Contract Administrator, in accordance with B8. Dosage shall be 1 L/m<sup>3</sup>.

E61.3.10 Synthetic Fibres

- (a) The synthetic fibres shall consist of one hundred percent (100%) virgin polypropylene or one hundred percent (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-S6-14, Fibre-Reinforced Structures, Clause 16.6 except the post-cracking residual strength index (Ri) shall be determined in accordance with ASTM C1609.

E61.3.11 Formwork

- (a) Formwork materials shall conform to CSA Standard A23.1, 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 O121-08, 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 O121-08. 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 false work is not acceptable and shall not be used by the Contractor unless specifically shown on the Drawings.

E61.3.12 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 B8.

E61.3.13 Permeable Formwork Liner

- (a) Formwork liner shall be Texel Drainform, Hydroform, or equal as accepted by the Contract Administrator, in accordance with B8. 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. A permeable formwork liner shall be installed at the following formed concrete surfaces:
  - (i) exposed vertical and sloping surfaces of the bridge deck and trainman's walkways;
  - (ii) exposed vertical and sloping surfaces of abutment walls and curbs; and,
  - (iii) exposed vertical and sloping surfaces of pier cap.

E61.3.14 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.

E61.3.15 Curing Compound

- (a) Curing compounds shall be liquid membrane-forming and conform to the requirements of ASTM Standard C309-11.
- (b) Curing Compound shall be WR Meadows 1215 WHITE Pigmented, or equal as accepted by the Contract Administrator, in accordance with B8.

E61.3.16 Curing Blankets

- (a) Curing blankets for wet curing shall be one hundred percent (100%)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 B8.

E61.3.17 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 B8. 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 twenty-eight (28) days in ago.
- (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.

- E61.3.18      Epoxy Adhesive
- (a) Epoxy adhesive for bonding concrete to steel shall be one of the following approved products: Sternson ST432 or ST433, Dural Duralbond, Capper Capbond E, Sikadur 32 Hi-bond, Concessive 1001 LPL, Meadows Rezi-Weld 1000, or equal as accepted by the Contract Administrator, in accordance with B8.
- E61.3.19      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 B8.
- E61.3.20      Cementitious Grout
- (a) Cementitious grout shall be nonshrink and nonmetallic. 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 B8. The minimum compressive strength of the grout at 28 days shall be 40 MPa.
- E61.3.21      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.
- E61.3.22      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 B8.
- E61.3.23      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 D1751-04(2013)e1 or equal as accepted by the Contract Administrator, in accordance with B8.
- E61.3.24      Precompressed Foam Joint Filler
- (a) Precompressed expanding filler shall be compressed to twenty percent (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.
- E61.3.25      EMSEAL Expansion Joint Seal
- (a) Expansion joint seal shall be EMSEAL BEJS or equivalent as approved by the Contract Administrator to ASTM C711 and ASTM G155-00A in accordance with B8.
- (i) Sealant system shall be comprised of three components:
- ◆ cellular polyurethane foam impregnated with hydrophobic one hundred percent (100%) acrylic, water-based emulsion, factory coated with highway-grade, fuel resistant silicone;
  - ◆ field-applied epoxy adhesive primer; and,
  - ◆ field-injected silicone sealant bands.



- (ii) Impregnation agent to have proven non-migratory characteristics. Silicone coating to be highway-grade, low-modulus, fuel resistant silicone applied to the impregnated foam sealant at a width greater than maximum allowable joint extension and which when cured and compressed will form a bellows. Depth of seal as recommended by manufacturer. BEJS foam seal to be installed into manufacturer's standard field-applied epoxy adhesive. The BEJS SYSTEM is to be installed recessed from the surface such that when the field-applied injection band of silicone is installed between the substrates and the foam-and-silicone-bellows, the system will be ½" (12 mm) down from the substrate surface.
  - (iii) Material shall be capable, as a dual seal, of movements of +50% to -50% (100% total) of nominal material size. Changes in plane and direction shall be executed using factory fabricated "Universal 90" transition assemblies. Transitions shall be warranted to be watertight at inside and outside corners through the full movement capabilities of the product.
  - (iv) All substitute candidates to be certified in writing to be free in composition of any waxes or asphalts, wax compounds or asphalt compounds. All substitute candidates shall be certified in writing to be:
    - ◆ capable of withstanding 65°C for three (3) hours while compressed down to the minimum of movement capability dimension of the basis of design product (-50% of normal material size) without evidence of any bleeding of impregnation medium from the material; and,
    - ◆ that the same material after the heat stability test will self-expand to the maximum of movement capability dimension of the basis-of-design product (+50% of nominal material size) within twenty-four (24) hours at room temperature 20°C.
- (b) No separate measurement or payment will be made for the Work described in this Section as it is considered incidental to the Contract Unit Prices "Supply and Place Structural Concrete (Deck and Trainman's Walkways).

E61.3.26 Extruded Polystyrene Foam

- (a) Supply and install extruded polystyrene foam (also known as Styrofoam™) to the thicknesses and extents as shown on the Drawings. Extruded polystyrene foam shall be Styrofoam™ Brand Cladmater™ or equivalents as approved by the Contract Administrator in accordance with B8.
- (b) Low density Styrofoam shall be the type accepted by the Contract Administrator, in accordance with B8.
- (c) High density Styrofoam shall be expanded polystyrene with a minimum compressive stress of 207 kPa at ten percent (10%) deformation.

E61.3.27 Low density EVA Foam

- (a) Low density ethylene vinyl acetate (EVA) foam shall be supplied and installed to the thicknesses and extents shown on the Drawings. Maximum density of EVA foam shall be 30 kg/m<sup>3</sup>. EVA foam shall be of type approved by the Contract Administrator.
- (b) Alternatively, low density polyethylene foam may be substituted for EVA foam. The maximum density of polyethylene foam shall be 30 kg.m<sup>3</sup>. Low density polyethylene foam shall be Ethafoam™ 180 by Dow Chemical Company, or equivalent as approved by the Contract Administrator in accordance with B8.

E61.3.28 Backup rod

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

E61.3.29 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 B8.
- (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 B8.

E61.3.30 Stainless Steel Dowels

- (a) Traffic barrier dowels shall conform to the requirements of ASTM A 955/A 955M Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement, as specified in E62.4.5.
- (b) The dowels shall be fabricated to the details shown on the Drawings.

E61.3.31 Stainless Steel Drip Plate

- (a) Pier stainless steel drip plates shall conform to the requirements of ASTM A 276/A 276M Standard Specification for Standard Stainless Steel Bars and Shapes, Type 304L.
- (b) The drip plates shall be fabricated to the details shown on the Drawings.
- (c) The supply and installation of drip plates shall be considered incidental to the placement of structural concrete, and no separate measurement or payment shall be made for this Work.

E61.3.32 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 Bakelit/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 B8.
- (b) 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 B8.
- (c) All damaged concrete, including tie holes to be filled with non-shrink grout prior to application of dampproofing.

E61.3.33 Waterstop

- (a) The waterstop, as indicated on the Drawings, shall be PVC waterstop conforming to CGSB 41-6P-35M polyvinyl chloride, edges wire looped for tying, or as accepted by the Contract Administrator, in accordance with B8.
- (b) Install PVC waterstop in all joints in a continuous manner as show on the Drawings. Install waterstop continuous without displacing reinforcement. But weld splices to manufacturer's directions. Secure in place to prevent dislodgement during placing of concrete.
- (c) Tie the waterstop adequately for support in accordance with manufacturer's instruction, but at spacing no greater than 300 mm to ensure proper embedment and to prevent displacement during concrete placement.
- (d) No separate measurement or payment will be made for the waterstop as it is considered incidental to the Contract Unit Price for "Supply and Place Structural Concrete (Deck and Trainman's Walkways).

E61.3.34 Prefabricated Drainage Sheet

- (a) Prefabricated drainage sheet shall be Nilex ND50 or an equivalent as accepted by the Contract Administrator, in accordance with B8.

E61.3.35 Miscellaneous Materials

- (a) Miscellaneous materials shall be of the type specified on the Drawings or as accepted by the Contract Administrator, in accordance with B8.

E61.3.36 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.

E61.4 Equipment

E61.4.1 General

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

E61.4.2 Vibrators

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

E61.4.3 Placing and Finishing Equipment for Bridge Deck Concrete

(a) Placing Equipment

- (i) Adjacent exposed reinforcing steel shall be adequately protected during concrete placement.

(b) Screed

- (i) The Contractor shall use a mechanical screed to strike the surface of the superstructure concrete.
- (ii) The screed shall be constructed to span the full out-to-out width of the bridge deck for concrete placement in one continuous operation.
- (iii) 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.
- (iv) 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; the Contract Administrator may require positive anchorage. A hold-down device shot into concrete will not be permitted, unless the concrete is to be subsequently resurfaced.
- (v) The mechanical screed on guides or rails shall be supported so that they are completely clear of the finished surface.
- (vi) Internal vibration of the concrete will be required with mechanical screeding. Care shall be taken not to overwork the concrete surface.
- (vii) 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.
- (viii) Screed surface touching concrete shall not be made of aluminum (magnesium acceptable).

- (ix) 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 structural deck concrete.
- (iii) The Contractor shall install a sturdy walkway with safety railing on each side of the Work area for 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.

(d) Moveable Deck Hoarding

- (i) 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.
- (ii) The rail system for the movable deck hoarding can be the same rail system used for the screed and the Work Bridges, subject to the approval of the Contract Administrator.
- (iii) 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.
- (iv) The hoarding shall not be removed from overtop of a newly completed structural deck without first obtaining permission from the Contract Administrator.

E61.5 Construction Methods

E61.5.1 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 C309-11 for the texture of concrete the curing compound is being applied to.

E61.5.2 Temporary False Work, Formwork, and Shoring

(a) Construction Requirements

- (i) The Contractor shall construct false work, formwork and shoring 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 false work, 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.
- (iv) 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.
- (v) 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.

- (vi) 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.
  - (vii) Shores shall be provided with positive means of adjustment (jacks or wedges). All settlement shall be taken up before or during concreting as required.
  - (viii) 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.
  - (ix) 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.
  - (x) All exposed edges shall be chamfered 20 mm unless otherwise noted on the Drawings.
  - (xi) 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.
  - (xii) 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 matching colour of surrounding concrete.
  - (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 their 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 they propose for reuse and shall strip them after forty-eight (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.

#### E61.5.3 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, E61.5.13 for the requirements to prepare the hardened concrete at a construction joint for receiving new concrete.

#### E61.5.4 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 will 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.

#### E61.5.5 Concrete Bridge Trainman's Walkways Joints

- (a) For the joint sealing at all locations, the contractor shall submit Shop Drawings and their proposed installation procedures to the Contract Administrator for approval fourteen (14) days prior to installation.
- (b) The installation of the fibre joint filler and the EMSEAL joint sealing shall be undertaken as shown on the Drawings.
- (c) EMSEAL joint seals shall not be field spliced except when specifically permitted by the Contract Administrator in writing.
- (d) 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.
- (e) The EMSEAL joint sealing at the walkway joints shall be installed as per the Manufacturer's recommendations.
- (f) All joint sealing of trainman's walkway joints shall take place prior to the installation of the deck waterproofing.
- (g) 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.

#### E61.5.6 Anchor Units for Trainman's Walkway Railing 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.

E61.5.7 Permeable Formwork Liner

- (a) Permeable formwork liner shall be used on all exposed formed surfaces, except on soffit surfaces, Pumping Station walls, or surfaces where a normal or 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.

E61.5.8 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.

E61.5.9 Control Joint Seals

- (a) Formed control joints sealant for all horizontal, vertical and sloping joints shall be applied in strict accordance with the details shown on the Drawings and the Manufacturer's instructions including appropriate primers if recommended.
- (b) Form control joints shall be thoroughly cleaned before sealing.

E61.5.10 Benchmarks

- (a) The Contractor shall install benchmark plugs supplied by the City at such locations on the structure as may be directed by the Contract Administrator.

E61.5.11 Structure Identification Date

- (a) The Contractor shall indent into the exposed concrete a structure identification date at such location at the bridge abutments as shown on the Drawings, in accordance with the detail shown on the Drawings, or as otherwise directed by the Contract Administrator.

E61.5.12 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, 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 E61 - 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 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 Contract Administrator 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 their facilities and Plant in order to complete the proposed placement; and,
  - ◆ in the case of continuous placing, provide additional crews and have adequate lighting to provide for proper placing, finishing, curing and inspecting.
- (ii) The Contractor shall adhere strictly to the concrete placement schedule, as approved by the Contract Administrator.

E61.5.13 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; and,
- (iv) for the trainman's walkways, during concreting of the deck slab, the top surface of the concrete shall be roughened using a small rake running longitudinally between barrier dowels.

#### E61.5.14 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  $0.75 \text{ kg/m}^2/\text{h}$ . 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 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.

#### E61.5.15 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 judgment 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, Pumping Station walls, and 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 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.
  - (v) The top surface of the sidewalk slab, bridge, backwall adjacent to trainman's walkway, access slab to the Pumping Station, and intermediate floor slab in the Pumping Station shall be given a broom finish. Upon completion of finishing operations, and when excessive moisture has evaporated, the plastic surface of the concrete shall be given a textured finish by means of broom finishing with a steel or fibre broom of a type accepted by the Contract Administrator at right angles to the direction of traffic. Surface depressions introduced by the broom strands in the brooming operations shall not be more than 3 mm deep.
- (d) Type 3 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 E61.3.17(b), E61.3.21, and E61.5.18.
  - (ii) All surfaces below 300 mm below finish grade shall receive dampproofing in accordance with E61.3.32 of this Specification.
- (e) 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.

#### E61.5.16 General Curing Requirements

- (a) Refer to E61.5.19 for cold weather curing requirements and E61.5.21 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, an asphalt overlay, or coating.
- (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 C156 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 twenty-four (24) hours. Concrete shall be protected from freezing until at least twenty-four (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 3°C in one hour or 20°C in twenty-four (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.
- (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 E61.5.16(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.

#### E61.5.17 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 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 before forms are constructed and concrete is placed for trainman's walkways. 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 trainman's walkways.
- (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.

#### E61.5.18 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 twenty-four (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.

#### E61.5.19 Cold Weather Concreting

##### (a) General

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

#### E61.5.20 Hot Weather Concreting

- (a) The requirements of this section shall be applied during hot weather, i.e., air temperatures forecast to go higher than 27°C during placing.
- (b) 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.
- (c) 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.
- (d) 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.
- (e) Sun shades and wind breaks shall be used as required during placing and finishing.
- (f) Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".
- (g) 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.
- (h) Hot weather curing shall follow immediately after the finishing operation.

#### E61.5.21 Hot-Weather Curing

- (a) 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
- (b) 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.

#### E61.5.22 Job Preparation

- (a) 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.

E61.5.23 Concrete Temperature

- (a) 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 E61 - 2, "Acceptable Concrete Temperature", for the indicated size of the concrete section.

<b>TABLE E61 - 2: ACCEPTABLE CONCRETE TEMPERATURES</b>		
<b>THICKNESS OF SECTION, M</b>	<b>TEMPERATURES °C</b>	
	<b>MINIMUM</b>	<b>MAXIMUM</b>
Less than:		
1	10	27
1.2	5	25

E61.5.24 Cleanup

- (a) The Contractor shall cleanup equipment and construction debris on at least a daily basis to the satisfaction of the Contract Administrator.
- (b) Access
  - (i) 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 their inspector for testing purposes as required. There will be no charge to the City for samples taken.

E61.6 Quality Control and Quality Assurance

E61.6.1 General

- (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 or by the Quality Assurance Testing Laboratory designated 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.
- (c) The Contract Administrator reserves the right to reject any materials or Works, which are not in accordance with the requirements of this Specification.
- (d) Quality Control testing shall be undertaken by the Contractor. Quality Assurance testing shall be undertaken by the Contract Administrator.
- (e) 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
- (f) 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.
- (g) All materials shall conform to CSA Standard A23.1.
- (h) All testing of materials shall conform to CSA Standard A23.2.

- (i) 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 their own expense.
- (j) 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.
- (k) Quality Assurance and control tests will be used to determine the acceptability of the concrete supplied by the Contractor.
- (l) 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.
- (m) The frequency and number of concrete Quality Control tests shall be in accordance with the requirements of CSA Standard A23.1. An outline of the quality tests is indicated below.
- (n) The Contract Administrator will undertake a cover meter survey of the top of bridge deck and exposed face of the traffic barriers. Concrete areas with cover not within the specified tolerances will be rejected.

#### E61.6.2

##### Concrete Testing

- (a) Slump tests shall be made in accordance with CSA Standard Test Method A23.2-5C, "Slump of Concrete". If the measured slump falls outside the limits described in E61.2.2 a second test shall be made. In the event of a second failure, the Contract Administrator reserves the right to refuse the use of the batch of concrete represented.
- (b) Air content determinations shall be made in accordance with CSA Standard Test Method A23.2-4C, "Air Content of Plastic Concrete by the Pressure Method". If the measured air content falls outside the limits in E61.2.2 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, 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 conducted at the Contractor's expense 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 (P<sub>cr</sub>), 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 (P<sub>pcr</sub>). Specimens shall be sampled in accordance

with E61.6.2(f). Testing shall include the specified number of specimens from sub-structure concrete, traffic barrier concrete and deck slab concrete for a total of four (4) complete tests. The Contractor shall promptly submit a summary of the test results to the Contract Administrator upon the conclusion of each test.

- (f) Samples of concrete for test specimens shall be taken in accordance with CSA Standard Test Method CSA-A23.2-1C, "Sampling Plastic Concrete".
- (g) Test specimens shall be made and cured in accordance with CSA Standard Test Method A23.2-3C, "Making and Curing Concrete Compression and Flexure Test Specimens".
- (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, "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 E61 -1 of this Specification and also to check the adequacy of curing and/or cold weather protection. At least two (2) field-cured test specimens shall be taken to verify strength of the in-place concrete. For each field-cured strength test, the strength of field-cured test specimens shall be determined in accordance with CSA Standard Test Method A23.2-9C, "Compressive Strength of Cylindrical Concrete Specimens", and the test result shall be the strength of the specimen.

### E61.6.3 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 their 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.

## E61.7 Measurement and Payment

### E61.7.1 Structural Concrete

- (a) Supplying and placing structural concrete will not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for the "Items of Work" listed here below, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, and accepted by the Contract Administrator.
- (b) Items of Work:
  - (i) Supply and Place Structural Concrete:
    - ◆ Abutments;
    - ◆ Pier Caps;
    - ◆ Deck and Trainman's Walkways;
    - ◆ Shoulder and Median Traffic Barriers;
    - ◆ Slope Protection Paving



- (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.
- (d) Supplying and placing of structural concrete for the Pumping Station sub-structure and Pumping Station masonry fill will be paid for in accordance with E99.
- (e) Supplying and placing of structural concrete for the Rock-Socketed Caissons will be measured and paid for in accordance with E58.

E61.7.2 Moveable Deck Hoarding

- (a) Supplying, setting up, operating, and removing of the moveable deck hoarding will not be measured and will be paid for at the Contract Lump Sum Price for "Supply and Install Moveable Hoarding for Deck Concrete", 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 and accepted by the Contract Administrator.

E61.7.3 Heating Concrete

- (a) Heating of concrete will be measured on a volume basis. The volume of heating concrete to be paid for will be the total number of cubic metres computed from the neat lines on the Drawing. Heating concrete materials and maintaining the temperature of the deposited concrete will be paid for at the Contract Unit Price per cubic metre for "Heating Concrete", 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.
- (b) If the prevailing temperature at the time of mixing and placing concrete is such that all heating operations are not considered necessary by the Contract Administrator, the Contractor will be instructed in writing to carry out heating in part only. Partial heating will be paid for at a percentage of the Contract Unit Price per cubic metre for "Heating Concrete", measured as specified herein.
- (c) These percentages shall be as follows:
  - (i) heating water ten percent (10%);
  - (ii) heating aggregates thirty percent (30%); and,
  - (iii) housing and heating deposited concrete sixty percent (60%).

E62. **SUPPLYING AND PLACING REINFORCING STEEL**

E62.1 Description

E62.1.1 General

- (a) This Specification shall cover all operations relating to the supply, fabrication, delivery, and placement of black steel reinforcing, hot-dipped galvanized steel reinforcing, ChromX 9000 (by MMFX) and stainless steel reinforcing, and associated bar accessories, as specified herein and as shown on the Drawings.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified.

E62.1.2 Scope of Work

- (a) The Work under this Specification shall involve supplying and placing all steel reinforcing, as shown on the Drawings for the following Works:

<b>Table 62 – 1: SCOPE OF WORK</b>	
<b>Item</b>	<b>Type of Steel Reinforcing</b>
Abutments	Black Steel Reinforcement
Caissons	Hot-dipped Galvanized Steel Reinforcement
Pier Caps	Hot-dipped Galvanized Steel Reinforcement
Deck and Trainman’s Walkways	ChromX 9000 (by MMFX)
Traffic Barriers	Stainless Steel Reinforcement
Shoulder Traffic Barrier Footings and Cap Slabs	Stainless Steel Reinforcement
Median Traffic Barrier Footing	Stainless Steel Reinforcement
Slope Protection Pavement	Hot-dipped Galvanized Steel Reinforcement
Pumping Station Caissons	Black Steel Reinforcement
Pumping Station Substructure and Curbs	Black Steel Reinforcement

**E62.2 References**

E62.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) ASTM A1035– Standard Specifications for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement;
- (b) ASTM A955M – Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcing;
- (c) ASTM A615M – Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement;
- (d) ASTM A143 – Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement;
- (e) ASTM A780/A780M – Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings;
- (f) ASTM A767/A767M – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement;
- (g) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete;
- (h) CAN/CSA G30.18-M92 – Billet Steel Bars for Concrete Reinforcement;
- (i) ACI 315R – Manual of Engineering and Placing Drawings for Reinforced Concrete Structures; and,
- (j) Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.

**E62.3 Submittals**

**E62.3.1 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 twenty (20) Business Days prior to the scheduled commencement of any fabrication, the qualifications of the Contractor, and the qualifications of Operators, the Shop Drawings including bar lists and the mill certificates.

- (c) The Contractor shall submit to the Contract Administrator for review, at least fourteen (14) Days prior to the commencement of any Work on Site, a QC testing program **for galvanized reinforcing** including the following minimum requirements:
  - (i) a Certificate of Compliance from the Manufacturer stating that the galvanizing coatings meet or exceed the requirements of ASTM A767M;
  - (ii) reinforcing bending practices, in accordance with ASTM 767M;
  - (iii) galvanizing coating thickness measurements, in accordance with ASTM 767M;
  - (iv) temperature requirements, in accordance with E62.5.1(d)(vi);
  - (v) visual inspection criteria for hot-dip galvanizing, including confirmation of limited to no bare spots, blisters, flux, inclusions, dross, or excess zinc material;
  - (vi) repair works, in accordance with ASTM A780M;
  - (vii) confirmation of embrittlement protection, including bend tests in accordance with ASTM A143M, complete with photo documentation; and
  - (viii) summary reporting for each shipment of reinforcing.
- (d) The Contractor shall submit to the Contract Administrator for review, at least fourteen (14) Days prior to the commencement of any Work on Site a Certificate of Compliance from the Manufacturer stating that the stainless steel materials supplied comply with the provisions of ASTM A955M and these Specifications, including corrosion resistance.
- (e) Contractor shall submit all original mill certificates to the Contract Administrator prior to placement of reinforcing on site.
- (f) Contractor to submit Quality Control Testing Program to the Contract Administrator in accordance with E62.5.1(d)(vii).
- (g) Contractor shall submit Shop Drawings (including bar lists) in accordance with section E4 and the latest edition of the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada (RSIC).

## E62.4 Materials

### E62.4.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- (b) Storage of materials shall be in accordance with the requirements of CSA Standard CAN/CSA-A23.1, Storage of Materials, except as otherwise specified herein.
- (c) Bundles of reinforcing steel shall be identified by tags containing bar marks.
- (d) The reinforcing steel shall not be placed directly on the ground. Sufficient timber pallets or blocking shall be placed under the reinforcing steel to keep them free from dirt and mud
- (e) 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
- (f) All reinforcing steel provided for the concrete Works 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 G30.18-09

### E62.4.2 Handling and Storage of Stainless Steel Reinforcing

- (a) Stainless steel reinforcing shall be store separately from other reinforcing steel with the bar tags maintained and clearly visible until placing operations commence. Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.

- (b) Chains for steel bands used for shipping shall not be in direct contact with stainless steel reinforcing. Wood or approved alternate should be used to protect the bars
- (c) Nylon or polypropylene slings shall be used for moving stainless steel reinforcing.
- (d) Keep carbon steel tools, chains, slings, etc. off stainless steel reinforcing.

E62.4.3 Plain and Galvanized Steel Reinforcing

- (a) Plain and Galvanized Steel reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) All plain and galvanized steel reinforcing shall conform to the requirements of CSA Standard CAN/CSA G30.18-09, Grade 400W, Billet-Steel Bars for Concrete Reinforcement

E62.4.4 Plain and Galvanized Steel Reinforcing

- (a) Plain and Galvanized Steel reinforcing steel shall be deemed to include all reinforcing bars, tie-bars, and dowels.
- (b) All plain and galvanized steel reinforcing shall conform to the requirements of CSA Standard CAN/CSA G30.18-09, Grade 400W, Billet-Steel Bars for Concrete Reinforcement.

E62.4.5 Stainless Steel Reinforcing

- (a) Stainless steel, as shown on the Drawings, shall be a high-manganese, low-nickel, nitrogen-strengthened austenitic stainless steel. Stainless steel reinforcing shall meet or exceed the minimum requirements of ASTM A955M, 300 Series, minimum Grade 420, of the Types listed below in Table 62 - 2, "Type of Stainless Steel Reinforcing".
- (b) The reinforcement deformations shall conform to the requirements of ASTM A615.
- (c) The stainless steel reinforcement shall be mechanically or chemically descaled prior to fabrication, leaving a totally passive stainless steel finish free of millscale, slag or oxidation.
- (d) Iron contamination shall be removed with picking paste or by wire brushing. Wire brush cleaning shall be done with stainless steel brushes only.
- (e) All hooks and bends shall be bent using pin diameters and dimension recommended by Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice.

<b>TABLE 62 - 2 TYPE OF STAINLESS STEEL REINFORCING</b>		
<b>Common or Trade Name</b>	<b>AISI Type</b>	<b>UNS Designation</b>
Type 316 LN	316 LN	S31653
Type 2205	Duplex 2205	S31803
Type 2304	EnduraMet 2304	S32304

E62.4.6 Low Carbon Chromium Reinforcing Steel (ChromX 9000)

- (a) All ChromX 9000 reinforced steel, as shown on the Drawings, shall conform to the requirements of ASTM A615 Grade 75 and ASTM Standard A1035/A1035M CS Grade 100 Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement.

E62.4.7 Galvanizing

- (a) Shop Applied
  - (i) The galvanizing shall be shop applied and strictly in accordance with CSA Standard G164 and ASTM A767M-16 to a retention equal to a Class II level (610 gm/m<sup>2</sup>), 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) Pre-clean reinforcing steel using acceptable methods to produce an acceptable surface for quality hot-dip galvanizing. If sulfuric acid or hydrochloric acid is used as a pickling bath for pre-cleaning, care shall be exercised to minimize the immersion time. If signs of hydrogen embrittlement are present after pickling due to excessive immersion time, all reinforcing in that shipment will be rejected and shall be replaced at no additional cost to this Contract.
  - (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 galvanized-coated with field applied galvanizing touch-up material as specified hereinafter.
- (b) Field Applied
- (i) Field applied galvanized coating shall be brush applied and be in accordance with ASTM A780M:
    - ◆ 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 in accordance with B8.
  - (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<sup>2</sup>. Any damaged article with a damaged area greater shall be rejected, removed, and replaced at the Contractor's expense.
  - (iv) At least seven (7) days prior to any field applied galvanizing, the Contractor shall submit the galvanizing product and application details to the Contract Administrator for review.
  - (v) Spray applied field galvanizing will not be permitted. Where restrictions occur that brush applied field galvanizing is not possible, spray applied field galvanizing may be permitted if accepted in writing by the Contract Administrator prior to application.
- (c) Galvanizing Touch-Up and Field-Applied Galvanizing
- (i) Field-applied galvanizing, to touch-up damaged hot-dip galvanizing, metalizing, or field welds, shall be done with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780/A780M-09 for "Repair of Damaged Hot-Dip Galvanized Coatings."
  - (ii) Approved products are:
    - ◆ Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California; and

- ◆ Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161 York Road, Kings Mountain, north Carolina. Locally, both products are available from Welder Supplies Limited, 25 McPhillips Street, Winnipeg.

#### E62.4.8 Bar Accessories

- (a) Bar accessories shall be of a type suitable for each type of reinforcing and a type acceptable to the Contract Administrator. They shall be made from a non-rusting material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete.
- (b) Bar chairs, bolsters, and bar supports shall be cementitious material. No plastic, PVC, or galvanized bar chairs will be used.
- (c) Placing of bar supports shall be done to meet the required construction loads.
- (d) Tie wire shall be the following:
  - (i) black, soft-annealed 1.6 mm diameter wire or Nylon coated wire for black steel reinforcing;
  - (ii) nylon coated wire or 1.6 mm galvanized coated wire for hot-dipped galvanized steel reinforcing; and,
  - (iii) stainless steel, fully annealed 1.6 mm diameter wire, Type 316 or 316L for stainless steel reinforcing.
- (e) 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 B8.
- (f) 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.
- (g) The supplying and installation of bar accessories shall be deemed to be incidental to the supplying and placing of reinforcing steel.

#### E62.5 Construction Methods

##### E62.5.1 Supply and Fabrication

- (a) General
  - (i) Reinforcing steel shall be fabricated in accordance with CSA Standard CAN/CSA G30.18-09 to the lengths and shapes as shown on the Drawings.
- (b) Plain, Galvanized Reinforcing Steel and ChromX 9000
  - (i) Plain, Galvanized and ChromX 9000 steel reinforcement shall be bent to the proper shape in a plant that has suitable devices for bending as recommended in the Reinforcing Steel Institute of Canada (RSIC) Manual at Standard Practice.
  - (ii) Heating shall not be used as an aid in bending.
- (c) Stainless Steel
  - (i) Stainless steel reinforcement shall be bent to the proper shape in a plant that has suitable devices for bending stainless steel as recommended in Reinforcing Steel Institute of Canada (RSIC) Manual of Standard Practice.
  - (ii) Heating shall not be used as an aid in bending.
  - (iii) The equipment used in the plant shall not cause any surface contamination or damage to the surface of the bars.
  - (iv) Stainless steel shall be tagged, indicating the mill and fabricator, stainless steel type and grade, and bar mark number including stainless designation.
- (d) Preparation of Galvanized Steel Reinforcing

- (i) The fabricator shall consult with the Contractor, 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.
- (ii) Remove all welding slag, splatter, anti-splatter compounds, and burrs prior to delivery for galvanizing.
- (iii) Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil, paint, and other deleterious material prior to fabrication.
- (iv) 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.
- (v) Hooks or bends should be smooth and not sharp. Bars are to be bent prior to galvanizing. Minimum bend diameters shall be provided in accordance with ASTM A767 latest edition and shall not be less than the following:

<b>Minimum Finished Bend Diameters for Galvanized Bars</b>	
<b>Bar No.</b>	<b>Bend Diameters (mm)</b>
10M	60
15M	90
20M	120
25M	200
30M	240
35M	280

- (vi) The reinforcing shall be a minimum of 10°C prior to bending and galvanizing operations, regardless of ambient temperatures in the plant. Where ambient temperatures fall below 10°C, bending and galvanizing in a facility that is not enclosed and temperature controlled will not be permitted.
  - (vii) The Contractor is responsible to ensure that accelerated strain-embrittlement does not occur during the manufacturing, bending practices and galvanizing of the reinforcing steel. At a minimum, the Contractor shall address the requirements of E62.3.1(c).
  - (viii) The Contractor shall submit to the Contract Administrator the following:
    - ◆ Reinforcing Supplier standards of practice for working of reinforcing steel. This shall include bending practices as per ASTM A767-latest edition and temperature requirements during fabrication (bending) of reinforcing. This is to be submitted with the Certificate of Compliance from the Manufacturer as specified in E62.4.7(a)(ii).
    - ◆ Contractor is to carry out a Quality Control Testing Program following the requirements as per ASTM A143/A143M-latest edition. This will include but is not limited to random bent bars to be tested after galvanizing, photos of items before and after testing, and a report submitted to the Contract Administrator for each trailer load received on-site. Testing criteria shall be submitted for review and approval to the Contract Administrator at least ten (10) Business days prior to manufacturing of reinforcing.
- (e) Handling and Storage
- (i) General
    - ◆ The Contractor shall handle and store the reinforcement in a manner that ensures it is not damaged or contaminated with dirt or other materials.
    - ◆ The reinforcement shall not be placed directly on the ground. Timber pallets, platforms, skids or other supports shall be placed under the reinforcement to keep it free from dirt and mud and to provide easy handling.
    - ◆ Prior to concrete placement, the Contractor and Contract Administrator shall inspect the reinforcement for surface damage.

(ii) Galvanized Steel Reinforcement

- ◆ All Galvanized steel reinforcement shall be clean and free from paint, oil, millscale and other 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 specified herein.

(iii) Stainless Steel Reinforcement

- ◆ Stainless steel reinforcing shall be store separately from other reinforcing steel with the bar tags maintained and clearly visible until placing operations commence. Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.
- ◆ Chains for steel bands used for shipping shall not be in direct contact with stainless steel reinforcing. Wood or approved alternate should be used to protect the bars.
- ◆ Nylon or polypropylene slings shall be used for moving stainless steel reinforcing.
- ◆ Keep carbon steel tools, chains, slings, etc. off stainless steel reinforcing.
- ◆ All stainless steel reinforcement shall be free of mud, oil and other contaminants that adversely affect bonding strength, and deposits of iron and non-stainless steel.
- ◆ Stainless steel reinforcing bars will be rejected if:
  - any area of contamination of the stainless steel by iron exceeds 100 mm in length;
  - two or more areas of iron contamination greater than 25 mm in length occur along the length of the bar; or
  - there are frequent small occurrences of rust contamination along the full length of the bar.
- ◆ If stainless steel reinforcing bars have been rejected due to excessive iron contamination, the Contractor may attempt to treat the bar to remove the contamination. This treatment can be accomplished by mechanical cleaning with a (stainless steel) wire brush, or by a polishing machine, or by chemical treatment (pickling). If the treatment(s) are not successful, the contaminated bar(s) shall be replaced at no cost to the City.
- ◆ If stainless steel reinforcing bars are mechanically damaged the bars will be rejected and the Contractor shall replace the rejected bars at no cost to the City. Any cuts into a bar, sharp tears or flattening of the deformations on the bars are all mechanical damage to the bars which will be cause for rejection.

(f) Placing and Fastening

(i) General

- ◆ The Contractor shall supply and place all necessary support accessories to ensure proper placement of reinforcement. All reinforcement shall be accurately placed in the positions shown on the Drawings and firmly tied and chaired before placing the concrete.
- ◆ Distances from the forms shall be maintained by means of stays, spacers, or other approved supports. Spacers and supports for holding reinforcement at the required location and ensuring the specified concrete cover over the reinforcement shall be made from precast concrete or non-rusting metal. Precast concrete supports of approved shape and dimensions, with compressive strengths equal to or exceeding the placed concrete, are acceptable.
- ◆ Any non-rusting metal chairs protruding through the surface of the hardened concrete shall be cut back at least 25 mm, and the holes filled. Non-rusting metal chairs shall not be used to support reinforcement on surfaces that are to be exposed. Where possible, this reinforcement is to be supported entirely from above.



- ◆ The use of pebbles, pieces of broken stone or brick, plastic, metal pipe, and wooden blocks, will not be permitted.
  - ◆ Immediately before placing, concrete reinforcement shall be free of all material that would reduce the bond to concrete.
- (ii) Placing Plain, Galvanized and ChromX 9000 Steel Reinforcing
- ◆ 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.
  - ◆ Place reinforcing bars to provide a clear space between the reinforcing bars as shown on the Drawings to accurately place preformed holes where necessary.
  - ◆ Reinforcing steel shall not be straightened or re-bent 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.
  - ◆ Following placement of galvanized-coated bars, all areas of damaged coating shall be repaired using approved touch-up coating material specified in E62.4.7(b).
  - ◆ Bars shall be tied at all intersections, except where spacing is less than 250 mm in each direction, when alternate intersections shall be tied. Welding or tack welding or reinforcing steel will not be allowed. Unless otherwise shown on the Drawings, the minimum distance between bars shall be 40 mm.
- (iii) Placing Stainless Steel Reinforcement
- ◆ Bars shall be tied at all intersections, except where spacing is less than 250 mm in each direction, when alternate intersections shall be tied.
  - ◆ All tools used for placing shall be stainless steel and shall not be contaminated with iron or non-stainless steel.
  - ◆ Welding or tack welding of stainless steel reinforcement will not be allowed. Unless otherwise shown on the Drawings, the minimum distance between bars shall be 40 mm.
- (g) Tying Reinforcement
- (i) Plain, Galvanized and ChromX 9000 Steel Reinforcement
- ◆ For lapping plain, galvanized and ChromX 9000 steel bars at the joints and intersection, an ample supply of annealed wire at least 1.5 mm in diameter shall be provided. Proper cutting pliers shall be used and the bending and tying of the wires done as neatly as possible.
  - ◆ Twisted ends of the tie wire shall be bent away from forms and surfaces so that they do not project into the concrete cover over the reinforcement.
- (ii) Stainless Steel Reinforcement
- ◆ For lapping stainless steel reinforcement at joints and intersections, an ample supply of stainless steel wire shall be provided. The wire shall not be contaminated with iron or non-stainless steel. Proper stainless steel cutting pliers shall be used and the bending and tying of the wires done as neatly as possible.
  - ◆ Twisted ends of the wire shall be bent away from forms and surfaces so that they do not project into the concrete cover over the reinforcement. All tools used shall be stainless steel and shall not be contaminated with iron or non-stainless steel.

(h) Splicing

(i) General

- ◆ Splices shall only be provided as shown on the Drawings. Splices other than as shown on the Drawings will not be permitted without the written approval of the Contract Administrator.
- ◆ Splices, where possible, shall be staggered.
- ◆ Welded splices will not be permitted.

(ii) Plain, Galvanized and ChromX 9000 Steel Reinforcing

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

(iii) Stainless Steel Reinforcement

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

E62.6 Quality Control

E62.6.1 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.
- (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.
- (c) The Contract Administrator reserves the right to reject any materials or Works which are not in accordance with the requirements of this Specification.

E62.6.2 Access

- (a) The Contract Administrator shall be allowed free 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.

E62.6.3 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.

E62.7 Measurement and Payment

E62.7.1 Supplying and Placing Reinforcing Steel

- (a) Supplying and Placing Reinforcing Steel shall be measured on a mass basis, as computed from the reviewed Shop Drawings.

- (b) Supplying and Placing Reinforcing Steel will be paid for at the Contract Unit Price per kilogram for the "Items of Work" listed here below, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.
- (c) Items of Work:
  - (i) Supplying Reinforcing Steel
    - ◆ Plain Steel Reinforcing
    - ◆ Galvanized Steel Reinforcing
    - ◆ Stainless Steel Reinforcing
    - ◆ ChromX 9000 Steel Reinforcing
  - (ii) Placing Reinforcing Steel
- (d) The measurement excludes the mass of bar accessories, which are incidental to the Works.
- (e) Supplying and Placing Reinforcing Steel for the Rock-Socketed Caissons will be measured and paid for in accordance with E58.
- (f) Supplying and placing Reinforcing Steel for the Pumping Station sub-structure and Pumping Station superstructure will be paid for in accordance with E99.

## **E63. SUPPLY AND INSTALLATION OF BEARINGS**

### **E63.1 Description**

E63.1.1 The Work shall consist of:

- (a) Supply, fabrication, delivery and installing bearings, top plate, , fasteners, anchor rods and their assemblies including grout pads (where applicable) as shown on the Drawings and in this Specification;
- (b) Quality control of materials and fabrication;
- (c) Metalizing and/or galvanizing of steel components (where applicable).

### **E63.2 References**

E63.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:

- (a) E64 Supply, Fabrication and Eelivery of Structural Steel for Bridge; and,
- (b) E70 Supply, Fabrication and Erection of Miscellaneous Metal.

### **E63.3 Submittals**

E63.3.1 The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:

- (a) detailed Shop Drawings for the bearings that are stamped, signed and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba in accordance with E4; and,
- (b) documentation of all Quality Control testing undertaken for bearings as specified herein.

### **E63.4 Materials and Equipment**

#### **E63.4.1 Supply and Fabrication**

- (a) Bearings shall be fabricated from new materials. Bearings shall be designed and fabricated in accordance with the latest edition of AREMA Chapter 15, Part 5.
- (b) Rubber bearing pads shall conform to AREMA. Chapter 15, Section 5, Clause 5.6.2.1 meeting the requirements of Table 15.5.5.

- (c) Elastomer shall be moulded natural rubber, AASHTO low temperature Grade 5 with a Shore A Hardness of 60 and a shear modulus (G) between 0.90 and 1.1 MPa.
- (d) Internal steel reinforcing plates for laminated bearings shall be rolled mild steel with a minimum yield strength of 300 MPa.
- (e) Steel for bearing miscellaneous metal shall be in accordance with latest edition of CAN/CSA G40.21, Grade 300W. This shall include top plates as detailed on the Drawings. Other components associated with the bearings shall be in accordance with this Specification and Bill of Miscellaneous Metal for Bearings as shown and detailed on the Drawings.
- (f) The internal steel plates shall be sand-blasted and cleaned of all surface coating rust, mill scale before bonding, shall be free of sharp edges and burrs, and shall have a minimum edge cover of 5mm of elastomer.
- (g) Welding procedures shall be such as to minimize distortion of the bearing components and to avoid damage to finished work or bonded materials. All welding shall conform to the requirements of CSA Standard W59-03 (R208).
- (h) The overall dimensions of the bearings shall be within a tolerance of +/- 3mm in plan and height. Fabrication tolerances for the elastomeric pads shall be in accordance with the latest version of AREMA.
- (i) Bearings shall be manufactured as a single unit.
- (j) Completed bearings shall have the supplier's name (or trademark) and a serial number indelibly marked thereon. The serial number shall be unique and such as to enable other bearings manufactured at the same time to be traced through the production control records should the need arise. Where practicable the serial number shall also be visible after installation of the bearing in the structure. Bearings shall be clearly marked with their position on site and direction of installation. Markings shall be clearly visible on all bearings to prevent mix-up on site. Information marked on the bearings must correspond with the information contained on the approved Shop Drawings for the bearings.

#### E63.4.2 Corrosion Protection

- (a) All exposed surfaces of the steel plates shall be zinc metalized. Surfaces to be metalized shall be blast cleaned in accordance with SSPC-SP5, "White Metal Blast Cleaning".
- (b) All non-sliding bearing surfaces shall be zinc metallized with a minimum coating of 0.25 mm in accordance with CSA Standard G189-1966 (R2003) "Sprayed Metallic Coatings for Atmospheric Corrosion Protection".
- (c) All edges of steel (bearing plates, etc.) to be metallized shall be slightly rounded in order that metallizing will adhere.

#### E63.4.3 Bearing Top Plates

- (a) Top plates and all required fittings shall be supplied and installed by the Contractor as shown on the Drawings
- (b) Steel for bearing top plates shall be in accordance with latest edition of CAN/CSA G40.21, Grade 300W.
- (c) All bearing top plates shall be hot-dip galvanized in accordance with ASTM A123 and CSA G164 to a minimum net retention of 610 g/m<sup>2</sup>

#### E63.4.4 Shear Stud Connectors

- (a) Shear stud connectors shall be supplied and installed by the Contractor as shown on the Drawings.
- (b) Shear stud connectors shall conform to the requirements of ASTM A108, Grades 1015, 1018 and 1020.

#### E63.4.5 Anchor Rods

- (a) Anchor rods shall be supplied and installed by the Contractor as shown on the Drawings.
- (b) Anchor rods shall conform to ASTM 955/A 955M "Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement", Type 316L, Grade 75.

E63.4.6 Anchor Rod Pipe Assemblies

- (a) Anchor rod pipe assemblies shall be supplied and installed by the Contractor as shown on the Drawings.
- (b) The assemblies shall conform to ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless" for pipes and CSA-G40.21-13 Grade 300W (A572 Grade 42) for plates.
- (c) Anchor rod pipe assemblies shall be hot dip galvanized in accordance with ASTM A123/A123M-15 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

E63.4.7 Grout

- (a) Grout pads and anchor bolt voids shall be SIKA 212 Flowable grout or approved equal in accordance with B8. Grout shall have a minimum 28 day compressive strength of 35 MPa.

E63.4.8 High Strength Bolts, Nuts and Washers

- (a) The requirements of the Specification for E64.4.3 shall apply.

E63.4.9 Welding Consumables

- (a) The requirements of the Specification for E64.4.5 shall apply.

E63.5 Construction Methods

E63.5.1 General

- (a) Any structural steel components that in the opinion of the Contract Administrator have been damaged or otherwise rendered useless by the improper handling by the Contractor shall be replaced by the Contractor at their own expense.
- (b) If the structural steel components are stored on site, the requirements of the Specification for E64.5.3 shall apply.

E63.5.2 Bearing Areas

- (a) Concrete coring and anchor rod placing
  - (i) The Contractor shall core holes and place anchor rods at the locations and in accordance with the details as shown on the Drawings. Holes for anchor rods shall be cored.
  - (ii) The Contractor shall predetermine the locations of existing steel bars prior to coring, using an effective reinforcing steel bar locator.
  - (iii) Anchor rod hole diameters shall be in accordance with the details as shown on the Drawings.
  - (iv) All holes shall be thoroughly cleaned prior to installation of grout and anchor rods.
  - (v) No additional payment or compensation will be made for this Item of Work as this is considered incidental to the Work included in this Specification and accepted by the Contract Administrator for the Contract Unit Price for supplying all materials and for performing all operations herein described and all other items incidental to Installation of Anchor Rods.

E63.5.3 Grout Pads

- (a) When shown on the Drawings or described in the Specification, the Contractor shall construct grout pads using SIKA 212 flowable grout or equivalent, accepted by the Contract Administrator in accordance with B8. Construction of grout pads shall be done by workers competent in this Work.
- (b) Grouts shall be packaged in waterproof containers with the production date and shelf life of the material shown. It shall be mixed, placed, and cured in strict accordance with the Manufacturer's recommendations.
- (c) The method of forming and pouring the grout shall be submitted to the Contract Administrator for review and approval prior to the work being undertaken. Dry-pack methods of constructing grout pads will not be accepted.
- (d) When the daily minimum air temperature or the temperature of the girders, bearings, or substructure concrete in the immediate area of the grouting falls below 5°C, or when there is a probability of it falling below 5°C within twenty-four (24) hours of grouting, the following provisions for cold weather grouting shall be implemented:
  - (i) before grouting, adequate preheat shall be provided to raise the temperature of the adjacent areas of the girders, bearings, and substructure concrete to at least 10°C;
  - (ii) temperature of the grout during placing shall be between 10°C and 25°C; and,
  - (iii) the grout pads (and girders where appropriate) shall be enclosed and kept at 15°C to 25°C for at least five days. The system of heating shall be designed to prevent excessive drying-out of the grout.

#### E63.5.4 Anchor Bolts

- (a) The Contractor shall remove all anchor bolt void forming materials prior to grouting. Any residues on the concrete surface, such as oils, grease, or other contaminants that can reduce bonding characteristics, shall be removed by sandblasting.
- (b) Anchor bolts shall be set accurately and grouted with non-shrink cement grout accepted by the Contract Administrator. All methods and materials for setting anchor bolts and building bearing pads shall be submitted to the Contract Administrator for review and acceptance. The location of the anchor bolts, in relation to the slotted holes in the expansion shoes, shall correspond with the temperature at the time of erection.

#### E63.5.5 Bearings

- (a) 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 Drawings and Specifications. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.
- (b) The Contractor shall accurately assemble and install the bearings as specified on the Drawings and as directed by the Contract Administrator.
- (c) Bearing centrelines shall be within +/-3mm of their correct positions after installation. Threaded fixings shall be tightened uniformly to avoid overstressing any part of the bearing. Bearings and their surrounding areas shall be left clean after installation.
- (d) Where the design requires that the girders bear on neoprene pads placed directly on pier or abutment seat concrete, the Contractor shall supply and install shims cut from lead sheeting as determined by the Contract Administrator to ensure full and uniform bearing.
- (e) Any bearings that in the opinion of the Contract Administrator have been damaged or otherwise rendered unusable by improper storage or handling by the Contractor shall be replaced by the Contractor at their expense.

#### E63.5.6 Handling, Transport, Storage and Installation

- (a) Care and Protection

- (i) During handling, transport and storage, bearings shall be kept clean and protected from mechanical damage, heat, contaminants and other deleterious effects.

(b) Handling Devices

- (i) Suitable handling devices shall be provided as required. Temporary clamping devices shall be used to maintain the correct orientation of the parts but shall not be used for slinging suspending bearings unless specifically designed for this purpose.

E63.5.7 Elastomeric Material Property Test Requirements

- (a) The rubber pad shall be exposed to field temperatures falling to  $-40^{\circ}\text{C}$  frequently for short durations and may remain below  $-15^{\circ}\text{C}$  continuously for up to 2 months. The test temperature for Low Temperature Properties shall be  $-30^{\circ}\text{C}$ .
- (b) The vulcanized bond between the elastomer and steel plates shall develop a minimum peel strength of 7 kN/m. Peel strength tests shall be performed in accordance with ASTM D429, Method B.
- (c) The Fabricator shall submit a certificate from their supplier to the Contract Administrator stating the requirements of the above clause have been met and the test requirements of E63.4.1(g) have been executed.

E63.6 Quality Control/Quality Assurance

E63.6.1 Quality Control

(a) Materials and Workmanship

- (i) The testing and inspection of materials and workmanship used in the manufacture of bearings shall be carried out to ensure compliance with this Specification. Test Certificates shall be made available for inspection by the Contract Administrator prior to the shipment of bearings.
- (ii) The Fabricator shall proof test twenty-five percent (25%) of the steel reinforced Elastomeric bearing pads in accordance with AREMA Chapter 15, Table 15-5-5.

(b) Testing of Complete Bearings

- (i) Testing of complete bearings, as specified, shall be carried out in accordance with this Specification. The bearings shall be considered satisfactory when the results of the test comply with this Specification.

E63.6.2 Quality Assurance

- (a) All materials will be subject to physical inspection by the Contract Administrator and will be subject to rejection during the course of the Work and for the length of time as specified in the General Conditions, if, in the opinion of the Contract Administrator, the materials involved do not meet the requirements of the Drawings and this Specification.
- (b) The Contractor shall furnish facilities for the inspection of material and workmanship in the mill, shop and field, and the Contractor Administrator shall be allowed free access to the necessary parts of the Works.

E63.7 Guarantee

E63.7.1 Fabrication Guarantee

- (a) Upon installation of the bearings the bearing Supplier shall inspect the bearings and certify in writing that the bearings have been properly installed. The Contractor shall provide a written guarantee that the bearings will perform satisfactorily within the design range of movement under the design loads for a period of five (5) years from the date of bearing installation. 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 of

Winnipeg in the event that the bearings do not perform satisfactorily within the design range of movement and under the design loads.

#### E63.7.2 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 Total Performance. Provided in the guarantee for the replacement of the bearings at no cost to the City of Winnipeg in the event that the bearings do not perform satisfactorily in the range of design movement and under the design loads.

#### E63.8 Measurement and Payment

##### E63.8.1 Supply, Fabrication, Delivery and Installation of Steel Reinforced Elastomeric Bearings

- (a) Supply, fabrication and delivery of Steel Reinforced Elastomeric Bearings will be measured on a unit basis and paid for at the Contract Unit Price for "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 and accepted by the Contract Administrator.
- (b) Items of Work:
  - (i) Supply, Fabrication and Delivery of Steel Reinforced Elastomeric Bearings
    - ◆ Bearings "EB1"
    - ◆ Bearings "EB2"

##### E63.8.2 Installation of Steel Reinforced Elastomeric Bearings

- (a) Installation of Steel Reinforced Elastomeric Bearings will be measured on a unit basis and paid for at the Contract Unit Price for "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 and accepted by the Contract Administrator.
- (b) Items of Work:
  - (i) Installation of Steel Reinforced Elastomeric Bearings
    - ◆ Bearings "EB1"
    - ◆ Bearings "EB2"

##### E63.8.3 Supply and Installation of Anchor Rods and Pipe Assemblies

- (a) The supply of the Anchor Rods and pipe assemblies will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Supply, Fabrication and Delivery of Steel Reinforced Elastomeric Bearings".
- (b) The installation of the Anchor Rods and pipe assemblies will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Installation of Steel Reinforced Elastomeric Bearings".

##### E63.8.4 Supply and Installation of Bearing Top Plates

- (a) The supply of the bearing top plates will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Supply, Fabrication and Delivery of Steel Reinforced Elastomeric Bearings".
- (b) The installation of the bearing top plates will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Installation of Steel Reinforced Elastomeric Bearings".



## E64. SUPPLY, FABRICATION AND DELIVERY OF STRUCTURAL STEEL FOR BRIDGE

### E64.1 Description

#### E64.1.1 General

- (a) This Specification covers all operations relating to the supply, fabrication, shop assembly, loading, blocking, delivery of structural steel as shown or described on the Drawings in this Specification including the following:
- (i) plate girders;
  - (ii) stiffeners;
  - (iii) diaphragms;
  - (iv) jacking beams;
  - (v) floor beams;
  - (vi) cross bracing;
  - (vii) gusset plates;
  - (viii) lifting devices;
  - (ix) all shop and field high strength connection bolts;
  - (x) shop and field welds;
  - (xi) trainman's walkway grating, checker plate, support structures and field connection hardware;
  - (xii) deck plates and deck drains;
  - (xiii) shim plates;
  - (xiv) deck angles and deck joint cover plates;
  - (xv) fibre optic support brackets;
  - (xvi) all other members required to complete the steel superstructure as shown on the Drawings and specified herein; and
  - (xvii) all labour, material and equipment required to load and block the steel superstructure.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.
- (c) The Contractor shall notify the Contract Administrator of any subcontractors (Fabricators) that have been subcontracted by the Contractor to fabricate, load and transport the structural steel components. The Contractor shall remain responsible for the work of such subcontractors. All requirements, such as right to access, shall apply to such subcontractors.
- (i) Railcar offloading at bridge site will not be available.
- (d) Quality Control of materials and fabrication.
- (e) Metallizing and/or galvanizing of steel components.

#### E64.2 References

- E64.2.1 The Fabricator shall insure that the steel fabricator's foreman and welding supervisor have a copy of the Specifications and AREMA Chapter 15; and are readily available for the Contract Administrator's reference.
- (a) AREMA Chapter 15 – Steel Structures
  - (b) CSA G40.20/G40.21-13 – Structural Quality Steels
  - (c) ASTM A709/A709M-16a – Structural Steel for Bridges
  - (d) ASTM A588/A588M-15 – High-Strength, Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance

- (e) ASTM A572/A572M-15 – High-Strength, Low-Alloy Columbium-Vanadium Structural Steel
- (f) ASTM A36/A36M-14 – Carbon Structural Steel
- (g) ASTM A500/A500M-13 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- (h) ASTM F3125M-15a, Grade A325, Type 1 – High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength
- (i) ASTM F1554-15e1 – Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength
- (j) CSA W59-13 – Welded Steel Construction (Metal Arc Welding)
- (k) AWS D1.5/D1.5M:2015 – Bridge Welding Code
- (l) AWS A5.29/A5.29M:2010 – Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding
- (m) CSA W47.1-09 (R2014)– Certification of Companies for Fusion Welding of Steel Structures (25a) AISC Category III Major Steel Bridges
- (n) CSA W178.2 – 2014 – Certification of Welding Inspectors
- (o) ASTM B833-13 – Zinc and Zinc Alloy Wire for Thermal Spraying (Metallizing) for the Corrosion Protection of Steel
- (p) AWS C2.18-93R – Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites
- (q) AWS C2.23-03/SSPC-CS 23.00 – Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc and Their Alloys and Composites for the Corrosion Protection of Steel
- (r) ASTM A123/A123M-15 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- (s) ASTM A143/A143M – Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
- (t) ASTM A153/A153M-16 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- (u) ASTM B695-04 (2009) – Coatings of Zinc Mechanically Deposited on Iron and Steel
- (v) CN Guidelines for Design of Railway Bridges (2006)
- (w) CN Standard Drawings appended to the CN Guidelines for Design of Railway Bridges (2006)
- (x) CN Drawing K1U-10.1m - CN Standard Clearance Diagram For All New Railway Bridges
- (y) CN Drawing R1S-1m – Standard Instructions For Dating Concrete Structures
- (z) CN Drawing TD-05-L-1m – Location for Bridge Name Plate

### E64.3 Submittals

E64.3.1 The Contractor shall submit the following documents to the Contract Administrator.

- (a) Copies of Mill Test Certificates in accordance with CSA G40.20/G40.21-13 (ASTM A6), showing chemical analysis and physical tests of all structural steel prior to commencement of fabrication. Structural steel without certification will be rejected.
- (b) Two copies of Charpy V-notch certified test reports prior to the start of fabrication.
- (c) A complete set of Shop Drawings prior to commencement of fabrication:
  - (i) the Contractor shall indicate on the Shop Drawings all the necessary material specifications for the materials to be used and identify the components in accordance with the Drawings and Specifications;

- (ii) applicable welding procedures, stamped as approved by the Canadian Welding Bureau, shall be attached to the Shop Drawings. The welding procedures used shall be indicated on Fabricator's Shop Drawings by cross-referencing them with the standard sheets submitted; and,
  - (iii) in no case will the Contractor be relieved of responsibility for errors or omissions in the Shop Drawings.
- (d) Clearly identify all Shop Drawings and correspondence submitted to the Contract Administrator with the project title as it appears on the Contract Drawing's title block including subdivision and mileage.
  - (e) Clearly indicate shop and erection details including cuts, copes, connections, holes, bearing plates, threaded fasteners, and welds. Indicate welds by CSA / AWS welding symbols.
  - (f) Final revised and As-built Shop Drawings shall be submitted in electronic form. Electronic form shall be submitted in a CD disk in two different formats – ADOBE ACROBAT "PDF" and AutoCAD "DWG".
  - (g) Shop Drawings shall be drawn to the same system (Metric or Imperial) as the Contract Drawings.
  - (h) Submit Manufacturer's test reports of mechanical tests on high strength bolts, if requested by the Contract Administrator.
  - (i) Welding Procedure Specification (WPS), including weld sizes, position of welding, preheating, types of electrodes, flux, current, and sequence of welding in addition to stress-relief heat treatment shall be submitted for the Contract Administrator's review. Any standard sheets submitted for review shall be marked up to indicate clearly the type of weld to be used for every particular application.
  - (j) The Contractor shall submit a proposed erection procedure to the Contract Administrator for review at least 14 days prior to transporting girders for erection. This submission shall be signed and sealed by a Professional Engineer registered in the Province of Manitoba.
  - (k) Three (3) weeks prior to shipping, provide four (4) copies of loading, blocking, and shipment scheme, including the proposed route and all traffic control procedures stamped by Professional Engineer registered to practice in the Province of Manitoba.
  - (l) All joints and procedures shall be approved by the Canadian Welding Bureau in accordance to CSA W59 or AWS D1.5.
  - (m) The Contractor shall submit a Detailed Quality Control Report including test results as specified in this Specification certified by welding inspector certified by the CWB to the requirements of CAN/CSA 178.2 (Level III) for bridges and structures.
  - (n) Submit three (3) weeks prior to steel girder hot-dip galvanizing a hot-dip galvanizing plan for the steel girder galvanizing in accordance with ASTM A143/ A143M

#### E64.4 Materials

##### E64.4.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- (b) The Contractor shall mark all materials to identify its material specification and grade. This shall be done by suitable marking or by a recognized colour coding.
- (c) The types and grades of structural steel used shall be as shown on the Drawings or as specified in this Specification.
- (d) Materials called for under these Specifications and on the Drawings shall, unless otherwise specified, satisfy the testing procedures and be in strict accordance with the requirements set out in the latest edition of the standards identified.

#### E64.4.2 General Requirements for Steel

- (a) Steel shall be in accordance with CSA G40.21-13 or ASTM A709, A588, A572 and A36.
- (b) Grade and Types, Fracture Critical Members:
  - (i) CSA-G40.21-13 Grade 350WT Category 5, A709 Grade 50F3:
    - ◆ plate girder webs and flanges
    - ◆ end bearing stiffener plates
    - ◆ stringers, diaphragms, floor beams and jacking beams (made from steel plate)
  - (ii) CSA-G40.21-13 Grade 350WT Category 3, A709 Grade 50F3:
    - ◆ Diaphragms, stringers and floor beams (from rolled sections)
    - ◆ Diaphragms, stringer and floor beam connection angles
- (c) Grade and Types, Non-Fracture Critical Members:
  - (i) CSA-G40.21-13 Grade 350W, (A588, A709 with minimum actual yield strength of 50 ksi)
    - ◆ bracing
    - ◆ struts
    - ◆ intermediate and horizontal stiffeners
    - ◆ knee bracing
    - ◆ deck and ballast plates
    - ◆ walkway brackets
    - ◆ columns/posts
    - ◆ jacking beams when used solely for jacking and not part of a floor system
    - ◆ gusset plates
    - ◆ all other miscellaneous components
  - (ii) CSA-G40.21-13 Grade 300W (A572 Grade 42)
    - ◆ secondary members to be galvanized
- (d) When ordering steel from the Mill, state that it will be used for railway bridge construction.
- (e) Furnish to the Contract Administrator's Shop Inspector mill test reports, properly correlated to all steel sections to be used for steel construction under this Specification.
- (f) Before the start of fabrication, supply to the Contract Administrator the results of the low temperature Charpy impact tests made in accordance with CSA-G40.21-13. Three test pieces for thickest plate of each heat of web and flange plates in the main girders shall be taken. The tests shall be taken at the temperature of -30 deg. C (-22 deg F) and shall have the following guaranteed minimum average level of energy absorption:
  - (i) Category 5 material - 34 Joules (25 ft-lbs)
  - (ii) Category 3 material - 27 Joules (20 ft-lbs)
  - (iii) For ASTM designated steels, impact test requirements will be as per Zone 3 service temperatures of Table 15-1-14 of AREMA Chapter 15 for Fracture Critical Members, and will be as per Zone 3 service temperatures of Table 15-1-2 for NonFracture Critical elements
- (g) Material for Charpy specimens shall be supplied to the Contract Administrator for inspection when requested.
- (h) All identification and erection marks shall be located on surfaces which will not be visible in the completed structure.

- (i) Fabrication shall be carried out in the Fabricator's own plant, the use of subcontractors for all or portions of the fabrication will only be considered unless applied for in writing by the Fabricator and subsequently approved in writing by the Contract Administrator. The Fabricator shall be fully responsible for the quality of work and shall bear all additional costs related to work being carried out at the subcontractors plant such as additional quality inspections, shipment, etc.
- (j) When mill test certificates originate from a mill outside of Canada or the United States of America, the Contractor shall have the information on the mill test certificate tested and verified by independent testing by a Canadian laboratory. This laboratory shall be certified by an organization accredited by the Standards Council of Canada to comply with the requirements of OSO/IEC 17025 for the specific tests or types of tests required by the material standard specified on the mill test certificate. The mill test certificate shall be stamped with the name of the Canadian laboratory and appropriate wording stating that the material is in conformance with the specified requirements. The stamp shall include the appropriate material specification number, testing date and the signature of an authorized officer of the Canadian laboratory.

#### E64.4.3 High Strength Bolts, Nuts and Washers

- (a) Bolts to ASTM F3125M, Grade A325, Type 1, nuts to ASTM A563-C3 Grade DH3 and washers to ASTM F436 Type 1. Galvanized bolted items may be used when approved by the Contract Administrator. Bolt tightening shall be provided by means of the turn-of-nut method.
- (b) Proof shall be submitted to the Contract Administrator demonstrating that the bolts, nuts and washers meet the chemical composition, mechanical properties, dimensions, workmanship and head burst as required by ASTM A325/ A325M, A563/ A563M and F436/ F436M. Verification of the acceptability of assemblage of zinc coated bolts shall be provided with the bolts, nuts and washers delivered to the job site shall also be submitted to the Contract Administrator.
- (c) For bolts supplied from a manufacturer outside of Canada or United States of America, the above information shall be independently verified by testing by a Canadian laboratory as outlined in the Clause E64.4.2(j).

#### E64.4.4 Anchor Bolts, Washers and Nuts:

- (a) Anchor bolts to ASTM F1554, Grade 105 and supplied with UNC threads where indicated on the Drawings. Steel plate washers, where indicated, shall be of sufficient area to completely cover each hole, with a minimum yield strength of 250 MPa (36 ksi). Nuts shall be specified as ASTM A563, heavy-hex style, to accommodate overlapping of threads due to metallized coatings. Anchor bolts, washers and nuts shall be galvanized.

#### E64.4.5 Welding

- (a) Welding electrodes and fluxes shall conform to the latest revised editions of:
  - (i) CSA W48 / AWS D1.5/D1.5M for submerged arc welding;
  - (ii) CSA W48 / AWS D1.5/D1.5M for manual welding; and,
  - (iii) AWS A5.29 / A5.29M for flux cored arc welding.
- (b) The deposited weld metal shall have atmospheric corrosion properties and Charpy V-Notch impact resistance properties similar to the parent metal being welded.
- (c) The electrodes for manual welding shall be low-hydrogen Type E55018-C3 (E8018-C3).
- (d) The electrode for flux core welding shall be Low Hydrogen E8XTX-Ni1 (E7XT8-Ni1).
- (e) All welding shall be done by Operators qualified under the provisions of the CSA Standard W47.1, Division 1 or AWS D1.5.

#### E64.4.6 Hot Dip Galvanizing

- (a) Hot Dip galvanizing of steel elements identified on the Drawings as being hot-dip galvanized, except anchor bolts, shall be executed after fabrication of the element and shall be in accordance with ASTM A123 and CSA G164 and shall have a minimum mass of zinc coating of  $610 \text{ g/m}^2$  (2 oz/ft<sup>2</sup>).
- (b) ASTM F1554 Anchor bolts shall be galvanized by the following methods: Zinc Hot Dip to ASTM F2329.
- (c) Galvanized nuts shall be tapped oversize according to ASTM A563 and shall meet the requirements of supplementary Requirement S1 of ASTM 563. Excess hot-dip galvanizing on threaded portions shall be removed by centrifuging or air blasting immediately upon withdrawal; flame chasing is prohibited.

#### E64.4.7 Metallization

- (a) The following areas shall be zinc metallized with a minimum coating of 0.25mm in accordance with AWS C2.23-03/SSPC-CS 23.00:
  - (i) Girder bottom flanges, to the extent shown on the Drawings.

#### E64.4.8 Painting of Exposed Metalized Surfaces

- (a) Painting of metalized surfaces shall be in accordance with E66.

#### E64.4.9 Identification of Span

- (a) Supply and install, where shown on the Drawings, an 8" x 12" (203 mm x 305 mm) span identification plate. The plate shall be installed using two 1/2" (12 mm) diameter stainless steel cap screws in accordance with the Drawings.
- (b) The plate may be fabricated by MP Reproductions in Montreal, PQ Ph. 514-861-8541.

#### E64.4.10 Bearing Levelling Pads

- (a) The Fabricator shall supply and place levelling pads where indicated on the Drawings.
- (b) Levelling pads shall be laminated fabric rubber such as Fabreeka, Sorbtex or equivalent in accordance with B8.
- (c) The levelling pads, where indicated, shall be fully adhered with a waterproof adhesive compatible with the pad.

### E64.5 Construction Methods

#### E64.5.1 Work Schedule

- (a) Provide with the tender a detailed work schedule in increments of not more than one week. The detailed schedule shall be in a clear, concise, bar chart form and shall clearly indicate the fabrication periods and sequences of operations of each item of work in sufficient detail so the Contract Administrator can determine the feasibility of the program and monitor the progress of the Work.
- (b) When establishing the work schedule conform to D20, D30, D31 and D34.
- (c) Interim reviews of work progress based on schedule submitted by the Fabricator will be conducted as decided by the Contract Administrator and schedule updated by the Fabricator in conjunction with approval of the Contract Administrator.

#### E64.5.2 Fabrication Procedures and Tolerances

- (a) General
  - (i) The workmanship shall meet established practice in modern shops. Special emphasis shall be placed in prevention of cracks, notch-like flaws and bruises that may lower the structure's resistance to fatigue and brittle fracture.
  - (ii) The punching of identification marks on members will not be allowed unless authorized in writing by the Contract Administrator.

- (iii) If damage occurs to the structural steel during fabrication, the Contract Administrator shall be notified immediately. The Contractor shall submit remedial method statement. Remedial repair measures are subject to the approval of the Contract Administrator.
  - (iv) Dimensions and fabrication that control field matching of parts shall receive careful attention in order to avoid field adjustments.
  - (v) Field high-tensile bolted splice joints in plate girders shall have all holes drilled or sub-punched and reamed using steel templates.
  - (vi) Steel plates for main members and splice plates shall be cut and fabricated so that the direction of the applied stress shall be parallel to the direction of plate rolling.
  - (vii) Oxygen cutting shall be in accordance with AWS D1.5 and CSA W59.
  - (viii) Welded splice joints for welded girders shall be assembled with butting members adjusted for line and camber before the fit-up preparations are made for welding.
  - (ix) All holes for end connections of jacking beams and end beams shall be drilled or sub-punched and reamed using steel templates. Templates shall be located with utmost care as to position and angle and firmly bolted in place.
- (b) Procedures and Tolerances
- (i) Fabrication procedures and tolerances shall be in accordance with Part 3, Chapter 15, AREMA Standard, unless stated otherwise in the Specifications or on the Drawings.
  - (ii) Shearing of plates shall only be permitted on edges of secondary material which will be welded; all edges of primary material must be machine flame cut or, if sheared, must be planed to a depth of  $\frac{1}{4}$ " (6 mm).
  - (iii) Flange material preheating:
    - ◆ flange material thickness of  $1 \frac{1}{2}$ " (40 mm) and up to  $2 \frac{3}{8}$ " (60 mm) shall be preheated to 150°F (65°C) before flame cutting or welding; and,
    - ◆ flange material thicker than  $2 \frac{3}{8}$ " (60 mm) shall be preheated to 225 deg. F (107°C) before flame cutting or welding.
  - (iv) All holes must be drilled from the solid or sub-punched a maximum  $11/16$ " (18 mm) diameter and reamed.
  - (v) Steel templates with hardened bushings will not be required for drilling holes in gussets and bracing with 4 holes or less.
  - (vi) Camber in girders shall be as indicated on the Drawings. Deviation from camber in girders shall not be permitted.
  - (vii) Bottom flanges of girders over bearings shall be true and square. Maximum measured deviation at outside edge of bearing plates shall not exceed  $1/25$ " (1 mm).
  - (viii) Deviations from straightness of main girders shall not exceed  $1/8$ " (3 mm).
  - (ix) Submit request for approval of flange splices, other than as called for on the Drawings, with tendering documents.
  - (x) Field connections and bolts for deck joint cover plate:
    - ◆ supply all bolts for shop and field connections as called for on the Drawings;
    - ◆ the Fabricator shall supply additional high strength connection bolts for field assembly. The number of field high strength bolts of each size and length furnished in excess of the nominal number required shall be five percent (5%) plus 5. The number of nuts and washers of each size and type furnished in excess of the nominal number required shall be five percent (5%);
    - ◆ all shop & field connections shall be slip-resistant (friction-type) using High Strength bolts;

- ◆ bolts shall conform to ASTM F3125M, Grade A325, Type 1, with matching nuts to ASTM A563 Grade DH3 and washers to A.S.T.M. F436, Type 1;
- ◆ contact surfaces shall be thoroughly cleaned of all weld deposits and dirt prior to assembly of components in order to obtain the desired friction component; and,
- ◆ tightening of high strength bolts shall be executed by the turn-of-nut method as specified under Chapter 15, Part 3, Clause 3.2.3 of the AREMA.

(xi) Assembly

- ◆ For spans being shipped completely assembled:
  - spans shall be shipped entirely shop assembled complete with bearing assemblies except for the following items:
    - walkway brackets shall be bolted to the spans in the field by others;
    - grating shall be secured to the brackets in the field by others;
    - railings shall be shop assembled in units for each span;
    - deck joint cover plates shall be installed in the shop to ensure a snug fit along the profile of the deck plate and shall be match marked and supplied loose for installation in the field by the Railway; and,
    - cap beam connection plates and filler plates shall be bolted to cap beams as indicated.
- ◆ for spans being shipped knocked down:
  - complete shop assembly required to ensure good fit of all parts in the field and match mark all parts. Ship completely knocked down for assembly in the field as follows:
    - diaphragms shall be supplied with connection angles loosely bolted;
    - floor beams to be connected to girders shall be supplied with connection angles loosely bolted;
    - all other floor beams shall be supplied loose with bolts for connecting in the field by Others;
    - gusset plates and connecting angles shall be permanently bolted to the girders;
    - walkway brackets and grating shall be supplied loose; and,
    - deck joint cover plates shall be installed in the shop to ensure a snug fit along the profile of the deck plate and shall be match marked and supplied loose for installation in the field.

(xii) For inspection purposes, all bolts must have their snug tight positions marked by the Fabricator prior to final tightening.

(xiii) All remaining miscellaneous steel pieces should be bundled and clearly marked as called for on the identification of pieces drawing

(c) Clean Material

- (i) The material shall be clean, free from rust, mill scale, and other foreign matter before being worked in the shop and after assembly.
  - ◆ Commercial blast clean with SSPC-SP-6 (sand blast) inside and outside of main girders, its connections (including angles, stiffeners and any bolted connection to the web to ensure slip resistance connection), and surfaces that need metallizing prior to the assembly.
  - ◆ Commercial blast clean with SSPC-SP-6 outside of External girders after assembly has been completed.
  - ◆ Remove heavy deposits of oil or grease by Solvent Cleaning to SSPC-SP-1.

(d) Finish



- (i) 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 and free from twists, bends, open joints, and sharp corners and edges.
- (e) Machining
  - (i) General
    - ◆ Machining shall be carried out as indicated on the Drawings and in these Specifications in accordance with established machine shop practice. All machined surfaces shall be free of flaws, cracks and machining ridges and shall present a polished appearance.
  - (ii) Facing of Bearing Surfaces
    - ◆ The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with concrete shall meet the ANSI surface roughness requirements as defined in ANSI B46.1, Surface Roughness, Waviness and Lay, Part I:
      - Steel Slabs ANSI 2,000;
      - Heavy plates in contact in shoes to be welded ANSI 1,000;
      - Milled ends of compression members;
      - milled or ground ends of stiffeners and fillers ANSI 500;
      - Bridge rollers and rockers ANSI 250; and,
      - Pins and pin rollers ANSI 125.
  - (iii) Care shall be taken that the completed surfaces are protected from damage from the time of machining until the installation in a structure.
  - (iv) Grinding
    - ◆ Final grinding and machining of the surface of all tension members shall be done parallel to the tensile forces that will occur in the assembled member.
  - (v) Butting Joints
    - ◆ Butting joints in compression members shall be faced and brought to an even bearing by milling or other methods meeting the Contract Administrator's approval.
  - (vi) Flat Machined Surfaces
    - ◆ Where called for on the Drawings, flat machined surfaces shall be obtained by planning or machine grinding, or other methods meeting the Contract Administrator's approval. The direction of machining and the extent of the areas to be machined shall be as indicated on the Drawings or as directed by the Contract Administrator. Flat machined surfaces shall be straight, true and smooth.
  - (vii) Curved Machined Surfaces
    - ◆ Curved surfaces shall be machined carefully in accordance with Drawings and Specifications in order to ensure correct fit of mating parts.
- (f) Stress Relieving
  - (i) Stress relieving of the structure or any component parts attached to the structure shall be done only if called for on the Drawings or in these Specifications. If stress relieving is called for, it shall conform to the requirements of AWS D1.5 and CSA W59.
- (g) Holes
  - (i) General
    - ◆ Except where a specific method of holing materials is shown on the Drawings or required in the Special Provisions, all holes shall be either drilled or sub-punched and reamed. Poor matching holes will be cause for rejection.
  - (ii) Punched Holes and Slots
    - ◆ For holes and slots punched full size, the diameter or size of the die shall not exceed that of the punch by more than 2 mm. All holes and slots which are punched shall have burrs and sharp edges removed. All holes

shall be clean-cut without torn or ragged edges. The punching shall not distort the structural member. If required by the Contract Administrator, a sample of the punching operation shall be carried out to the satisfaction of the Contract Administrator prior to the start of fabrication.

(iii) Drilled Holes

- ◆ Drilling shall be done with twist drills, and all burrs and sharp edges shall be removed carefully. Care shall be taken to centre the drill accurately and to ensure that the hole is perpendicular to the member. Holes shall be clean-cut, without torn or ragged edges.

(iv) Sub-Punched and Reamed Holes

- ◆ All holes shall be sub-punched or sub-drilled to a diameter 5 mm smaller than the nominal hole diameter, and enlarged by reaming to the correct diameter. The diameter of the die shall not exceed the diameter of the punch by more than 2 mm. Holes shall be clean-cut without torn or ragged edges. Reamed holes shall be truly cylindrical and perpendicular to the member and all burrs shall be removed carefully. All reaming shall be done with twist reamers which shall be directed by mechanical means.

(v) Allowable Tolerance for Holes

- ◆ All matching holes for bolts shall register with each other so that a gauge 2 mm less in diameter than the hole shall pass freely through the assembled members in a direction at right angles to such members. Finished holes shall be not more than 2 mm in diameter larger than the diameter of the bolt passing through them unless otherwise specified by the Contract Administrator. The centre-to-centre distance between any two holes of a group of holes shall not vary by more than 1 mm from the dimensioned distance between such holes. The centre-to-centre distance between any group of holes shall not vary by more than the following tolerances unless shown otherwise on the Drawings:
  - Centre-to-centre 12 m or less 1.0 mm;
  - Centre-to-centre over 12 m to 18 m 1.5 mm;
  - Centre-to-centre over 18 m to 24 m 2.5 mm;
  - Centre-to-centre over 24 m 3.0 mm; and,
  - Miss-punched or miss-drilled members shall not be corrected by welding.

(h) Span Length Dimensions

- (i) Particular attention shall be paid to span length dimensions. Tolerances on these dimensions shall be as per AREMA Chapter 15, Section 3.

(i) Fitted Stiffeners

- (i) End stiffeners and stiffeners intended to be load supporting shall have full bearing on the flanges to which they transmit load or from which they receive load. Full bearing shall be achieved by machining or welding (using double bevel complete penetration joint) as shown on the Drawings. Stiffeners not intended to support loads shall, unless shown or specified otherwise, fit sufficiently tight to exclude water after being painted. All intermediate transverse stiffeners shall be machined to fit as required by the Drawings.

(j) Match Marking

- (i) Splice plates and splices shall be shop checked for fit and match marked.

(k) Welding

(i) Specifications

- ◆ Welding shall conform to the requirements of the Structural Welding Code - Steel of the American Welding Society AWS D1.5 and addendum and CSA W59 Welded Steel Construction.

- (ii) Welding of principal members shall be performed by automatic or semi-automatic submerged arc process, in accordance with CSA Standard W59, Welded Steel Construction or AWS D1.5.
  - ◆ Gas metal-arc, electrogas, and electroslag welding are not permitted.
  - ◆ The fabrication of steel members designated herein or on design plans as fracture critical members and the materials making up those members shall be in accordance with the requirements set forth in AREMA Manual for Railway Engineering, Chapter 15, Section 1.14 - Fracture Critical Members. All welding for fracture critical members shall be in accordance to AWS D1.5, Section 12.
- (iii) Welds between the web and flange plates shall be made in the flat position, except that 8 mm (5/16") fillet welds may be made in horizontal position.
- (iv) Arc strikes and tack welds, which will not be incorporated into the final welds as shown on the approved drawings, will not be permitted. Tack welds are to be not longer than 70 mm (2 3/4"), not closer than 500 mm (20") and no larger than 5 mm (3/16").
- (v) Exact shop welding procedures, including weld sizes, stress relief treatment, types of electrodes, flux, current, and sequence of welding shall be submitted for the Contract Administrator's review. Any standard sheets submitted for review shall be marked up to indicate clearly the type of weld to be used for every particular application. The welding procedures used shall be indicated on Fabricator's Shop Drawings by cross-referencing them with the standard sheets submitted.
- (vi) Welding Procedures and Qualification
  - ◆ Welding procedures that conform in all respects to the approved procedures of AWS D1.5 and CSA W59 shall be deemed as pre-qualified and are exempt from tests or qualifications.
  - ◆ Welding procedures that do not conform to approved procedures in AWS D1.5 and CSA W59 shall be qualified by tests carried out in accordance with AWS D1.5. The Contract Administrator may accept previous qualifications of the welding procedure.
- (vii) All welding shall be done by Operators qualified under the provisions of the CSA Standard W47.1, Division 1 or AWS D1.5.
- (viii) Butt welds of tension flange plates shall be stress-relieved in accordance with procedure described in Clause 5.12 of CSA Standard W59 or Section 4.4 of AWS D1.5.
- (ix) Fillet welds between flange and web plates and between end stiffeners and web plates will be NDT tested.
- (x) Flange and web butt welds will be inspected (after stress relieving when applicable) by approved radiographic and ultrasonic methods and approved before assembly of flanges to the web. Standards of acceptance for radiographic, ultrasonic or magnetic particle examination of welds shall be as specified in CSA Standard W59, Clause 12.5 / AWS D1.5, Section 4.4.
- (xi) Distortion and Shrinkage Stresses
  - ◆ Distortion and shrinkage stresses shall be kept to a minimum by the use of jigs and fixtures, utilizing heat distribution and a welding sequence. Areas contiguous to welding operations shall be preheated to a maximum temperature of 120°C, if necessary in the estimation of the Contract Administrator to prevent distortion or weld cracking. The provisions of AWS D1.5 and CSA W59 shall be followed in the control of distortion and shrinkage stresses.
- (xii) Run-off Plates and Backing Strips
  - ◆ Run-off plates shall be used at the ends of all welds except where run-off plates are not practical and then the weld shall be run back onto itself to minimize craters forming at the end of the weld.

- ◆ Material to be used for backing strips and run-off plates shall conform to the same specifications as the base material and shall be of a sufficient length to prevent craters due to the stoppage of the weld.
- (I) Hot-Dip Galvanizing
- (i) Shop Applied:
    - ◆ the galvanizing shall be shop applied and strictly in accordance with ASTM A123 and CSA Standard G164 to a minimum net retention of 610 g/m<sup>2</sup>;
    - ◆ 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;
    - ◆ submit a hot-dip galvanizing plan for the steel girder galvanizing outlining the process, methods, responsibilities and all things necessary to avoid steel embrittlement in accordance with ASTM A143/ A143M. The Plan shall identify the methods the fabricator and galvanizer shall undertake to avoid the occurrence of strain-age embrittlement. The Plan shall also include a communication plan between the fabricator and galvanizer throughout fabrication and galvanizing process to ensure best practices are used throughout to minimize the possibility of strain-age embrittlement;
    - ◆ handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion;
    - ◆ 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;
    - ◆ coating adhesion shall withstand normal handling consistent with the nature and thickness of the coating and normal use of the article; and,
    - ◆ 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 galvanized-coated with field applied galvanizing touch-up material as specified hereinafter.
  - (ii) Field Applied Touch-up Galvanizing
    - ◆ Any areas of damaged galvanizing on the sign structures shall receive field applied touch-up galvanizing.
    - ◆ 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.
    - ◆ 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.
    - ◆ 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.
    - ◆ The maximum area to be repaired in the field on a single repair shall be 5,000 mm<sup>2</sup>. Any damaged article with a damaged area greater shall be rejected, removed, and replaced at the Contractor's expense.
  - (iii) Surface Preparation and Cleaning
    - ◆ Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with ASTM A123, 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  $610 \text{ g/m}^2$ . All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.

- ◆ 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 or pickling prior to galvanizing. Heavy deposits of oil and grease shall be removed with solvents prior to blasting or pickling.
- ◆ The sandblasting and cleaning of structural steel members shall be done in the shop.
- ◆ 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.

#### E64.5.3 Handling, Delivery and Storage of Materials

- (a) Precautionary measures shall be taken to avoid damage to structural steel during handling, transit, stockpiling and erecting. The use of chains and metal cable slings for lifting is forbidden. If use of metal chains or slings cannot be avoided, adequate protections as authorized by the Contract Administrator shall be applied to the part to be lifted so as to prevent any contact between the sling and the span. Parts may not be dropped, tossed or dragged during vehicle loading and unloading. Pinholes, or other field connection holes shall not be used for lifting purposes. Special attention is directed to the shipping and storing of steel beams. The only acceptable method of shipment or storage of beams, if not uniformly supported for their entire length, is a method which allows the beams to rest on the bottom faces of the bottom flanges, at or near actual points of support in the erected position. All parts of bearing assemblies shall be separated and secured effectively before shipping in order to avoid damage in transit. Damaged parts shall not be installed in the structure and may be rejected at the discretion of the Contract Administrator.
- (b) Materials that are not placed directly in the structure shall be stored above probable high water, on skids, platforms or in bins in a manner that will prevent distortion or the accumulation of water or dirt on the structural steel. The materials shall be kept separate and stored properly for ease of inspection, checking and handling and shall be drained and protected from corrosion.
- (c) When transporting bridge girders using equipment other than a flatbed trailer, the Contractor shall be responsible for ensuring the following:
- (d) The Contractor shall submit the temporary traffic control plan in accordance to all jurisdictions and regulation procedures, as part of the handling, delivery and storage of materials. The proper advance signing must also be in place.

#### E64.5.4 Weight Information

- (a) The TOTAL WEIGHT of each fully assembled span shall be indicated at the end of the bottom flange of the span. The weight shall be stencilled on the material with a minimum 100 mm (4") high yellow waterproof letters. The weight shall be indicated in Imperial units.
- (b) For all members or components that are shipped unattached to the spans, these members shall show the weight of these individual members or components on a metal tag attached thereto.

#### E64.5.5 Protective Blocking

- (a) Provide protective blocking for lifting and transportation. Exercise care during fabrication and transportation so as not to damage span and, in particular, to avoid notches to edges of members, which may cause cracks due to fatigue stresses.
- (b) When girders are galvanized, all lifting/handling/blocking shall be done with non-metallic components such that the galvanizing is not damaged.

- (c) The use of welded attachments of any type, the field drilling or burning of holes, in any member, for shipping, or any other purpose is strictly forbidden.
- (d) Bolts shall not be loosened or removed from attachments in order to facilitate shipping.

#### E64.5.6 Loading for Shipment

- (a) Each span should be marked and tagged indicating the Span Number.
- (b) Mark end of girder to identify which end will be pointing west or north when erected in the bridge by marking "West" or "North" on the top of the top flange at the end of each girder.
- (c) Loading on the rail cars will be done with the West or North ends of all spans pointing to the same end of the rail car.
- (d) The Fabricator shall supply and install the necessary blocking to fully support the span during shipment.
- (e) The Fabricator shall provide the Contract Administrator loading and blocking scheme drawings in accordance with E64.3.
- (f) The Fabricator shall supply all material (including bolsters or swivel blocks under spans) and labour required to load and block the spans or girders to meet the Association of American Railroads (AAR) open top loading rule requirements.
  - (i) Load securements shall be capable of withstanding 3 times the object weight in the longitudinal direction, and 2 times the object weight in the lateral and vertical directions.
  - (ii) Tie downs shall consist of 1" minimum diameter rods or plates only. The use of tie down cables or wires is strictly prohibited.
  - (iii) Spans or girders over 50 feet in length can be shipped on flat cars and the fabricator shall then request flat cars from CN's customer service when undertaking necessary transport arrangements.
  - (iv) For spans being shipped knocked down, the fabricator shall load and block each main girder individually on separate railcars.
  - (v) Spans or girders are to be shipped in the vertical position.
- (g) All field connection bolts, nuts, and washers shall be packed in 5 gallon (20 litres) metal cans and clearly labelled. The label will show mile and subdivision, the type and quantities of fasteners each can contains and the name and address of the receiver. The cans shall be strapped to a wooden pallet.
- (h) Walkway grating panels shall be strapped in bundles of 5 or 10 pieces with steel strapping. The steel strapping must be cushioned so as not to come in direct contact with the grating panel.
- (i) Walkway support structure materials shall be strapped to wooden pallets or shipped in steel drums or shall be strapped in bundles of not more than 2000 pounds each.
- (j) Shipping instructions shall accompany the bill of lading to ensure that the spans arrive on site, pointing in the correct direction for erection.
- (k) The Fabricator shall obtain a clearance for dimensional loads from the Engineer prior to shipment of the span(s).

#### E64.5.7 Identification of Pieces

- (a) All members or components shall be identified on a metal tag attached thereto.
- (b) The metal tag shall have the following information:
  - (i) bridge location (Mileage and Subdivision)
  - (ii) "mark" as indicated on the Drawings.
  - (iii) "weight" in lb. of the girders and their assembled connections.
- (c) The metal tags shall be have the following characteristics:

- (i) Tag format type no. 90, 18 gauge
- (ii) Dimension: 2 1/2 x 2 3/4"
- (iii) Tag information shall be engraved with min. 1/2" high letters.
- (iv) Metal bands shall be used to attach the tags to the components.

#### E64.6 Quality Control

##### E64.6.1 General

- (a) The Contractor shall be responsible for all quality control testing specified in the Specification and shall complete the minimum weld testing requirements using procedures and frequency of testing according to CSA W59 to verify that welds meet the quality requirements of the current edition of the CSA Standard W59 and AWS D1.5.
- (b) All testing shall be completed by qualified personnel who are certified at the time of testing, in accordance with E64.6.3.
- (c) Structural Steel
  - (i) All structural steel shall be free of surface imperfections, pipes, porosity, laps, laminations and other defects.

##### E64.6.2 Inspection

- (a) The Contract Administrator will arrange for, and the City will pay for an independent inspection consultant to carry out shop inspection of the fabrication including non-destructive testing of the welds such as radiographic, ultrasonic or magnetic particle tests and any other tests deemed necessary to complete the inspection. This will be in addition to the Fabricator's Quality Control Program.
- (b) The Fabricator shall give two weeks' notice to the Contract Administrator at the beginning of work in the shops so inspection may be provided. No work in the shop shall be done until the Contract Administrator has been notified.
- (c) The following inspections shall be carried out:
  - (i) Geometric Control
    - ◆ Plate and Shape Sizes
    - ◆ Dimensions
    - ◆ Alignment
    - ◆ Tolerances
  - (ii) Quality of Welds
    - ◆ Non-destructive testing of welds shall be in accordance with E64.6.4 and E64.6.5
  - (iii) High Strength Bolts
    - ◆ Turn of the nut method or by torque wrench – one hundred percent (100%) sampling of installed bolts (site installed bolts are not included)
  - (iv) Surface Finishes
    - ◆ Cleaning
    - ◆ Galvanizing
    - ◆ Metalizing

##### E64.6.3 Non-Destructive Testing Agency and Personnel

- (a) An independent testing organization shall be certified by the Canadian Welding Bureau (CWB) to the requirements of CAN/CSA W178.1 for bridge structures by radiographic, ultrasonic, magnetic particle, and liquid penetrant test methods to perform all non-destructive testing of the welds.
- (b) All visual inspection of welds shall be performed in accordance with CAN/CSA W59 by a welding inspector certified by the CWB to the requirements of CAN/CSA 178.2 (Level II minimum) for bridges and structures.

- (c) Non-destructive testing shall be done by a non-destructive testing technician certified to the Canadian General Standards Board (CGSB) in the test method specified and being performed by the Inspector.
- (d) Neither the technician nor the independent testing organization shall be changed without the approval of the Contract Administrator.

#### E64.6.4 Non-Destructive Testing of Welds

- (a) All welding shall be subject to inspection by Non-Destructive Testing. The Contractor shall, at their own cost, perform magnetic particle testing of all fillet welds between flanges and webs of plate girders. This work shall be carried out in a manner meeting with the approval of the Contract Administrator.
- (b) The Contractor shall perform the inspections to verify that welds meet the quality requirements of the current edition of the CSA W59 and AWS D1.5-S and:
  - (i) all non-destructive testing performed by the Fabricator shall be done by personnel qualified under CSA W59 and/or AWS D1.5-S;
  - (ii) the Fabricator shall submit to the Contract Administrator, in triplicate, copies of all inspections and weld testing reports;
  - (iii) butt welds in flange and web joints are to be completed, inspected, and accepted before the flange to web tee joint is made; and,
  - (iv) welds requiring repairs shall be retested after repairs are made, at the expense of the Contractor.

#### E64.6.5 Radiographic, ultrasonic or magnetic particle testing shall be completed by the Independent Testing Agency appointed by the Contract Administrator using procedures and frequency of testing according to CSA W59 however, notwithstanding the CSA W59 requirements, the amount and location of welding to be tested shall be at least:

- (a) Visual Examination – one hundred percent (100%) of all welds;
- (b) Radiograph Test Method – one hundred percent (100%) of butt joint groove welds in flange splices on tension zones inspected after stress relieving one hundred percent (100%) of butt joint groove welds in flange and web splices;
- (c) Ultrasonic Test Method – one hundred percent (100%) of all bearing stiffener to flange welds of girders and beams;
- (d) Magnetic Particle Test Method - All flange to web fillet welds fifty percent (50%) concentrated at the centre of the girders, at every stop and start location and repair location; and,
- (e) All joints to be radiograph inspected shall be ground flush on both sides, and shall be free of paint, scale and grease. The direction of grinding shall be perpendicular to the length of the weld.

#### E64.7 Quality Assurance

- E64.7.1 All materials will be subject to physical inspection by the Contract Administrator and will be subject to rejection during the course of the Work and for the length of time as specified in the General Conditions, if, in the opinion of the Contract Administrator, the materials involved do not meet the requirements of the Drawings and this Specification.
- E64.7.2 All materials shall be subject to testing by the Contract Administrator and will be approved only if the requirements of the Drawings, standards and this Specification are met. The Contractor shall supply the specimens for testing in accordance with the requests of the Contract Administrator.
- E64.7.3 The Contractor shall furnish facilities for the inspection of material and workmanship in the mill, shop and field, and the Contract Administrator shall be allowed free access to the necessary parts of the Works.



- E64.7.4 The Contractor shall submit to the Contractor Administrator material traceability reports and non-destructive test results carried out as part of internal quality assurance in the plant if requested by the Contractor Administrator.
- E64.7.5 Inspection of welds shall not be permitted until the material temperature has cooled to below 100 degrees Celsius
- E64.7.6 The Contractor shall provide sufficient access and shop area to permit the performance of the tests. The Contractor shall give the Contract Administrator not less than 24 hours' notice of when work will be ready for testing, and such notice shall advise the Contract Administrator of the type and quantity of work which will be ready for testing. All defects revealed shall be repaired by the Contractor at their own expense and to the approval of the Contract Administrator.
- E64.8 Measurement and Payment
- E64.8.1 Supply, Fabrication and Delivery of Structural Steel
- (a) The supply, fabrication and delivery of structural steel will not be measured. This Item of Work will be paid for at the Contract Lump Sum price for "Supply, Fabrication and Delivery 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 and accepted by the Contract Administrator.
  - (b) The Contract Administrator will arrange for, and the City will pay for the radiographic, ultrasonic or magnetic particle tests, except that the cost of inspection of any welding repairs entailed in the fabrication will be at the expense of the Contractor.

## E65. ERECTION OF STRUCTURAL STEEL

### E65.1 Description

- E65.1.1 The Work shall consist of:
- (a) unloading and erecting structural steel components (e.g. structural steel girders, stiffeners, diaphragms, splice plates, jacking plates, bearing sole plates, bearing anchor bolts, nuts and washers, and all incidental structural steel elements.) as shown and described on the Drawings and in this Specification;
  - (b) design, supply, fabrication, installation, maintenance and removal of temporary falsework (where applicable);
  - (c) Design, supply, delivery, installation, maintenance and removal of erection bracing, temporary wind bracing, lateral stability bracing, longitudinal ties and other temporary works for structural steel girders; and,
  - (d) the quality control (QC) testing of all materials and the Work.
- E65.1.2 The Contractor shall not erect the structural steel girders until the substructure concrete has cured a minimum of seven days and achieved eight percent (80%) of the twenty-eight (28) day specified concrete strength requirements. Schedule of lifts will need to be arranged in advance with date and time coordinated with the Protecting Foreman and Contract Administrator.
- E65.2 References
- E65.2.1 All related Specifications and reference Standards are in accordance with the most current issue or latest revision:
- (a) Specification E64.
  - (b) Specification E7.
- E65.3 Submittals

E65.3.1

The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:

(a) Girder Erection Procedure

- (i) A schedule and detailed plan clearly illustrating the method and sequence by which the Contractor proposes to unload and erect the structural steel girders. The girder erection procedure shall include detailed design notes and Shop Drawings in accordance with E4 and shall bear the seal of a Professional Engineer registered in the Province of Manitoba.
- (ii) The girder erection procedures shall be sealed, signed and dated by a Professional Engineer, registered or licensed to practice in the Province of Manitoba necessary to describe the following and assume full responsibility that the design is being followed:
  - ◆ access to work, including earth berms, work bridges, or rock berms. The Professional Engineer shall confirm that the temporary works can fully support all loads during girder erection;
  - ◆ type and capacity of proposed equipment;
  - ◆ sequence of operation, including position of cranes, trucks with girders, and traffic accommodation;
  - ◆ detailed crane position and location, particularly adjacent to substructure elements, such as piers and abutment backwalls, with details of load distribution on wheels and outriggers throughout each lift. If the Contract Administrator, approves the crane positioned on the structure during a portion of the Work, details of crane position on the structure showing wheel loads and axle spacing of equipment moving on structure shall also be submitted;
  - ◆ loads and their position from crane wheels and outriggers during all positions of lifting when the crane(s) is on or adjacent to the structure;
  - ◆ details of temporary falsework, including proposed methods to be used to ensure stability and the required splice elevations and structure shape and details of release (if applicable):
    - method of providing temporary supports for stability; and,
    - details of lifting of girders, showing vertical forces at lifting points and on the lifting devices.
  - ◆ complete details of blocking for bearings where necessary to constrain movement due to horizontal forces and/or gravity effects;
  - ◆ when applicable, complete details of longitudinal ties between the ends of girders at locations where the bridge will be made continuous. These ties shall be capable of resisting tension or compression that will develop due to temperature change, creep, and shrinkage. These shall be kept in place until the diaphragms have been installed and a majority of bridge deck concrete has been cast and reached specified strength;
  - ◆ Grout Pad Construction, if applicable; and,
  - ◆ provide an "As Constructed" detailed survey of the substructure showing the following:
    - location and elevation of all bearing seats;
    - shim height at each bearing location, if applicable;
    - top of girder elevations at each bearing (and each splice location where applicable); and,
    - safety and compliance with Manitoba Workplace Health and Safety Act and Regulations shall be integral to the girder erection procedure.

(b) Temporary Works

- (i) Detailed design notes and Shop Drawings for proposed temporary works, including but not limited to erection bracing, temporary wind bracing and lateral stability bracing for structural steel girders shall be sealed signed and dated by a Professional Engineer, registered or licensed to practice in the Province of Manitoba.

## E65.4 Construction Methods

### E65.4.1 General

- (a) The Contractor shall schedule, coordinate and sequence structural steel erection in cooperation with the delivery of the structural steel by the structural steel fabricator.
- (b) Any structural steel components that in the opinion of the Contract Administrator have been damaged or otherwise rendered useless by the improper handling by the Contractor shall be replaced by the Contractor at their own expense.
- (c) If the structural steel components are stored on site, the requirements of E64.5.3, shall apply.

### E65.4.2 Erection of Structural Steel Girders

#### (a) General

- (i) Before taking possession and erecting the girders, the Contractor shall verify that the lengths of the girders, the layout of the substructure units, the elevations of the bearings seats, and the location of the anchor bolts are in accordance with the Drawings. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.
- (ii) It is essential that the girders be erected with utmost attention being given to girder positioning, alignment, and elevation. The Contractor shall adjust girder position, bearing location, and bearing elevation in order to achieve as closely as possible the lines and grades shown on the Drawings. The Contractor shall minimize any differential camber (girder to girder), and the sweep of the girders by jacking, loading of girders, winching, or whatever means are necessary, and shall provide the necessary temporary attachments to hold the girders in position. The Contract Administrator shall approve of all proposed methods of jacking, loading, winching, etc. prior to the work being undertaken.
- (iii) Unloading and erection of the structural steel girders shall be under the direction of a Professional Engineer, registered or licensed to practice in the Province of Manitoba. The Professional Engineer shall be experienced in bridge girder erection and be present for all stages of the girder erection.
- (iv) Loose timber blocking will not be permitted for use as temporary works for any aspect of girder erection.
- (v) It is the Contractor's responsibility to ascertain the actual weight of the girders.

#### (b) Equipment

- (i) All cranes, rigging and equipment shall be in good condition and properly maintained at all times during the period of the work. All cranes, rigging and equipment shall be of sufficient capacity to complete every stage of the erection Works.
- (ii) The Contract Administrator shall, at their discretion, verify capacity and state of equipment provided and any equipment found not meeting the requirements for erection work shall be removed and replaced. Slings and other lifting devices that will be in contact with structural steelwork shall be of a type, which shall not damage shop primed or painted surfaces.

#### (c) Erection

- (i) The Contract Administrator shall be notified in writing of the starting date at least two (2) weeks prior to the commencement of field operations. Work shall not be carried out until the Contract Administrator is on the Site.
- (ii) Components shall be lifted, placed, and maintained in position using appropriate lifting equipment, temporary bracing, guys, or stiffening devices so that the components are at no time overloaded, unstable, or unsafe. Additional permanent material may be provided, if approved by the Contract Administrator, to ensure that the member capacities are not exceeded during erection. The additional material shall be shown in the erection diagram.

- (iii) Release of temporary supports or temporary members, etc. must be gradual, and under no circumstances will a sudden release be permissible.
  - (iv) Unless otherwise approved by the Contract Administrator, at least fifty percent (50%) of the holes in the joints shall be filled with drift pins or hand tightened bolts prior to removing the crane. At least fifty percent (50%) the bolts required in the flanges shall be installed. For roadway or railway overpass structures, drift pins shall not be left in place over traffic when the crane is removed.
  - (v) For temporary fit ups, main girder splices and connections shall be aligned with drift pins and a sufficient number of fitting up bolts shall be installed to maintain the integrity of the connection.
  - (vi) The fitting up bolts may be the high strength bolts used in the installation. Drift pins shall be 1 mm larger in diameter than the required bolts. Excessive drifting that distorts the metal and enlarges the holes is not allowed. Reaming up to 2 mm over the nominal hole diameter is permitted, except for oversize or slotted holes.
  - (vii) Repairs to erected material will only be permitted after the repair procedure has been approved by the Contract Administrator.
  - (viii) Filling of misplaced holes by welding is permitted only with the written approval of the Contract Administrator.
  - (ix) Material intended for use in the finished structure shall not be used for erection or temporary purposes unless such use has been shown on the Shop Drawings, erection diagram, or authorized by the Contract Administrator.
  - (x) Hammering that will damage or distort the members is not permitted.
  - (xi) Surfaces that will be in permanent contact shall be cleaned immediately prior to assembly.
- (d) Temporary Stresses
- (i) The Contractor shall assume full responsibility for ensuring that all bridge member and component stresses are within permissible limits at all stages of the construction work. The Contractor shall provide all necessary additional steel reinforcement, bracing or other measures required to ensure that the erection procedures do not overstress any temporary or permanent member or component at any stage of the Work.
- (e) Alignment and Camber
- (i) The structural steel girders shall be erected to the proper alignment in plan and in elevation, taking into account the dead load camber shown on the Drawings. Members shall be aligned to the dimensional tolerances specified in CAN/CSA W59-M, but in no case, shall it deviate by more than 50 mm from the theoretical location.
  - (ii) Alignment shall be measured from survey lines joining the ends of any test length of a member.
- (f) Temporary Bracing
- (i) The Contractor shall be responsible for the design, supply, installation and removal of all:
    - ◆ erection bracing;
    - ◆ temporary wind bracing;
    - ◆ lateral stability bracing; and,
    - ◆ longitudinal ties.
  - (ii) As may be required during and immediately following the erection of structural steel girders.
  - (iii) The bracing shall be designed and installed so that it will not interfere with the installation of steel diaphragms.
- (g) Lifting Devices

- (i) After the Contract Administrator has approved the erection positions of the girders, all lifting devices shall be removed to the satisfaction of the Contract Administrator.

#### E65.4.3 Connections

- (a) Holes made in the field shall be drilled or reamed. Shop reamed holes shall not be re-reamed in the field.
- (b) At the time of erection, all splice plates shall be free of loose mill scale, burrs, and all contamination such as drilling shavings, oil, dirt, and paint.
- (c) Surfaces to be in permanent contact shall be cleaned immediately prior to assembly.
- (d) Any error in shop fabrication or any deformation resulting from handling or transportation that prevents the proper assembly and fitting of parts, especially splices of main structural members, shall be reported and the proposed method of correction shall be submitted to the Contract Administrator. Corrective measures shall not commence until the submitted proposal is accepted by the Contract Administrator.

#### E65.4.4 Cantilever Erection

- (a) When members or components to be erected will be cantilevered, splices that support the cantilevering member or component shall be fully bolted before extending.

#### E65.4.5 Attachments

- (a) The use of tack welds for securing temporary or permanent attachments that are not shown on submitted Shop Drawings, erection drawings or fabrication drawings shall not be permitted on any portion of girders or any other structural members.

#### E65.4.6 Field Welding

- (a) The company undertaking field-welding shall be certified to Division 1 of CAN/CSA W47.1.
- (b) The requirements of the Specifications for E64.4.5 shall apply.

#### E65.4.7 Bolted Construction

- (a) The requirements of the Specifications for E64.5.2(g) shall apply.
  - (i) Bolt heads shall be located on the outside faces of exterior girder webs.
  - (ii) Bolt heads in field splices for box girders shall be located on the exterior surfaces.

#### E65.4.8 Removal of Falsework and Site Clean-up

- (a) Upon completion of the erection and before final acceptance, the Contractor shall remove all temporary falsework. They shall remove all piling, excavated or surplus materials, rubbish and temporary supports, replace or renew any damaged fences, and restore in an acceptable manner all property damaged during the execution of the Work. Disposed of surplus materials shall be in a manner and at a location satisfactory to the Contract Administrator.
- (b) The Contractor shall leave the bridge site, roadway and adjacent property in a neat restored and presentable condition, satisfactory to the Contract Administrator. When requested by the Contract Administrator, the Contractor shall provide written evidence that affected property owners and/or regulatory agencies have been satisfied.

#### E65.4.9 Protection of Concrete Components

- (a) If the coating system is to be applied in the field, the substructure shall be protected during construction against rust-staining by water runoff until the structural steel has been coated.
- (b) Restoration of Damaged Surface Coatings and Final Cleaning

- (i) The Contractor shall repair all damaged surface coatings which, in the estimation of the Contract Administrator, are defective, including any damaged metallized or galvanized surfaces.
- (ii) All metal surfaces shall be left free of dirt, dried concrete, debris or foreign matter to the satisfaction of the Contract Administrator.

#### E65.5 Measurement and Payment

E65.5.1 The Erection of Structural Steel will not be measured and it will be paid for at the Contract Lump Sum price for "Erection 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 and accepted by the Contract Administrator.

### E66. STRUCTURAL STEEL PAINTING

#### E66.1 Description

##### E66.1.1 General

- (a) This Specification covers all operations relating to the preparation of surfaces and application of paint using approved conventional methods as shown on the Drawings and specified herein including the following:
  - (i) Exposed caisson steel casings
  - (ii) Exposed underside of the girder flanges
- (b) The quality control testing of all materials.
- (c) 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.

#### E66.2 References

##### E66.2.1 Reference Standards

- (a) Perform work in accordance with the requirements of the latest issue of the following specifications and standards:
  - (i) SSPC-SP1 Solvent Cleaning;
  - (ii) SSPC-SP2 Hand Tool Cleaning;
  - (iii) SSPC-SP3 Power Tool Cleaning;
  - (iv) SSPC-SP7 Brush Off Blast Clean
  - (v) SSPC-SP10 Near White Blast Cleaning;
  - (vi) SSPC-SP11 Power\_Tool Cleaning to Bare Metal;
  - (vii) SSPC-Vis 1 Guide to Pictorial Surface Preparation Standards for Painting Steel Surfaces;
  - (viii) Specification D21; and,
  - (ix) SSPC specifications are available from:  
The Society of Protective Coatings  
Telephone: (412) 281-2331  
40 - 24th Street, 6th Floor  
Pittsburgh, PA 15222-4656  
USA  
Website: <http://www.sspc.org>

#### E66.3 Submittals

- E66.3.1 The Contractor shall submit the following to the Contract Administrator, in accordance with the Specification:
- (a) Submit fourteen (14) days prior to abrasive blasting, a written certification from a certified laboratory, stating that abrasive media meets the material requirements as described in this Specification.
  - (b) Submit fourteen (14) days before commencing the application of the coating system, a written certification from the coating manufacturer, stating that all material supplied are as specified on the Drawings, described in this Specification and in accordance with the Manufacturer's current product data sheets.
  - (c) Submit the Manufacturer's product data sheets describing the following:
    - (i) recommended maximum dry film thicknesses for each coating layer;
    - (ii) mixing and thinning directions;
    - (iii) recommended spray nozzles and pressures;
    - (iv) acceptable humidity level and temperature range for application; and,
    - (v) minimum acceptable recoat time period for temperatures between 5°C to 30°C in intervals of 5°C, including the acceptable range of relative humidity for each temperature interval.
  - (d) Details of surface preparation and coating system application to areas difficult to access.
  - (e) A written guarantee from the supplier of the coating system within fourteen (14) days of completion of coating operations stating that the product will perform satisfactorily for a minimum period of five (5) years from the Total Performance date, provided that both the surface preparation and application of the paint has been carried out in accordance with the Manufacturer's recommendations. The supplier shall state that they have reviewed this Specification and the surface preparation and application procedures and find them in accordance with their recommendations. The supplier shall guarantee the replacement of the coating, including any surface preparation, touch-ups, and final overcoats, at no cost to the City of Winnipeg in the event that the coating system does not perform satisfactorily over the five (5) year guaranteed time period.
  - (f) The Contractor shall provide to the Contract Administrator a guarantee in writing, stating that the coating system will perform satisfactorily for a period of five (5) years from the date of Total Performance. The Contractor shall provide in the guarantee for the reapplication of the paint system at no cost to the City of Winnipeg in the event that the coating system does not perform satisfactorily. This shall include, but not necessarily be limited to: the supply and installation of the working platform, hoarding, scaffolding; removal, and disposal of the unacceptable coating system; surface preparation; coating; and all other items necessary to reapply a coating system.

#### E66.4 Materials

##### E66.4.1 Paint System

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- (b) The Paint system shall be the following, or accepted alternative by Contract Administrator in accordance with B8. Paint system shall be applied in accordance with the manufacturer's specifications, and to the satisfaction of the Contract Administrator.
- (c) Painting System
  - (i) Uniformly tinted polyurethane seal coat shall be at least sixty percent (60%) solids, shall be compatible with the zinc metalizing and galvanizing, 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.

- (ii) Coating system shall be Amercoat 385 as tie coat/epoxy primer and intermediate coat, and Amercoat 450H as polyurethane topcoat.

#### E66.4.2 Paint Color

- (a) Each coat of a different colour must be approved by the Contract Administrator.
- (b) Paint colour shall be as follows:
  - (i) exposed caisson steel casings: Color shall closely match the color of surrounding concrete as determined by a trial patch approved by the Contract Administrator; and,
  - (ii) exposed underside of the girder flanges: Color shall closely match the color of surrounding concrete as determined by a trial patch approved by the Contract Administrator
- (c) Mixing and application shall be in strict accordance with manufacturer's written instructions.

#### E66.5 Construction Methods

##### E66.5.1 Preparation of Metal Surfaces

- (a) Clean all surfaces by removing paint, rust, mill scale, welding slag, dirt, oil, grease and other foreign substances by cleaning in accordance with the manufacturer's instructions.
- (b) Remove all salts and surface contaminants by water blasting or steam cleaning prior to dry abrasive blasting.
- (c) When cleaning by air blasting with sand, provide adequate separators and traps to remove detrimental amounts of water and oil from compressed air before reaching nozzle. Remove traces of blast products from surface and from pockets and corners by brushing with clean brushes, by blowing with clean compressed air, or by vacuum cleaning. Do not damage partially or completed work adjacent to area being cleaned.
- (d) Abrasives used in shop cleaning shall be free of chlorides and other contaminants which could affect the coating being applied, and shall produce the anchor pattern required by the coating system.
- (e) Hand and power tool clean areas inaccessible to blasting equipment. Such cleaning shall be in accordance with SSPC-SP2 and SSPC-SP3.
- (f) The Contractor shall prepare only as much surface as can be coated with primer the same day. If unusual circumstances occur which prevent all prepared surfaces from being primed the same day, a light blast cleaning will be required over all unprimed surfaces prior to recommencement of painting.
- (g) For seal coat application, surface shall be rough. If surface is smooth, sand it down using rough grit sandpaper.

##### E66.5.2 Degree of Cleanliness of Surfaces

- (a) Prior to commencing paint application, the degree of cleanliness of surfaces must conform to the following Steel Structures Painting Council Specification:
- (b) Commercial Blast Finish to SSPC-SP10 for Commercial Blast Cleaning.
- (c) Hand and power tool clean to SSPC-SP2 or SSPC-SP3.
- (d) Provide necessary equipment for access to assist Contract Administrator to carry out tests for cleanliness.

##### E66.5.3 Protection of Adjacent Properties and Public



- (a) Protect all rail and other vehicular traffic, bridge operating equipment, buildings and machinery from abrasive sand or grit, paint spray or splash and falling objects. The Contractor shall be solely responsible for any damage or injury resulting from their operation.
- (b) Protect adjacent properties, landscaping, and public, including vehicles, from any damage due to operations.

E66.5.4 Protection of the Environment

- (a) The containment system's purpose is to prevent the debris generated during surface preparation from entering into the environment and to facilitate the controlled collection of debris for disposal.
- (b) When abrasive blast cleaning is used to clean and prepare the steel surfaces, the Contractor shall contain the abrasive particles, and debris resulting from the operation.
- (c) The containment system includes but is not limited to, such articles as cover panels, screens, tarps, scaffolds, supports, shrouds and ground sheets used to enclose the entire work area or a paint removal tool.
- (d) The materials used for screens shall be of a commercial brand designed specifically for the purpose of containing and facilitating collection of blasting and painting debris. If woven screens are used, the material shall contain no more than fifteen percent (15%) voids with a mesh opening not exceeding 20 mils (500 microns).
- (e) The method of attaching tarpaulins to the bridge will be subject to the approval of the Contract Administrator. The welding of attachments to and the drilling holes in structural members are prohibited.

E66.5.5 Protection of Surfaces

- (a) Apply primer or paint as soon as possible after surface has been cleaned and before deterioration of surface occurs.
- (b) In the event that rusting occurs after completion of surface preparation, clean surfaces again.
- (c) Prevent contamination of cleaned surfaces by sand, grit, salts, acids, alkali, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats of paint. Must remove such contaminants from surface to the satisfaction of the Contract Administrator and apply paint immediately.
- (d) Protect cleaned and freshly painted surfaces from excessive dust produced by traffic, and from dust, sand and grit produced by blasting operation at no extra cost.
- (e) Chemical pre-treatment of bare metal surfaces shall not be permitted.

E66.5.6 Mixing Paint

- (a) Do not dilute or thin paint for brush application; use as received from manufacturer and thin only as recommended by the manufacturer for spray application.
- (b) The paint shall be mixed in a manner which will ensure breaking up of all lumps, complete dispersion of settled pigment, and provide a uniform composition. The paint shall be agitated often enough during application to keep the pigment in suspension.
- (c) Mixing or keeping paint in suspension by means of an air stream bubbling under paint surface will not be permitted.

E66.5.7 Paint Film Thicknesses

- (a) The seal coat shall be applied in two coats of Amercoat 385 followed by a top coat of Amercoat 450H with a Dry Film Thickness (DFT) of each coat as directed by coating manufacturer's instructions. DFT shall be checked and accepted by the Contract Administrator.
- (b) Do not exceed maximum dry film thickness recommended by coating manufacturer.

#### E66.5.8 Applying Paint

- (a) Applying paint by brushing, rolling or spraying or a combination of each. Use sheepskins or daubers only when no other method is practicable in places of difficult access.
- (b) Do not apply paint when:
  - (i) air temperature is below 4°C or when temperature is expected to drop to 0°C before paint has dried;
  - (ii) fog or mist occurs at site; it is raining or snowing; there is a danger of rain or snow;
  - (iii) relative humidity is above eighty-five percent (85%), unless otherwise authorized by the Contract Administrator;
  - (iv) surface to be painted is wet, damp or frosted;
  - (v) previous coats are not thoroughly dry; and,
  - (vi) steel temperature is more than 3°C below dew point temperature.
- (c) Provide all necessary instrumentation to the Contract Administrator or their representative to measure atmospheric conditions (i.e. ambient temperature, relative humidity, dew point, wind speed, etc.) as well as wet and dry paint thicknesses.
- (d) To maximum extent possible apply each coat of paint as a continuous film of uniform thickness, free of pores. Repaint and permit to dry any thin spots or areas missed in application before next coat of paint is applied.
- (e) Stripe coat edges of flanges and angles, nuts, bolts, etc. by spray or brush prior to applying full coat of paint to ensure adequate coverage on all sharp edges.
- (f) Brush application:
  - (i) work paint into all cracks, crevices and corners where possible and paint surfaces not accessible to brushes by spray, daubers or sheepskins;
  - (ii) brush out runs or sags; and,
  - (iii) leave a minimum of brush marks in applied paint.
- (g) Spray application:
  - (i) provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied and equipped with suitable pressure regulators and gauges;
  - (ii) provide traps or separators to remove oil and water from compressed air and drain periodically during operations;
  - (iii) keep paint ingredients properly mixed in spray pots or containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary;
  - (iv) apply paint in a uniform layer, with overlapping at edge of spray pattern.
  - (v) brush out immediately any runs and sags; and,
  - (vi) use brushes to work paint into cracks, crevices and blind spots which are not adequately painted by spray. In areas not accessible to spray gun, use brushes, daubers or sheepskins.

#### E66.5.9 Inspection and Quality Control

- (a) The Contractor shall provide access to the Work for inspection and testing purposes.
- (b) The Contract Administrator shall from time to time during the Work inspect surfaces prior to painting for degree of cleanliness and after the painting has been completed make quality control tests, i.e., wet, dry film thicknesses, adhesion, etc.
- (c) Areas found to be deficient with respect to preparation of surfaces and/or painting shall be corrected and made good by the Contractor, at their cost, to the satisfaction of the Contract Administrator.

- (d) Any newly painted surfaces will be considered to lack uniformity, continuity and soundness, and will be rejected, if any of the following defects are apparent.
  - (i) Runs, sags, holidays or shadowing caused by inefficient application methods.
  - (ii) Evidence of poor coverage at bolts, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
  - (iii) Surfaces which have been struck, scraped, spotted by rain or otherwise damaged.
  - (iv) Surfaces which exhibit an objectionable texture such as orange peel, mud cracking, fish eyes, etc.
  - (v) Surfaces damaged by over spray.

#### E66.6 Measurement and Payment

E66.6.1 Painting will be incidental to the "Items of Work" listed here below and no separate payment will be made.

(a) Items of Work

- (i) Supply and Install Rock-Socketed Caissons
- (ii) Supply, Fabrication and Delivery of Structural Steel for Bridge

#### E67. SIGNALS AND COMMUNICATION FIBRE OPTIC CONDUITS

##### E67.1 Description

E67.1.1 This Specification shall cover the supply and installation of signal and communication conduits in the trainman's walkways as detailed on the Drawings.

E67.1.2 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.

E67.1.3 Bell and CN will use their own forces to install the fibre optic cables; however, the Contractor must coordinate with Contract Administrator all required work to facilitate this task.

##### E67.2 Materials

###### E67.2.1 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.

###### E67.2.2 Conduits

- (a) Rigid conduits shall be 150 mm nominal diameter unplasticized PVC in accordance with CSA C22.2 No. 136 complete with the appropriate approved fittings, couplings and expansion joints as detailed on the Drawings. The conduit shall be manufactured by IPEX Electrical Inc. or as accepted by the Contract Administrator, in accordance with B8.
- (b) Conduits shall be supplied with solvent cement and other required fittings for a complete water tight installation in the field to the satisfaction of the Contract Administrator.
- (c) At each trainman's walkway, at the end of the span the Fabricator shall supply Junction boxes and two elbows (one downward and one upward) in order to permit burial of the duct approximately 2 feet into the embankment.

###### E67.2.3 Fish Wire

- (a) Fish wire in ducts shall be galvanized steel line type and shall not be less than 12 BWG Grade 130.

### E67.3 Equipment

- E67.3.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

### E67.4 Construction Methods

#### E67.4.1 Placing of Conduits

- (a) All conduits shall be installed as shown on the Drawings. The conduit to be placed in concrete shall be firmly anchored in place to prevent movement during pouring concrete to prevent damage to any conduit. The open ends of the conduits shall be suitably capped to protect the conduits from any blockage.
- (b) The conduits shall extend a minimum of 1 m past the edge of the bridge for future extension.

#### E67.4.2 Placing of Fish Wire

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

#### E67.4.3 Obstructions

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

#### E67.4.4 Miscellaneous Works

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

### E67.5 Quality Control

- E67.5.1 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.

- E67.5.2 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.

- E67.5.3 The Contract Administrator reserves the right to reject materials or works, which are not in accordance with the requirements of this Specification.

### E67.6 Measurement and Payment

- E67.6.1 Supplying and placing conduits for signal and communication fibre cables will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Supply and Place Structural Concrete for Deck and Trainman's Walkways" listed in the Specification E61, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, and accepted by the Contract Administrator

## E68. **SUPPLY AND INSTALLATION OF EXPANSION JOINTS**

### E68.1 Description

- E68.1.1 This Specification shall cover the supply and installation of expansion joints and its components, trainman's walkway cover plates, cover plates, end plates, nuts and anchors, epoxy adhesives, grout and pre-formed neoprene joint seals as shown on the Drawings and as specified herein.

- E68.1.2 Galvanizing of steel components
- E68.1.3 Quality control testing of all materials.
- E68.1.4 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.
- E68.2 Materials
- E68.2.1 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.
- E68.2.2 Epoxy Adhesive
- (a) Epoxy adhesive shall be ST 431, Dural Duralbond, Copper Capbound E, Sikadur 32 Hi-bond, Concrevis 1001 LPL, or equal as accepted by the Contract Administrator in accordance with B8.
- E68.2.3 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 B8.
- E68.2.4 Epoxy Grout
- (a) Grout shall be non-metallic, non-shrink grout of a type approved by the Contract Administrator.
- E68.2.5 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 B8.
- E68.2.6 Expansion Joints
- (a) Expansion joints shall be modular expansion joint located at the piers SU.2, SU. 3 and SU.4, as shown on the Drawings.
  - (b) The modular expansion joints shall be a Wabo 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 B8.
  - (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 ASTM A123 and CSA G164 to a minimum net retention of 610 gm/m<sup>2</sup>.
- E68.2.7 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 B8. They shall be galvanized after shop fabrication in accordance with ASTM A123 and CSA G164 to a minimum net retention of 610 gm/m<sup>2</sup>.

- E68.2.8 Steel Extrusions
- (a) Steel for the extrusions shall conform to CSA Standard CAN/CSA-G40.21-04, Grade 230G minimum.
- E68.2.9 Anchor Studs
- (a) Anchor studs shall conform to the requirements of ASTM Specification A108-07, Grade Designation 1020 and shall be galvanized.
- E68.2.10 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 ASTM A123 and CSA G164 to a minimum net retention of 610 gm/m<sup>2</sup>.
- E68.2.11 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.
- E68.2.12 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.
- E68.2.13 Preformed Neoprene Joint Seals
- (a) General
    - (i) Preformed joint seal shall be manufactured from a vulcanized elastomeric compound using crystallization resistant polychloroprene (neoprene) as the only polymer.
    - (ii) 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 68 - 1 of this Specification. All tests will be made on specimens prepared from the extruded seals.
- E68.3 Equipment
- E68.3.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.
- E68.4 Construction Methods
- E68.4.1 Fabrication
- (a) The Contractor shall submit to the Contract Administrator detailed Shop Drawings for the bridge deck expansion joints that are stamped, signed and dated by a Professional Engineer registered or licensed to practice in the Province of Manitoba in accordance with E4. 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.
  - (b) 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.
  - (c) Matching expansion joints shall be assembled and bolted together for shipping.

- (d) Expansion joint assemblies shall be shop checked for fit and match marked.
- (e) 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.
- (f) In no case shall weldments be substituted for extrusion shapes.

#### E68.4.2 Installation

- (a) The Contractor shall install expansion joints as shown on the 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 skewes and crossfalls.

#### E68.4.3 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.

#### E68.4.4 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.

#### E68.4.5 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.

#### E68.4.6 Watertight Verification of Joint Seal

- (a) Prior to installing the expansion joint and trainman's walkway cover plates, the Contractor shall dyke off the 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 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 joint forming materials and debris from the deck and from the substructure units below. The Contractor shall provide safe access, acceptable to the Engineer, to the pier tops for inspection of the expansion joints during testing.

## E68.5 Guarantee

### E68.5.1 Fabrication Warranty

- (a) Before final acceptance of the expansion joints by the Contract Administrator, the Contractor shall provide the Department with a written warranty from the expansion joint supplier 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 date of Completion, provided that the expansion joints have been properly installed, acceptable to the Contract Administrator. The Supplier shall state that they have observed the installation and found it to be in accordance with their recommended procedure. The Supplier shall warranty the replacement of the joints, including removal of the defective expansion joint assemblies and supply and installation of the replacement expansion joint, at no cost to the City of Winnipeg, 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 date of Completion.

### E68.5.2 Installation Warranty

- (a) The Contractor shall ensure that the expansion joints are installed in such a manner that will not void the fabrication warranty.
- (b) Similar to the expansion joint Supplier, and prior to final acceptance by the Contract Administrator, the Contractor shall warranty, in writing, the performance of the expansion joints for a period of five (5) years from the date of Total Performance. The Contractor shall provide in the warranty for the replacement of the expansion joints at no cost to the City of Winnipeg, including all direct and indirect costs in the event 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 Total Performance.

## E68.6 Quality Control

### E68.6.1 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.

### E68.6.2 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.



E68.6.3 Samples and Testing Procedures

- (a) The Contractor shall supply sample material at no charge to the City for quality control testing purposes. The samples will each be 1.5 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 68-1.
- (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.

<b>Table 68 – 1: Physical Requirements</b>		
<b>PROPERTY</b>	<b>PHYSICAL REQUIREMENTS</b>	<b>TEST PROCEDURE*</b>
1.Tensile Strength	Minimum 13.5 MPa	ASTM D412 OPSS 1210.07.03.01.02
2.Elongation at Break	Minimum 250%	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% Maximum 20% Maximum 10 Points	ASTM D573
5. Permanent Set at Break	Maximum 10%	ASTM D412
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% 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

## E68.7 Measurement and Payment

E68.7.1 The Supply and Installation of Expansion Joints will not be measured and it will be paid for at the Contract Lump Sum Price for the "Supply and Installation of Expansion Joints", 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 and accepted by the Contract Administrator.

## E69. WATERPROOFING FOR RAILWAY BRIDGES

### E69.1 Description

#### E69.1.1 General

- (a) This Specification covers all operations relating to the Waterproofing for Railway Bridges.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.
- (c) In addition to the applicable sections of AREMA Chapter 8, Part 29.
- (d) Deck waterproofing shall be applied to the inside surfaces of curbs and top surface of the deck as shown on the Drawings. Waterproofing membrane shall be applied on top of a primer compatible with substrate as recommended by the Manufacturer. The membrane shall be one hundred percent (100%) solvent free reactive, cold liquid, spray applied, and seamless elastomeric membrane system in accordance with AREMA Chapter 29, Section 2.3.10.

### E69.2 Materials

E69.2.1 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.

E69.2.2 Unless otherwise approved in writing by the Contract Administrator, the waterproofing membrane shall be as follows:

#### E69.2.3 Precast & Cast-In-Place Concrete Decks

- (a) One layer of 0.09 in (2.4 mm) thick butyl rubber, secured with an approved adhesive.
- (b) 0.16 in (4 mm) thick, SBS modified bitumen membrane reinforced with non-woven polyester mesh.  
Approved systems are:
  - (i) Torchflex TP-250-FF as manufactured by IKO Industries; and,
  - (ii) Sopralene Flame 250 as manufactured by Soprema.
- (c) Seamless spray applied system
  - (i) Two-component elastomer membrane such as bridge deck membrane as manufactured by Bridge Preservation.
  - (ii) Two-component methyl methacrylate resin membrane as manufactured by Stirling Lloyd.
- (d) General Requirements
  - (i) All waterproofing systems to be applied in accordance to the manufacturers' specification.
  - (ii) Surface preparation of members to be waterproofed shall be carried out in accordance to the waterproofing manufacturers' requirement.

E69.2.4 All deck or bridge joints shall be sealed against egress of water dropping onto bridge seats or roadways below.

E69.2.5 Membrane Protection – Asphaltic Panels

- (a) Asphaltic panels shall be a minimum 3/8 inch (10 mm) thickness laid in two layers with staggered joints for membrane protection. Alternates must be submitted to the Contract Administrator for review with the Railway, and must be approved in writing by the Contract Administrator.

E69.3 Measurement and Payment

E69.3.1 Supplying and Placing Waterproofing

- (a) Supplying and placing waterproofing shall not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for the "Supply and Placement of Waterproofing", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, and accepted by the Contract Administrator.

E70. **SUPPLY, FABRICATION AND ERECTION OF MISCELLANEOUS METAL**

E70.1 Description

E70.1.1 General

- (a) This Specification covers all operations relating to the following:
- (i) Supply, fabrication, and erection of miscellaneous metal as shown or described on the Drawings and in this Specification. Miscellaneous metal includes, but is not limited to:
    - ◆ bearing top plates Mk."TPF" and Mk."TPE";
    - ◆ anchor rods Mk."X1";
    - ◆ anchor rod pipe assemblies Mk. "PA1" and Mk. "PA2";
    - ◆ preset anchor units - Mk."AU1";
    - ◆ expansion joint plates; and,
    - ◆ steel trainman's walkway handrails.
  - (ii) All operations relating to the supply and installation of the steel trainman's walkway handrails, specified herein and as shown on the Drawings.
  - (iii) Quality control of materials and fabrication, including magnetic particle testing of welds.
  - (iv) Galvanizing of miscellaneous metal.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

E70.2 References

E70.2.1 References and Related Specifications

- (a) All related Specifications shall be current issued or latest revision at the first date of tender advertisement.
- (b) CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- (c) CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding
- (d) CSA W59, Welded Steel Construction (Metal Arc Welding)
- (e) CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles
- (f) CSA W47.1, Certification of Companies for Fusion Welding of Steel
- (g) ASTM A36, Standard Specification for Carbon Structural Steel
- (h) ASTM A53, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless

- (i) ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- (j) ASTM A123, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
- (k) ASTM A276, Standard Specification for Standard Specification for Stainless Steel Bars and Shapes
- (l) ASTM A320, Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
- (m) ASTM F3125, High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength
- (n) ASTM A404, Standard Specification for General Requirements for Stainless Steel Bars, Billets and Forgings
- (o) ASTM A449, Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
- (p) ASTM A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
- (q) ASTM A500, Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- (r) ASTM A514, Standard Specification for High- Yield- Strength, Clenched and Tempered Alloy Steel Plate, Suitable for Welding
- (s) ASTM A516, Standard Specification for Pressure Vessel Plates, Carbon Steel, For Moderate and Low Temperature Service
- (t) ASTM A517, Standard Specification for Pressure Vessel Plates, Alloy Steel, High Strength, Quenched and Tempered
- (u) ASTM A615, Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement
- (v) ASTM B22, Standard Specification for Bronze Castings for Bridges and Turntables
- (w) ASTM B29, Standard Specification for Refined Lead
- (x) ASTM B100, Standard Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use
- (y) ANSI B46.1, Surface Texture (Surface Roughness, Waviness, and Lay)
- (z) AASHTO/AWS D1.5M/D1.5, Bridge Welding Code
- (aa) AWS D1.1, Structural Welding Code – Steel

### E70.3 Submittals

E70.3.1 The Contractor shall submit the following to the Contract Administrator:

- (a) copies of Mill Test Certificates showing chemical analysis and physical tests of all miscellaneous metal prior to commencement of fabrication. Miscellaneous metal without this certification will be rejected;
- (b) certification of chemical analysis and physical tests for all materials;
- (c) a complete set of Shop Drawings prior to commencement of fabrication. The Contractor shall indicate on the Shop Drawings all the necessary material specifications for the materials to be used and identify the components in accordance with the Drawings and Specifications. Applicable welding procedures, stamped as approved by the Canadian Welding Bureau, shall be attached to the Shop Drawings. In no case will the Contractor be relieved of responsibility for errors or omissions in the Shop Drawings; and,
- (d) manufacturer's test reports of mechanical tests on high strength bolts, if requested by the Contract Administrator.

## E70.4 Materials

### E70.4.1 General

- (a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.
- (b) The Contractor shall mark all materials to identify its material specification and grade. This shall be done by suitable marking or by a recognized colour coding.

### E70.4.2 Miscellaneous Metals

- (a) Miscellaneous metals shall conform to the material grades specified on the Drawings, and meet the requirements and satisfy the testing procedures of CSA G40.21.

### E70.4.3 Bearing Top Plates

- (a) Steel for bearing top plates shall be in accordance with latest edition of CAN/CSA G40.21, Grade 300W.
- (b) All bearing top plates shall be hot-dip galvanized in accordance with ASTM A123 and CSA G164 to a minimum net retention of 610 g/m<sup>2</sup>.

### E70.4.4 Anchor Rod Pipe Assemblies

- (a) Anchor rod pipe assemblies shall be supplied and installed by the Contractor as shown on the Drawings.
- (b) The assemblies shall conform to ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless" for pipes and CSA-G40.21-13 Grade 300W (A572 Grade 42) for plates.
- (c) Anchor rod pipe assemblies shall be hot-dip galvanized in accordance with ASTM A123/A123M – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

### E70.4.5 Anchor Rods

- (a) Anchor rods shall be supplied and installed by the Contractor as shown on the Drawings.
- (b) Anchor rods shall conform to ASTM 955/A 955M "Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement", Type 316L, Grade 75.

### E70.4.6 Expansion Joint Plates

- (a) Expansion joint plates shall be supplied and installed by the Contractor as shown on the Drawings.
- (b) Steel for expansion joint plates shall be in accordance with latest edition of CAN/CSA G40.21, Grade 300W.
- (c) All expansion joint plates shall be hot-dip galvanized in accordance with ASTM A123 and CSA G164 to a minimum net retention of 610 g/m<sup>2</sup>.

### E70.4.7 Preset Anchor Unit

- (a) Preset anchor unit shall be NCA anchor for railing, Type DGR-1, as detailed on the Drawings.
- (b) All preset anchor units shall be hot-dip galvanized in accordance with ASTM A123 and CSA G164 to a minimum net retention of 610 g/m<sup>2</sup>.

### E70.4.8 Trainman's Walkway Handrail

- (a) All structural steel plates shall be in accordance with latest edition of CAN/CSA G40.21, Grade 300W.
- (b) All hollow structural sections for railing shall conform to G40.21, Grade 350W Class C or ASTM A500 Grade C.

- (c) All handrail components shall be hot-dip galvanized in accordance with ASTM A123 and CSA G164 to a minimum net retention of 610 g/m<sup>2</sup>.

E70.4.9 Railing Neprene Pads

- (a) Railing neprene pads shall be supplied and installed by the Contractor as shown on the Drawings.
- (b) Neprene pads shall conform to ASTM D2240 and ASTM D412, low temperature Grade 4 or 5 with a Shore A durometer hardness of 50.

E70.4.10 Welded Steel Construction

- (a) Welded steel construction (Metal Arc Welding) shall conform to the requirements and satisfy the testing procedures of CSA W59 and Welded Highway & Railway Bridges - AWS D1.1 of The American Welding Society & Addendum.

E70.4.11 Shear Stud Connectors

- (a) Shear stud connectors shall conform to the requirements of ASTM A108, Grades 1015, 1018 and 1020.

E70.4.12 Zinc

- (a) Zinc for hot dipped, galvanized coatings shall conform to the requirements of ASTM A123.

E70.4.13 Stainless Steel

- (a) Stainless steel bolts, nuts, washers, inserts, etc. when shown on the Drawings shall conform to the requirements of ASTM A320, Class B8. Stainless steel double headed studs and stainless steel dowels when shown on the Drawings, shall conform to the requirements of ASTM A276, Type 304L (UNS S30403).

E70.5 Construction Methods

E70.5.1 Fabrication

- (a) General
  - (i) The workmanship shall meet established practice in modern shops. Special emphasis shall be placed in prevention of cracks, notch-like flaws and bruises that may lower the structure's resistance to fatigue and brittle fracture.
  - (ii) The punching of identification marks on members will not be allowed unless authorized in writing by the Contract Administrator.
  - (iii) If damage occurs to the miscellaneous metal during fabrication, the Contract Administrator shall be notified immediately to facilitate the implementation of remedial measures. Remedial repair measures are subject to the approval of the Contract Administrator.
  - (iv) Dimensions and fabrication that control field matching of parts shall receive careful attention in order to avoid field adjustments.
  - (v) Field high-tensile bolted connections shall have all holes drilled or sub-punched and reamed using steel templates. Templates shall be located with utmost care as to position and angle and firmly bolted in place.
  - (vi) Cutting shall be in accordance with AWS D1.1 and CSA W59.
- (b) Clean Material
  - (i) The material shall be clean, free from rust, mill scale, and other foreign matter before being worked in the shop. Material shall be cleaned by wheelabrating, sandblasting or other methods subject to the Contract Administrator's approval.
- (c) Finish
  - (i) 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 and free from twists, bends, open joints, and sharp corners and edges.

(d) Machining

(i) General

- ◆ Machining shall be carried out as indicated on the Drawings and in these Specifications in accordance with established machine shop practice. All machined surfaces shall be free of flaws, cracks and machining ridges and shall present a polished appearance.

(ii) Facing of Bearing Surfaces

- ◆ The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with concrete shall meet the ANSI surface roughness requirements as defined in ANSI B46.1, Surface Roughness, Waviness and Lay, Part I:

Steel Slabs	ANSI 2,000
Heavy plates in contact in shoes to be welded Milled ends of compression members,	ANSI 1,000
milled or ground ends of stiffeners and fillers	ANSI 500

- (iii) Care shall be taken that the completed surfaces are protected from damage from the time of machining until the installation in a structure.

(iv) Grinding

- ◆ Final grinding and machining of the surface of all tension members shall be done parallel to the tensile forces that will occur in the assembled member.

(v) Butting Joints

- ◆ Butting joints in compression members shall be faced and brought to an even bearing by milling or other methods meeting the Contract Administrator's approval.

(vi) Bored Holes

- ◆ Bored holes shall be true to specified diameter, smooth and straight, at right angles with the axis of the member and parallel with each other, unless otherwise required. The final surface shall be produced by a finished cut. Boring of holes in built-up members shall be done after assembly is complete.

(vii) Flat Machined Surfaces

- ◆ Where called for on the Drawings, flat machined surfaces shall be obtained by planing or machine grinding, or other methods meeting the Contract Administrator's approval. The direction of machining and the extent of the areas to be machined shall be as indicated on the Drawings or as directed by the Contract Administrator. Flat machined surfaces shall be straight, true and smooth.

(viii) Curved Machined Surfaces

- ◆ Curved surfaces shall be machined carefully in accordance with Drawings and Specifications in order to ensure correct fit of mating parts.

(e) Bending

- (i) When bending is necessary in order to meet the requirements of the design, it shall be done with care and by methods subject to the approval of the Contract Administrator. The bend line shall be at right angles to the direction of rolling. The internal radius of bend of load carrying sections shall not be less than twice the thickness of the bend section when bent cold, and if a smaller radius of bend is essential, the material shall be bent hot and later annealed. Before bending, the edges of the section in the region of the bend shall be smoothed and rounded to a radius of 2 mm.

(f) Stress Relieving

- (i) Stress relieving of the structure or any component parts attached to the structure shall be done only if called for on the Drawings or in the Special Provisions. If stress relieving is called for, it shall conform to the requirements of AWS D1.1 and CSA W59.
- (g) Holes
  - (i) General
    - ◆ Except where a specific method of holing materials is shown on the Drawings or required in the Special Provisions, all holes shall be either drilled or sub-punched and reamed with the exception of the holes and slots in the rectangular steel guardrail which may be punched. Poor matching holes will be cause for rejection.
  - (ii) Punched Holes and Slots
    - ◆ For holes and slots punched full size, the diameter or size of the die shall not exceed that of the punch by more than 2 mm. All holes and slots which are punched shall have burrs and sharp edges removed. All holes shall be clean-cut without torn or ragged edges. The punching shall not distort the structural member. If required by the Contract Administrator, a sample of the punching operation shall be carried out to the satisfaction of the Contract Administrator prior to the start of fabrication.
  - (iii) Drilled Holes
    - ◆ Drilling shall be done with twist drills or core drills, and all burrs and sharp edges shall be removed carefully. Care shall be taken to centre the drill accurately and to ensure that the hole is perpendicular to the member. Holes shall be clean-cut, without torn or ragged edges.
  - (iv) Sub-Punched and Reamed Holes
    - ◆ All holes shall be sub-punched or sub-drilled to a diameter 5 mm smaller than the nominal hole diameter, and enlarged by reaming to the correct diameter. The diameter of the die shall not exceed the diameter of the punch by more than 2 mm. Holes shall be clean-cut without torn or ragged edges. Reamed holes shall be truly cylindrical and perpendicular to the member and all burrs shall be removed carefully. All reaming shall be done with twist reamers which shall be directed by mechanical means.
  - (v) Allowable Tolerance for Holes
    - ◆ All matching holes for bolts shall register with each other so that a gauge 2 mm less in diameter than the hole shall pass freely through the assembled members in a direction at right angles to such members. Finished holes shall be not more than 2 mm in diameter larger than the diameter of the bolt passing through them unless otherwise specified by the Contract Administrator. The centre-to-centre distance between any two holes of a group of holes shall not vary by more than 1 mm from the dimensioned distance between such holes. Mispunched or misdrilled members shall not be corrected by welding.
- (h) Welding
  - (i) Specifications
    - ◆ Welding shall conform to the requirements of the Structural Welding Code - Steel of the American Welding Society AWS D1.1 and addendum and CSA W59 Welded Steel Construction.
  - (ii) Welding Operator Qualification
    - ◆ Welding operators shall be qualified in accordance with the requirements of C.W.B. at the time of fabrication for the processes that will be required as part of the Work. Qualification shall have been issued within 2 years of commencement of fabrication.



- ◆ The reports of the results of the qualification tests shall bear the welding operator's name, the identification mark he/she will use and all pertinent data of the tests. Evidence that the welding operators have been executing satisfactory welding in the required processes within the six (6) month period immediately prior to commencement of fabrication shall also be provided to the Contract Administrator. The Contractor shall bear the whole cost and be fully responsible for the qualification of all welding operators.
- (iii) Welding Procedures, Specifications and Qualification
- ◆ Welding procedures that conform in all respects to the approved procedures of AWS D1.1 and CSA W59 shall be deemed as pre-qualified and are exempt from tests or qualifications.
  - ◆ Welding procedures that do not conform to approved procedures in AWS D1.1 and CSA W59 shall be qualified by tests carried out in accordance with AWS D1.1. The Contract Administrator may accept previous qualifications of the welding procedure.
- (iv) Welding Materials
- ◆ All electrodes for manual shielded metal arc welding shall conform to the low-hydrogen classification requirements of the latest edition of the American Welding Society's Filler Metal Specification AWS A5.1 or AWS A5.5 and the CAN/CSA W48 Specification and be capable of producing weld metal having an impact strength of at least 27 J (Charpy V-Notch) at -18°C. All bare electrodes and flux used in combination for submerged arc welding, the electrode and gas shielding used in combination for gas metal-arc welding, or the electrode and shielding medium used in combination for flux cored arc welding of steels shall conform to the requirements in the latest edition of the American Welding Society AWS A5.17, A5.18 or A5.20 and CAN/CSA W48 and be capable of producing weld metal having a minimum impact strength of 27 J (Charpy V Notch) at -18°C or shall be capable of producing low alloy weld metal having the mechanical properties listed in Table 4.1.1 of AWS D1.1.
  - ◆ Low alloy weld properties shall be determined from a multiple pass weld made in accordance with the requirements of the latest edition of the applicable Specification (AWS A5.17, A5.18, or A5.20) or the welding procedure specification.
  - ◆ Every user shall demonstrate that each combination of electrode and shielding medium will produce weld metal having the above mechanical properties until the applicable AWS Filler Metal Specification is issued. At that time, the AWS Filler Metal Specification will control. The test assembly for Grades E100XX and E110XX shall be made using CAN/CSA G40.21M 700Q or ASTM A514/A517 steel.
  - ◆ The Contract Administrator may accept evidence of record of a combination that has been satisfactory tested in lieu of the test required, provided the same welding procedure is used.
  - ◆ Electrodes conforming to AWS A5.1 shall be purchased & delivered in hermetically sealed containers or shall be dried for at least two (2) hours between 230°C and 260°C before they are used. Electrodes conforming to AWS A5.5 shall be purchased & delivered in hermetically sealed containers or shall be dried 1 hour + 15 min. at a temperature of 425°C + 15°C before being used. All electrodes for use in welding ASTM A514/A517 and CSA 700 Q. steel having a strength lower than that of the E100XX classification shall be dried for 1 hour + 15 min. at a temperature of 425°C + 15°C before being used.

- ◆ Electrodes shall be dried prior to use if the hermetically sealed container shows evidence of damage. Immediately after removal from hermetically sealed containers or from drying ovens, electrodes shall be stored in ovens held at a temperature of at least 120°C. E70XX electrodes that are not used within four (4) hours, E80XX within 2 hours, E90XX within one (1) hour, and E100XX and E110XX within 0.5 hours after removal from hermetically sealed containers or removal from a drying or storage oven shall be re-dried before use. In humid atmospheres, these time limits will be reduced as directed by the Contract Administrator. Electrodes that have been wet shall not be used. Electrodes shall be re-dried no more than once.
  - ◆ Flux used for submerged arc welding shall be non-hygroscopic, dry and free of contamination from dirt, mill-scale, or other foreign material. All flux shall be purchased in moisture-proof packages capable of being stored under normal conditions for at least six (6) months without such storage affecting its welding characteristics or weld properties.
  - ◆ Flux from packages damaged in transit or handling shall be discarded or shall be dried before use at a minimum temperature of 120°C for 1 hour. Flux shall be placed in the dispensing system immediately upon opening a package. If flux is used from an open package or an open hopper that has been inoperative for four (4) hours or more, the top 25 mm shall be discarded. Flux that has been wet shall not be used. Flux fused in welding shall not be reused.
- (v) Preheat and Interpass Temperature
- ◆ The minimum preheat and interpass temperatures for welding miscellaneous metal shall conform to AWS D1.1 and CSA W59.
- (vi) Welding Processes
- ◆ Welding processes which do not conform to the provisions of AWS D1.1 or CSA W59 shall not be used without the written approval of the Contract Administrator.

BASE METAL	WELDING PROCESS					BASE METAL
	SMAW		GMAW	FCAW	SAW	
CSA G40.21M	CSA W48.1 AWS A.5.1	CSA W48.3 AWS A5.5	CSA W48.4 AWS A5.18,5.28	CSA W48.5 AWS A5.20	CSA W48.6 AWS A5.17,5.23	ASTM
230G 260W,260T	E60XX E70XX		E70S-X E70U-X	E60T-X E70T-X	F6X-XXX F7X-XXXX	A53 Gr B A500 Gr A A516Gr55,60
300W 300T  350G <sup>d</sup> 350W	E70XX or E60XX	E70XX	E70S-X  E70U-X	E70T-X <sup>a</sup> or F60T-X	F7X-XXXX or F6X-XXXX	A36 A441>4" A550GrB A501 A529 A570Gr D,E A572Gr42,45 A607Gr45

BASE METAL	WELDING PROCESS					BASE METAL
350R <sup>b,c</sup> 350A <sup>b,c</sup>  400A <sup>b,c</sup>	E70XX	E70XX	E70S-X  E70U-X	E70T-X <sup>a</sup>	F7X-XXXX	A242 <sup>c</sup> A441#4" A516Gr65,70 A570Gr50,55 588 <sup>c</sup> A606 A607Gr50,55 A618 A633Gr,A,B,C,D
400G <sup>d</sup> ,400W 400T		E80XX	GrE80S	GrE80T	GrF80	A572Gr60,65
480W 480T		E90XX	GrE90S	Gr390T	GrF90	
480A <sup>b,d</sup>		E100XX	GrE100S	GrE100T	GrF100	
700Q <sup>d</sup>		E110XX	GrE110S	Gr3110T	GrF110	A514 A517

Footnotes for Matching of Base Metal and Electrode Combinations

- a) Exclusive of E70T-2, E70T-3, E70T0-G
- b) When steels of Types R and A are used in the exposed, bare, unpainted condition, the electrodes suggested or others producing a similar alloy composition in the deposited metal should be used. For applications where the material is not boldly exposed, where a colour match is not important, for all but capping passes in multipass welds and for narrow single pass welds, the electrodes suggested for Grades 300T, 400T and 480T may be used (See CAN/CSA G40.21M).
- c) See Clauses 5.2.1.4 and 5.2.1.5 and Table 5-2 of CSA W59.
- d) See Mfg. Specifications.

Use of the same-type filler metal having the next higher mechanical properties as listed in the AWS or CSA Specifications is permitted:

- .1 In joints involving base metals of different yield points or strength, filler metal applicable to the lower strength base metal may be used subject to the Contract Administrator's approval.
- .2 When welds are to be stress relieved, the deposited weld metal shall not exceed 0.05% vanadium.
- .3 See AWS D1.1 article 4.20 for Electroslag and Electro gas weld metal requirements. Appendix C Impact Requirements are mandatory.
- .4 Lower strength filler metal may be used for fillet welds and partial penetration groove welds when indicated on the plans or in the special provisions.

(vii) Distortion and Shrinkage Stresses

- ◆ Distortion and shrinkage stresses shall be kept to a minimum by the use of jigs and fixtures, utilizing heat distribution and a welding sequence. Areas contiguous to welding operations shall be preheated to a maximum temperature of 120°C, if necessary in the estimation of the Contract Administrator to prevent distortion or weld cracking. The provisions of AWS D1.1 and CSA W59 shall be followed in the control of distortion and shrinkage stresses.

(viii) Tack Welding

- ◆ All tack welds shall be a minimum of 10 mm in length and made with low hydrogen electrodes and shall not be incorporated in the final structure without specific written authorization by the Contract Administrator.

(ix) Stud Shear Connectors

- ◆ The accessories, equipment and welding procedures for the installation of the shear connectors shall be in accordance with AWS D1.1 and CSA W59. Welding by hand will not be allowed.

(x) Hot-Dip Galvanizing

- ◆ Galvanizing, when called for on the Drawings, shall be done in accordance with ASTM A123 and CSA G164;

- ◆ All metal surfaces to be galvanized shall be cleaned thoroughly of rust, rust scale, mill scale, dirt, paint and other foreign material to SSPC – SP 6 (sand, grit or shop blasting or pickling) prior to galvanizing.
- ◆ Heavy deposits of oil and grease shall be removed with solvents prior to blasting or pickling to SSPC – SP 1.

E70.5.2 Handling, Delivery and Storage of Materials

- (a) Precautionary measures shall be taken to avoid damage to miscellaneous metal during handling, transit, stockpiling and erecting. Pinholes, or other field connection holes shall not be used for lifting purposes. Special attention is directed to the shipping and storing of miscellaneous metal. Damaged parts shall not be installed in the structure and may be rejected at the discretion of the Contract Administrator.
- (b) Materials that are not placed directly in the structure shall be stored above probable high water, on skids, platforms or in bins in a manner that will prevent distortion or the accumulation of water or dirt on the miscellaneous metal. The materials shall be kept separate and stored properly for ease of inspection, checking and handling and shall be drained and protected from corrosion.

E70.5.3 Erection

- (a) Layout
  - (i) Before erection of miscellaneous metal, the Contractor shall satisfy himself that the installation locations are in accordance with the Drawings and Specifications. All discrepancies discovered by the Contractor shall be brought immediately to the attention of the Contract Administrator.

E70.5.4 Workmanship

- (a) The parts shall be assembled as shown on the Drawings and all match marks shall be observed. The material shall be handled carefully so that no parts will be bent, broken or otherwise damaged.
- (b) Hammering which will injure or distort the member is not permitted.

E70.5.5 Misfits and Field Fitting

- (a) Misfits of any part or parts to be erected under this Specification may be cause for rejection. No field fitting shall be undertaken by the Contractor until the cause for misfit of parts has been determined and the Contract Administrator, so informed, has given direct approval to accept the Contractor's proposed corrective measures. The Contract Administrator's decision as to the quantity of such work to be performed at the Contactor's expense will be final and binding.

E70.5.6 Field Welding

- (a) All field welding shall be electric arc welding, and shall be carried out in accordance with the Drawings, AWS D1.1 and CSA W59.

E70.5.7 Final Cleaning

- (a) All metal surfaces shall be left free of dirt, dried concrete, debris or foreign matter to the satisfaction of the Contract Administrator.

E70.6 Quality Control

E70.6.1 The Contractor shall be responsible for making a thorough inspection of materials to be supplied under this Work. All miscellaneous metal shall be free of surface imperfections, pipes, porosity, laps, laminations and other defects.

- (a) Welding
  - (i) All welding may be subject to inspection by Non-Destructive Testing. This inspection shall be carried out in a manner approved of the Contract Administrator.

- (ii) The Contractor shall provide sufficient access and shop area to permit the performance of the tests.
- (iii) The Contractor shall give the Contract Administrator not less than 24 hours' notice of when work will be ready for testing and shall advise the Contract Administrator of the type and quantity of work that will be ready for testing.
- (iv) All defects revealed shall be repaired by the Contractor at their own expense and to the approval of the Contract Administrator.

#### E70.7 Quality Assurance

E70.7.1 All materials will be subject to physical inspection by the Contract Administrator and will be subject to rejection during the course of the Work and for the length of time as specified in the General Conditions, if, in the opinion of the Contract Administrator, the materials involved do not meet the requirements of the Drawings and this Specification.

E70.7.2 All materials shall be subject to testing by the Contract Administrator and will be approved only if the requirements of the Drawings, standards and this Specification are met. The Contractor shall supply the specimens for testing in accordance with the requests of the Contract Administrator.

E70.7.3 The Contractor shall furnish facilities for the inspection of material and workmanship in the mill, shop and field, and the Contract Administrator shall be allowed free access to the necessary parts of the Works.

#### E70.8 Measurement and Payment

##### E70.8.1 Supply, Fabrication and Erection of Miscellaneous Metal

- (a) The Supply, Fabrication and Erection of Miscellaneous Metal are considered incidental to the Items of Work referencing this Specification and no separate measurement or payment will be made.

##### E70.8.2 Supplying and Fabrication of Trainman's Walkway Railing

- (a) Supplying and fabrication of trainman's walkway handrails shall not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for the "Supply and Fabricate Miscellaneous Metal", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, and accepted by the Contract Administrator.

##### E70.8.3 Installation of Trainman's Walkway Railing

- (a) Installation of trainman's walkway handrails shall not be measured. This Item of Work shall be paid for at the Contract Lump Sum Price for the "Placing Miscellaneous Metal", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, and accepted by the Contract Administrator.

##### E70.8.4 Supply and Installation of Preset Anchor Units

- (a) The supply of the precast anchor units for railing will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Supply and Fabricate Miscellaneous Metal".
- (b) The installation of the precast anchor units for railing will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Placing Miscellaneous Metal".

##### E70.8.5 Supply and Installation of Railing Neoprene Pads

- (a) The supply of the railing neoprene pads will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Supply and Fabricate Miscellaneous Metal".

- (b) The installation of the railing neoprene pads for railing will not be measured. This Item of Work is considered incidental to the Contract Lump Sum Price for the "Placing Miscellaneous Metal".

## E71. SLOPE PROTECTION PAVING

### E71.1 Description

- E71.1.1 This Specification shall cover all operations related to slope protection paving Work as herein specified and as shown on the Drawings.
- E71.1.2 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.
- E71.1.3 The slopes to be covered by slope protection, unless otherwise specified, shall be trimmed or backfilled to the lines and grades specified on the Drawings, with a tolerance of plus or minus 150 mm. Concrete Slope Protections shall include fine-grading the slope surface to a plane 100 mm below the specified grades, filling with 200 granular backfill as specified herein, and placing 150 mm of reinforced concrete as specified below.
- E71.1.4 All thickness measurements indicated herein will be made perpendicular to the slope surface.

### E71.2 References

#### E71.2.1 Referenced Specifications and Drawings

- (a) The latest version of the City of Winnipeg Standard Construction Specifications and the latest edition and all subsequent revisions of the following standards:
- (i) CAN/CSA A23.1/A23.2 – Concrete Materials and Methods of Concrete; Construction/Methods of Test for Concrete;
  - (ii) CW 3310 - Portland Cement Concrete Pavement Works; and,
  - (iii) Specification E61.

### E71.3 Submittals

- E71.3.1 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.

### E71.4 Materials

#### E71.4.1 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 Contractor as directed 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.

#### E71.4.2 Granular Backfill

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

- E71.4.3 The provisions of the Specification E61 shall apply.

- E71.4.4 Concrete for slope protections shall meet all the requirement of Type 5 concrete, as defined in Specification E61.

E71.4.5 Reinforcing steel shall be hot-dip galvanized reinforcement as defined in Specification E62.

E71.5 Equipment

E71.5.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be kept in good working order.

E71.6 Construction Methods

E71.6.1 Reinforced Concrete Slope Paving

- (a) Before starting concrete slope protection work, the Contractor shall submit a detailed layout and forming plan to the Contract Administrator for review.
- (b) The slopes to be covered by concrete slope protection shall be backfilled, trimmed and dressed by the Contractor to lines and grades acceptable to the Contract Administrator. The Contractor shall supply and place granular backfill to a minimum thickness of 100 mm over the trimmed slopes. If top and/or toe cup-off walls are specified on the Drawings, trenches shall be dug to suit. Granular fill shall conform to the requirements of the "Structural Backfill" Specification.
- (c) Reinforcing steel shall be placed in accordance with Specification E62 "Reinforcing Steel". The method of securing and maintaining the reinforcement mat in its proper locations shall be reviewed and accepted by the Contract Administrator.
- (d) The concrete shall be handled and placed in accordance with Specification E61.
- (e) The concrete shall be placed in either horizontal or vertical courses, with one course being allowed to cure for at least 12 hours before the adjoining course is placed. Formwork shall be provided below and above the reinforcement mat to ensure proper slab thickness, correct positioning of the mat, and the formation of a proper cold joint between courses. Vertical or horizontal joints, as the case may be, shall be formed or grooved 50 mm to the depth of the reinforcing mat. All joints shall be finished with a sidewalk type edging tool and left unfilled. The surfaces enclosed by joints shall be given a sidewalk surface (floated surface finish; grooved texture). Finishing work shall be carried out by competent, fully experienced personnel only.
- (f) Curing shall be performed as specified in Specification E61.
- (g) Backfill at the toe, top or edges shall be non-granular, conforming to the requirement of "Backfill" Specification, and shall not be placed until the slope protection has been reviewed and accepted by the Contract Administrator.

E71.7 Quality Control

E71.7.1 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.

E71.8 Measurement and Payment

E71.8.1 Slope Protection Paving

- (a) Supplying and placing structural concrete for slope protection paving will not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for the "Items of Work" listed in the Specification E61, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the Work included in this Specification, and accepted by the Contract Administrator
- (b) The supply and installation of all isolation joints and seals for slope pavement as indicated on the Drawings shall be considered incidental to the Work.

- (c) The Contractor is reminded that excavation and grading, supply and installation of geotextile, supply and placing of granular backfill, and heating of concrete (if required) are incidental to the Work in accordance with this Specification.

## **E72. SUPPLY AND INSTALLATION OF BRIDGE ELECTRICAL**

### **E72.1 Description**

E72.1.1 This Specification shall cover all operations relating to the supply, fabrication, and erection of the electrical lighting system shown on the Drawings and as specified herein.

#### **E72.1.2 Scope of Work**

- (a) Refer to Drawing C2-CT-062 and 063.

E72.1.3 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 other things necessary for and incidental to the satisfactory performance and completion of all Work hereinafter specified.

### **E72.2 Materials**

#### **E72.2.1 General**

- (a) Refer to Drawing C2-CT-062 and 063.

### **E72.3 Construction Methods**

#### **E72.3.1 General**

- (a) Refer to Drawing C2-CT-062 and 063.

### **E72.4 Measurement and Payment**

E72.4.1 Supply and installation of bridge lighting will not be measured and paid for at the Contract Lump Sum Price for "Supply and Installation of Bridge Electrical", 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 and accepted by the Contract Administrator.

## **E73. CAST-IN-PLACE CONCRETE PILE FOUNDATIONS FOR STEEL OVERHEAD SIGN SUPPORT STRUCTURES**

### **E73.1 Description**

#### **E73.1.1 General**

- (a) The Work covered under this Item shall include all concreting operations related to construction of cast-in-place concrete pile foundations for new steel overhead sign support structures in accordance with this Specification and as shown on the Drawings.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

### **E73.2 Materials**

#### **E73.2.1 General**

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

#### **E73.2.2 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 A23.1.

#### E73.2.3 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 be approved by the Contract Administrator at least seven (7) days before any construction is undertaken. If, in the opinion of the Contract Administrator, such materials in whole or in part, do not conform to the Specifications detailed herein or are found to be defective in manufacture or have become damaged in transit, storage, or handling operations, then such materials shall be rejected by the Contract Administrator and replaced by the Contractor at their own expense.

#### E73.2.4 Patching Mortar

- (a) The patching mortar shall be made of the same cementitious 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 and placing.

#### E73.2.5 Cement

- (a) Cement shall be Type HS or HSb, high-sulphate-resistant hydraulic cement, conforming to the requirements of CSA Standard A23.1-09.

#### E73.2.6 Concrete

- (a) General
  - (i) Concrete repair material shall be compatible with the concrete substrate.
- (b) The Contractor shall be responsible for the design and performance of all concrete mixes supplied under this specification. Either ready mix concrete or proprietary repair mortars, where applicable, may be used having the following minimum properties in accordance with CSA A23.1-14:
  - (i) Class of Exposure: S-1;
  - (ii) Compressive Strength @ 56 days = 35 MPa;
  - (iii) Water / Cementing Materials Ratio = 0.4;
  - (iv) Air Content: Category 2 per Table 4 of CSA A23.1-14 (4-7%); and,
  - (v) Cement – shall be as specified in E73.2.5.
- (c) Mix design for ready mix concrete shall be submitted to Contract Administrator at least two weeks prior to concrete placing operations.
- (d) The workability of each concrete mix shall be consistent with the Contractor's placement operations. Self-compacting concrete may be used for pile foundations.
- (e) Any proposed proprietary repair mortar shall be subject to the approval of the Contract Administrator and must meet or exceed the properties of the ready mix concrete.
- (f) The temperature of all types of concrete shall be between 15°C and 25°C at discharge. Temperature requirements for concrete containing silica fume shall be between 10°C and 18°C at discharge unless otherwise approved by the Contract Administrator.
- (g) Concrete materials susceptible to frost damage shall be protected from freezing.

#### E73.2.7 Aggregate

- (a) The Contractor shall be responsible for testing the fine and coarse aggregates to establish conformance to these specifications, and the results of these tests shall be provided to the Contract Administrator if requested. All aggregates shall comply with CSA A23.1.
- (b) Coarse Aggregate
  - (i) The maximum nominal size of coarse aggregate shall be sized to suit the Contractor's mix design. Gradation shall be in accordance with CSA A23.1, Table 11, Group 1. The coarse aggregate shall satisfy the Standard Requirements specified in CSA A23.1, Table 12, "Concrete Exposed to Freezing and Thawing".
  - (ii) Coarse aggregate shall consist of crushed stone or gravel or a combination thereof, having hard, strong, durable particles free from elongation, dust, shale, earth, vegetable matter or other injurious substances. Coarse aggregate shall be clean and free from alkali, organic or other deleterious matter; and shall have an absorption not exceeding 2.25%.
  - (iii) The aggregate retained on the 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, and excess of thin particles or any other extraneous material.
  - (iv) Coarse aggregate when tested for abrasion in accordance with ASTM C131 shall not have a loss greater than thirty percent (30%).
  - (v) Tests of the coarse aggregate shall not exceed the limits for standard for requirements prescribed in CSA A23.1, Table 12, for concrete exposed to freezing and thawing.
- (c) Fine Aggregate
  - (i) Fine aggregate shall meet the grading requirements of CSA A23.1, Table 10, Gradation FA1.
  - (ii) Fine aggregate shall consist of sand, stone, screenings, other inert materials with similar characteristics or a combination thereof, having clean, hard, strong, durable, uncoated grains free from injurious amounts of dust, lumps, shale, alkali, organic matter, loam, or other deleterious substances.
  - (iii) Tests of the fine aggregate shall not exceed the limits for standard requirements prescribed in CSA A23.1, Table 12.

#### E73.2.8 Cementing Materials

- (a) Cementing materials shall conform to the requirements of CSA A3001.

#### E73.2.9 Silica Fume

- (a) Should the Contractor choose to include silica fume in the concrete mix design, it shall not exceed eight percent (8%) by mass of cement.

#### E73.2.10 Fly Ash

- (a) Fly ash shall be Type C1 or Type F and shall not exceed twenty-five percent (25%) by mass of cement.

E73.2.11 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 formation of lumps shall not be used in the Work.

#### E73.2.12 Admixtures

- (a) Air entraining admixtures shall conform to the requirements of ASTM C260.
- (b) Chemical admixtures shall conform to the requirements of ASTM C494 or C1017 for flowing concrete.

- (c) All admixtures shall be compatible with all other constituents. The addition of calcium chloride, accelerators, and air-reducing agents will not be permitted, unless otherwise approved by the Contract Administrator.
- (d) Appropriate low range water reducing and/or superplasticizing admixtures shall be used in concrete containing silica fume. Approved retarders or set controlling admixtures may be used for concrete containing silica fume.
- (e) An aminocarboxylate based migrating corrosion inhibitor admixture shall be used in concrete that will be used as a repair material that will either be in contact with or adjacent to reinforcing steel in existing concrete. Proposed admixtures shall be subject to the approval of the Contract Administrator.

E73.2.13 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.

E73.2.14 Concrete Supply

- (a) Concrete shall be proportioned, mixed, and delivered in accordance with the requirements of CSA A23.1, except that the transporting of ready mixed concrete in non-agitating equipment will not be permitted unless prior written approval is received from the Contract Administrator.
- (b) Unless otherwise directed by the Contract Administrator, the discharge of ready mixed concrete shall be completed within 90 minutes after the introduction of the mixing water to the cementing materials and aggregates.
- (c) The Contractor shall maintain all equipment used for handling and transporting the concrete in a clean condition and proper working order.

E73.2.15 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 G30.18, Grade 400 W, Billet-Steel Bars for Concrete Reinforcement. All reinforcing steel shall be new deformed billet steel bars. All bars, including ties, shall be hot-dip galvanized in accordance with ASTM A767 for a minimum net retention of 610 g/m<sup>2</sup>. Reinforcing steel supply and installation will be incidental to construction of concrete pile foundation and no separate payment will be made.

E73.2.16 Anchor Bolts, Nuts, and Washers

- (a) Anchor bolts, nuts, and washers shall be in accordance with ASTM F1554 (Grade 55), and shall be hot-dip galvanized full length in accordance with ASTM F2329 for a minimum net retention of 610 g/m<sup>2</sup>, for the entire length of the anchor bolts. The top threaded portion of the anchor bolts shall be 300 mm long and the bottom threaded portion of the anchor bolts shall be 100 mm long. Anchor bolt supply and installation will be incidental to construction of concrete pile foundation and no separate payment will be made.

E73.2.17 Anchor Bolt Templates

- (a) Anchor bolt templates shall be CSA G40.21 Grade 300W, minimum 10 mm thick, and will be incidental to construction of new concrete pile foundation and no separate payment will be made.

E73.2.18 Miscellaneous Materials

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

E73.3 Construction Methods

#### E73.3.1 Location and Alignment of Piles

- (a) Pile construction shall not commence until the Contractor has obtained clearance from the appropriate Utility Authorities including but not limited to Manitoba Hydro, MTS and City of Winnipeg Water and Waste.
- (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 one percent (1%) from the vertical.

#### E73.3.2 Buried Utilities

- (a) The Contractor shall exercise extreme caution when constructing the pile foundations in the vicinity of existing buried utilities and buildings. 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.

#### E73.3.3 Excavation

- (a) Pile excavation shall be achieved by auguring (i.e. drilling) or hydro-jet excavation for the full depth of all piles.
- (b) It may be necessary to hydro-jet excavate utilities adjacent to a pile location to adequately ascertain the location or provide enough "slack" in conduits to move them slightly to avoid interference with the pile locations. The Contract Administrator may elect to alter the location of a pile if hydro-jet excavation shows that utilities cannot be avoided.
- (c) Upon reaching the required elevation, the bottom of the excavation shall be cleaned as directed by the Contract Administrator in the field.
- (d) All excavated material from the piles shall be promptly hauled away from the Site to an approved disposal area as located by the Contractor.
- (e) 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 excavation has been completed.
- (f) If any hole is condemned because of caving, it shall be filled with lean-mix concrete and a new hole excavated 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 minimum cover around the utility. Payment will not be made for condemned piles.

#### E73.3.4 Sleeving

- (a) Steel or corrugated metal pipe sleeving shall be used if required to temporarily line the excavation to prevent bulging or caving of the walls.
- (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 excavation. 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 excavation and the sleeving shall not exceed 75 mm.
- (e) The sleeving may remain cast in place if required to protect nearby utilities at the direction of the Contract Administrator. The top of sleeving shall be 300 mm below the top of finished grade.

E73.3.5 Inspection of Excavations

- (a) Concrete shall not be placed in an excavation until the excavation has been inspected and approved by the Contract Administrator.
- (b) The Contractor shall have available suitable light for the inspection of each excavation throughout its entire length.
- (c) Any improperly set sleeving or improperly prepared excavation shall be corrected to the satisfaction of the Contract Administrator.

E73.3.6 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 excavation intact before concrete is placed.
- (b) Spacers shall be utilized to properly locate the reinforcing steel cage in the excavation.

E73.3.7 Placing Anchor Bolts

- (a) The anchor bolts shall be aligned with the steel templates matching the bolt holes in the sign structure base plate. The setting templates shall be held in place by the top and bottom nuts of the anchor bolts. The anchor bolts shall be plumb. Extreme care shall be used in this operation. Placement of anchor bolts without the steel template will not be permitted.
- (b) The threaded portion of the anchor bolts projecting above the top surface of pile shall be coated with oil, before the concrete is poured, to minimize the fouling of threads splattered by concrete residue.

E73.3.8 Forms

- (a) For "hydro-jet excavated" piles the top of the piles shall be formed with tubular forms (Sonotube) to a minimum depth of 1500 mm below final grade.
- (b) 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.
- (c) In locations of caving, the tubular form (Sonotube) should extend a minimum of 500 mm below where the shaft becomes uniform. The minimum depth of the tubular forms (Sonotube) shall be as specified by E73.3.8(a) and E73.3.8(b).
- (d) 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.

E73.3.9 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 with a hand float and provided with a one percent (1%) slope for drainage away from the centreline of the pile.

- (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.
- (e) All concrete, during and immediately after deposition, shall be consolidated by mechanical vibrations 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 that may cause honeycombing, pitting, or planes of weakness.

#### E73.3.10 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 excavation 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 excavation 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 excavation.

#### E73.3.11 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.

#### E73.3.12 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 10°C 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 3° in one hour or 20° in twenty-four hours.

#### E73.3.13 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.

#### E73.3.14 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.

#### E73.3.15 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 10°C 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 their own expense. Also, concrete allowed to freeze prior to the three (3) days will not be accepted for payment.

#### E73.3.16 Removal and Restoration of Adjacent Surface Treatments

- (a) If the new pile being constructed is located in a concrete sidewalk/median slab, the existing slab shall be removed to the nearest existing joints. If the nearest existing joint is more than 600 mm beyond the perimeter of the pile, the Contractor shall remove a square section of the existing slab that is 300 mm beyond the pile perimeter. The surface of the slab shall be saw-cut to a depth of 50 mm around the perimeter of the square section. Care shall be taken to ensure that the saw-cut edge of the section is not chipped or broken during the removal of the concrete. Concrete slabs damaged beyond the specified limits shall be replaced at the Contractor's cost to the satisfaction of the Contract Administrator. After the pile has been constructed, the concrete sidewalk/median slab shall be restored flush with the adjacent surface level.
- (b) If the pile being constructed is located in grass boulevard/median, following pile construction disturbed areas shall be backfilled and restored with sod around the new pile as directed by the Contract Administrator
- (c) If the pile being constructed is located in a paving stone surface, the paving stones shall be temporarily removed to the extent required for new pile construction and appropriately stored by the Contractor. Following pile construction, the Contractor shall cut as required and re-set the salvaged paving stones around the new pile flush with the adjacent surface level, as directed by the Contract Administrator.
- (d) The removal and restoration of surface treatments will be considered incidental to pile construction works at each Site and no separate payment will be made.

#### E73.4 Quality Control

- E73.4.1 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.

- E73.4.2 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.

#### E73.5 Measurement and Payment

**E73.5.1 Construction of New Cast-in-Place Concrete Pile Foundations**

- (a) Construction of new cast-in-place concrete pile foundations including supply and installation of anchor bolts complete with nuts, washers and steel templates will be measured on a unit basis and paid for at the Contract Unit Price for "Items of Work" listed here below, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.
- (b) Items of Work:
  - (i) Cast-in-Place Concrete Pile Foundations:
    - ◆ S780 – 762 mm Diameter Pile
    - ◆ S781 – 915 mm Diameter Pile
    - ◆ S782 – 762 mm Diameter Pile
    - ◆ S783 – 915 mm Diameter Pile
    - ◆ S784 – 1219 mm Diameter Pile
    - ◆ S785 – 1219 mm Diameter Pile
- (c) Supplying and installing all the listed materials, concrete design requirements, equipment, construction methods, and quality control measures associated with this Specification and the Drawings shall be considered incidental to "Cast-in-Place Concrete Pile Foundations", unless otherwise noted herein. No measurement or payment shall be made for this Work unless indicated otherwise.
- (d) Abandonment of piles due to utility interference will be measured on a unit basis and paid for at the Contract Unit Price per pile per Site for the "Abandonment of Piles due to Utility Interference" for abandoned piles in accordance with this Specification and accepted by the Contract Administrator.

**E74. SUPPLY AND INSTALLATION OF STEEL OVERHEAD SIGN SUPPORT STRUCTURES**

**E74.1 Description**

- (a) The Work covered under this item shall include all operations related to the supply, fabrication, delivery, and erection of new steel overhead sign support structures.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of the Work as hereinafter specified.

**E74.2 Materials**

**E74.2.1 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 used for fabrication of overhead sign support structures shall be new, previously unused material.

**E74.2.2 Handling and Storage of Materials**

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

**E74.2.3 Structural Steel**



- (a) Structural steel for all components of the overhead sign support structures shall be in accordance with CSA Standard G40.21 M, to the grades indicated on the Drawings. For purposes of hot-dip galvanizing, the silicon content in the steel shall be controlled within zero to three hundredths of a percent (0 to 0.03%) or fifteen hundredths to twenty-two hundredths of a percent (0.15 to 0.22%) for monotubular shafts and arms, and to less than three tenths of a percent (0.3%) for all other steel components.
- (b) The Contractor is advised that copies of mill test certificates showing the chemical and physical properties of all structural steel to be supplied under this Specification must be supplied to the Contract Administrator and be found acceptable prior to commencement of fabrication.
- (c) Steel shall not be acceptable unless the mill test certificate states the grade to be as indicated on the Drawings. Lower grade steel shall not be acceptable (despite favourable published mill test results). Items fabricated without steel certification shall be rejected.

E74.2.4 Flange Bolts, Nuts, and Washers

- (a) Flange bolts, nuts, and washers shall be in accordance with ASTM F3125 Grade A325, Type 1, hot-dip galvanized in accordance with ASTM F2329.

E74.2.5 Mounting Bracket Fasteners (Bracket-to-Bracket)

- (a) Mounting bracket fasteners (connecting two-clamp brackets) shall be all-thread rod conforming to one of the following:
  - (i) SAE Grade 2 hot dip galvanized;
  - (ii) ASTM A307 Grade B hot dip galvanized; and,
  - (iii) ASTM F1554 Grade 55 hot dip galvanized.
- (b) Hot-dip galvanizing shall be in accordance with ASTM F2329. Plated coatings will not be accepted.
- (c) Two (2) nuts, two (2) washers and one (1) lock washer (all hot dip galvanized) shall be provided for each segment of threaded rod.
- (d) The Contractor is permitted to field cut the threaded rod to suit the required length. If so, apply Zinga zinc rich galvanizing touch up paint to cut ends.

E74.2.6 Mounting Bracket Fasteners (Bracket to Panel)

- (a) Mounting bracket fasteners connecting the bracket to the aluminum backing bars of the sign panel shall be stainless steel all-thread hex bolts conforming to ASTM F593 Grade 304 or 316.
- (b) One (1) nut, one (1) washer, and one (1) lock washer shall be furnished with each bolt.

E74.2.7 Fasteners for Handhole Covers

- (a) Fasteners for handhole covers shall be in accordance with ASTM A276 Type 316 stainless steel.

E74.2.8 Hot-Dip Galvanizing

- (a) Hot-dip galvanizing of structural steel shall be in accordance with ASTM A123 for a minimum net retention of 610 g/m<sup>2</sup>.

E74.2.9 Galvanizing Touch-up and Field-Applied Galvanizing

- (a) Only approved products listed below shall be used for field-applied galvanizing, to touch-up damaged hot-dip galvanizing on-site and to galvanize field welds.
- (b) Approved products for self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780-09(2015) for "Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings" are as follows:

- (i) Galvalloy as manufactured by Metalloy Products Company, P.O. Box No. 3093, Terminal Annex, Los Angeles, California, available from Welder Supplies Limited, 150 McPhillips Street, Winnipeg; and
- (ii) Welco Gal-Viz Galvanizing Alloy, as manufactured by Thermocote Welco, Highway 161, York Road, Kings Mountain, North Carolina, available from Welder Supplies Limited, 150 McPhillips Street, Winnipeg.

E74.2.10 Cold Applied Galvanizing Compound

- (a) Approved cold-applied galvanizing compound is as follows:
  - (i) ZINGA, as manufactured by ZINGAMETALL, Ghent, Belgium, available from Pacific Evergreen Industries Ltd. Vancouver, BC, Ph. (604) 926-5564, and Centennial Mine & Industrial Supply, Saskatoon, Sask., Ph. (306) 975-1944.

E74.2.11 Rodent Screen

- (a) Rodent screens shall be ½" – 18F stainless steel (316L) expanded metal sheet or approved equal in accordance with B8.

E74.2.12 Aluminum T-Bars

- (a) The Contractor shall supply and deliver aluminum T-bars to the City of Winnipeg Traffic Services Branch Sign Shop a minimum of three (3) weeks in advance of the Contractor's intended date for pick-up. The City will install the sign plates/panels on the supplied T-bars.
- (b) Aluminum T-Bars shall be in accordance with ASTM B221 6061-T6.

E74.2.13 Sign Plates/Panels

- (a) Sign plates/panels will be supplied by the City of Winnipeg Traffic Services Branch. The Contractor will be responsible for pick-up of all sign plates and panels at the City of Winnipeg Traffic Services Branch Sign Shop and will be responsible for installation of all sign plates and panels on the sign support structures.

E74.2.14 Welding Consumables

- (a) Welding consumables for all processes shall be certified by the manufacturer to be complying with the requirements of CSA Standard W59 and the following Specifications:
  - (i) manual shielded metal arc welding (SMAW): All electrodes shall be basic-type electrodes conforming to CSA W48, classification E480XX, or imperial equivalent;
  - (ii) gas metal arc welding (GMAW): All electrodes shall conform to CSA W48, classification ER480S-X, or imperial equivalent;
  - (iii) flux cored arc welding (FCAW): All electrodes shall conform to CSA W48, classification E480XT-X or imperial equivalent. Electrodes shall be controlled by hydrogen (CH) designation;
  - (iv) submerged arc welding (SAW): All electrodes shall conform to CSA W48, classification F480X-EXXX or imperial equivalent;
  - (v) shielding gas shall be welding grade carbon-dioxide with a guaranteed dew point of -46°C; and
  - (vi) all electrodes, wires, and fluxes used shall be of a classification requiring a minimum impact of 27 joules at -18°C.
- (b) The proposed welding procedures and welding consumable certificates shall be submitted to the Contract Administrator for their approval at least two (2) Calendar Days prior to the scheduled commencement of any fabrication.

E74.2.15 Miscellaneous Materials

- (a) Miscellaneous material incidental to this Work shall be as approved by the Contract Administrator.

### E74.3 Equipment

E74.3.1 All equipment shall be of a type approved by the Contract Administrator and shall be kept in good working order.

### E74.4 Construction Methods

#### E74.4.1 General Requirements

- (a) Holes in the base plates shall be sized as shown on the Drawings, and provisions made for field erection must be accurate within plus or minus 13 mm between supports, without affecting final installation and load capacity.
- (b) The base plates for the sign support structures shall be constructed to be fully compatible and mountable on the anchor bolts, provided in the foundations by the Contractor.
- (c) Sufficient reinforced handholes and wiring holes shall be provided for lighting of the signs as shown on the Drawings. All wiring holes shall have threaded couplings. All unused coupling holes shall be capped with a threaded galvanized plug.
- (d) The sign support structure shall be so fabricated that erection can be achieved by means of bolted connections.
- (e) Each sign structure shall be provided with a "raised" structure identification number with a welding electrode in accordance with the details shown on the Drawings. The sign structure identification number shall be placed before hot-dip galvanizing.
- (f) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facilities shall be consulted regarding the size and location of these holes.
- (g) Prior to fabrication, the dimensional limitations on the size and shape imposed by the galvanizing facilities shall be determined for hot-dip galvanizing the sign structures.

#### E74.4.2 Fabrication

- (a) All fabrication shall be carried out in accordance with this Specification and the Contract Drawings, as well as AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals - 2015 – 1st Edition, plus all subsequent revisions.
- (b) The punching of identification marks on the members will not be allowed, except for the structure identification number.
- (c) Any damage to members during fabrication shall be drawn to the attention of the Contract Administrator in order that the Contract Administrator may approve remedial measures.
- (d) Dimensions and fabrication details that control the field matching of parts shall receive very careful attention in order to avoid field adjustment.
- (e) All portions of the Work shall be neatly finished. Shearing, cutting, clipping, and machining shall be done neatly and accurately. Finished members shall be true to line, free from twists, bends, sharp corners, and edges.
- (f) Cut edges shall be true and smooth and free from excessive burrs or ragged breaks. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.
- (g) All holes shall be free of burrs and rough edges.

#### E74.4.3 Welding

- (a) Welding of steel structures shall be in accordance with CSA W59, "Welded Steel Construction".
- (b) All seams shall be continuously welded and free from any slag and splatter. Longitudinal welds shall be a minimum of sixty percent (60%) penetration, except those within 200 mm of baseplates, flanges, and circumferential welds, which shall

be one hundred percent (100%) penetration. All circumferential groove welds shall be one hundred (100%) penetration, and where circumferential welds are used at a butt joint, an internal backup strip shall be provided.

- (c) Longitudinal seam welds in horizontal supports shall be located at the top of the horizontal members.
- (d) All welds shall be ground smooth and flush with the adjacent surface prior to hot-dip galvanizing.

#### E74.4.4 Surface Preparation and Cleaning

- (a) Surface preparation and cleaning of materials prior to hot-dip galvanizing shall be in accordance with ASTM A123 and SSPC Specification SP:6, "Commercial Blast Cleaning," unless otherwise specified herein. The Contractor shall ensure that all exterior and interior surfaces of vertical support members of sign structures are blast cleaned prior to pickling to achieve the minimum zinc coating mass of 610 g/m<sup>2</sup>. All welding and provision of holes is to be completed prior to surface preparation and cleaning, except where shown on the Drawings.
- (b) The sandblasting and cleaning of sign structures shall be done in the shop.
- (c) After the structures have been sandblasted they shall be thoroughly cleaned of all sandblasting abrasive grit and debris, with special attention paid to areas of the structure where sand and debris collect, including but not limited to, behind the gusset plates, handholes and base plate.
- (d) After the sign structures 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.

#### E74.4.5 Hot-Dip Galvanizing

- (a) The hot-dip galvanizing plant shall be a Regular Member of the American Galvanizers Association, Inc.
- (b) All outside surfaces of the overhead sign support structures shall be hot-dip galvanized in accordance with ASTM A123 to a minimum net retention of 610 g/m<sup>2</sup>.
- (c) Adequate venting and drainage holes shall be provided in enclosed sections for hot-dip galvanizing. The galvanizing facility shall be consulted regarding the size and location of these holes. Holes shall be provided by drilling not burning.
- (d) The galvanizing coating on outside surfaces of overhead sign support structures shall be generally smooth and free of blisters, lumpiness and runs. In particular, the outside surfaces of the bottom 2.5 m of the vertical support members shall have a smooth finish equal to the finish on hot-dipped galvanized handrails.
- (e) In addition to the provision of corrosion protection by the galvanized coating, the aesthetic appearance of the structure after hot-dip galvanizing will also be a criterion in the acceptance or rejection of the galvanized coating. The galvanized coating on the entire structure shall have a uniform "silver" colour and lustre. Galvanizing with parts of the structure having dull grey coating or streaks or mottled appearance will not be acceptable. If the galvanizing is rejected for aesthetic reasons, the Contractor shall rectify the appearance by applying spray-on molten zinc metallizing with 85/15 zinc/aluminum alloy. The metallizing shall be carried out in the shop before the structure is installed.
- (f) Minor defects in the galvanizing coating shall be repaired as specified here below for "Field-Applied Touch-Up Galvanizing". The Contract Administrator shall be consulted before repairs are made.
- (g) Other defects and contaminants in the galvanizing coating, such as heavy dross protrusions, flux inclusions and ash inclusions shall be grounds for rejection of the galvanizing coating system.
- (h) The Contractor shall verify the thickness of galvanized coatings as part of their own quality control testing and make their results available to the Contract Administrator.

- (i) All threaded couplings shall be rethreaded after the sign structures have been hot-dip galvanized.
- (j) The sign structures shall be stored on timber blocking after hot-dip galvanizing.

#### E74.4.6 Delivery and Erection

- (a) The Contractor shall notify the Contract Administrator at least two (2) Working Days in advance of the anticipated delivery to the Site and erection of the overhead sign support structures.
- (b) The sign structures shall be lifted and secured with nylon ropes or other approved methods. Use of steel chains and steel hooks against hot-dip galvanized or powder coated surfaces will not be permitted. The structure components (shaft and arm etc.) shall be placed on timber blocking and secured with nylon ropes during their transportation to the Site.
- (c) Refer to E75 for Traffic Management requirements during erection.

#### E74.4.7 Attachment of Structure to Anchor Bolts

- (a) Each anchor bolt shall be provided with four galvanized nuts: two (2) nuts at the bottom of the anchor bolt to secure the anchor bolt assembly template, one nut below the base plate for levelling the structure, and one nut above the base plate for anchoring the structure.
- (b) The anchor bolts shall have a minimum projection of 25 mm above the anchoring nuts.
- (c) The distance between the top of the concrete pile and the underside of the levelling nut shall not exceed one anchor bolt diameter.
- (d) The threaded portions of the anchor bolts and nuts shall be treated with a wax based lubricant.
- (e) The Contractor shall plumb the shaft by adjusting the levelling and anchor nuts.
- (f) Levelling nuts and anchor nuts shall be tightened to a snug tight condition, defined as the full effort of an ironworker using an ordinary wrench, or a few impacts of an impact wrench.
- (g) The Contractor shall tighten the top anchoring nuts in an alternating "star" type pattern as follows:
  - (i) for anchor bolts less than or equal to 38 mm diameter: 1/3 of a turn (+20°, -0°) past a snug tight condition; and,
  - (ii) for anchor bolts greater than 38 mm diameter: 1/6 of a turn (+20°, -0°) past a snug tight condition.

#### E74.4.8 Structural Bolt Installation

- (a) Structural bolts for flange and splice connections shall be tightened in accordance with the turn-of-nut method as follows:
  - (i) alternately tighten all bolts to achieve a snug tight condition. The mating surfaces shall be in firm contact;
  - (ii) tighten all bolts in accordance with Table 74-1;and,
  - (iii) following tightening, check all bolts in the joint by hand using an ordinary wrench.

**Table 74-1: Required Turns Past Snug Tight for Turn-of-Nut Method**

Bolt Diameter <i>D</i> (inches)	Bolt Length up to $4D$		Bolt Length over $4D$ to $8D$		Bolt Length over $8D$ to $12D$	
	Length up to	Required Turns	Length Range	Required Turns	Length Range	Required Turns
1/2"	2"	1/3 ± 30°	2 to 4"	1/2 ± 30°	4 to 6"	2/3 ± 45°
5/8"	2.5"	1/3 ± 30°	2.5 to 5"	1/2 ± 30°	5 to 7.5"	2/3 ± 45°
3/4"	3"	1/3 ± 30°	3 to 6"	1/2 ± 30°	6 to 9"	2/3 ± 45°
7/8"	3.5"	1/3 ± 30°	3.5 to 7"	1/2 ± 30°	7 to 10.5"	2/3 ± 45°
1"	4"	1/3 ± 30°	4 to 8"	1/2 ± 30°	9 to 13.5"	2/3 ± 45°
1 1/8"	4.5"	1/3 ± 30°	4.5 to 9"	1/2 ± 30°	10 to 15"	2/3 ± 45°
1 1/4"	5"	1/3 ± 30°	5 to 10"	1/2 ± 30°	11 to 16.5"	2/3 ± 45°

**E74.4.9 Installation of Sign Plates/Panels**

- (a) The Contractor will be responsible for installation of sign plates/panels on the sign support structures, unless otherwise noted on the Drawings.
- (b) The Contractor shall take great care when handling existing or new plates. Any damage to sign plates will be repaired by the City of Winnipeg Traffic Services. All costs and delays associated with the repair shall be borne by the Contractor.
- (c) The Contractor shall install the sign plates/panels on the sign support structures immediately following erection of the support structures (same day). In no case will a sign support structure be allowed to be erected and left for a significant amount of time (greater than one (1) day) without having the sign plates/panels installed.
- (d) Sign panels shall be installed such that the panels are level to ground after all support structure deflection has occurred.
- (e) Sign panels shall not be twisted or warped following installation.

**E74.4.10 Rodent Screens**

- (a) Rodent screens that will prevent vermin and debris from entering the gap between the bottom of the base plate and the top of the concrete foundation shall be installed in lieu of grout pads at all overhead sign structure bases.
- (b) The entire gap shall be covered with an expanded stainless steel metal screen, in accordance with E74.2.11. The bottom edge of the expanded stainless steel screen shall be in full contact with the surface of the concrete foundation. The top edge of the expanded stainless steel screen shall not extend beyond the top surface of the structure base plate.
- (c) The rodent screen shall be made of one continuous piece of expanded stainless steel with only one overlapping splice where the ends come together and lap a minimum of 75 mm.
- (d) The rodent screen shall be attached to the vertical side of the structure baseplate with self-tapping stainless steel screws (#8-1/2" long) complete with stainless steel washers. Pilot holes shall first be drilled into the baseplate to facilitate screw installation. Screws shall be installed at 200 mm on center maximum and at least one screw shall be installed through the overlapping splice to clamp the two layers of rodent screen together.
- (e) The two overlapping layers of rodent screen shall also be clamped just above the concrete foundation with a stainless steel fastener assembly consisting of a machine screw (#8-5/8" long) complete with a nut, two flat washers and a lock washer. The rodent screen shall be tightly clamped between the flat washers.

#### E74.4.11 Field-Applied Touch-up Galvanizing

- (a) Any areas of damaged galvanizing on the sign structures shall receive field-applied touch-up galvanizing.
- (b) Surfaces to receive touch-up galvanizing shall be cleaned using a wire brush, a light grinding action, or mild blasting to remove loose, scale, rust, paint, grease, dirt, or other contaminants.
- (c) 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 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.
- (d) For cold applied galvanizing compound, the approved product shall be applied by either a brush or roller. The compound shall be applied in three (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.

#### E74.5 Quality Control

##### E74.5.1 General

- (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 Work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection 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.
- (b) 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.

##### E74.5.2 Welding Qualifications

- (a) The Contractor shall produce evidence that the plant has recently been fully approved by the C.W.B. to the requirements of CSA W47.1 Division 2.1 for welding of steel structures.
- (b) Approved welding procedures shall be submitted to the Contract Administrator prior to fabrication of any steel items.

##### E74.5.3 Testing

- (a) In addition to the Contractor's own quality control testing of all materials, welding procedures and steel fabrication including hot-dip galvanizing will be inspected and tested by the Contract Administrator to ascertain compliance with the Specifications and Drawings.
- (b) The Contract Administrator will hire a testing agency certified by the Canadian Welding Bureau to carry out shop fabrication inspection and testing before the overhead sign support structures are approved ready for installation of coating system. The inspector shall have access to all of the fabricator's normal quality control records for this Contract, specified herein. Inspection and testing will include:
  - (i) visual inspection of one hundred percent (100%) of welds;
  - (ii) ultrasonic testing of one hundred percent (100%) of full penetration sections of longitudinal seam welds and circumferential butt welds;
  - (iii) magnetic particle testing of a random ten percent (10%) of partial penetration sections of longitudinal seam welds;

- (iv) ultrasonic testing of twenty-five percent (25%) of base plate and flange plate welds; and,
- (v) inspection of hot-dip galvanizing and coating thickness.
- (c) Welds that are found by any of the inspection and testing methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor.
- (d) No repair shall be made until agreed to by the Contract Administrator.
- (e) Defects in hot-dip galvanizing shall be rectified as directed by the Contract Administrator.

E74.5.4 Unacceptable Work

- (a) Any Work found to be unacceptable shall be corrected in accordance with CSA W59.
- (b) No repair shall be made until agreed to by the Contract Administrator.

E74.6 Measurement and Payment

E74.6.1 Supply and installation of new steel overhead sign support structures will be measured on a unit basis per new steel overhead sign support structure supplied and installed, and paid for at the Contract Unit Price for "Items of Work" listed here below, which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.

E74.6.2 Items of Work:

- (a) Supply and Installation of New Steel Overhead Sign Support Structures:
  - (i) S780 – WB Grant at Waverley St
  - (ii) S781 – NB Waverley St at Taylor Ave
  - (iii) S782 – WB Taylor Ave at Waverley St
  - (iv) S783 – EB Wilkes Ave at Waverley St
  - (v) S784 – SB Waverley St at Victor Lewis Dr
  - (vi) S785 – SB Waverley St at Wilkes Ave

**E75. TRAFFIC MANAGEMENT FOR OVERHEAD SIGN SUPPORT STRUCTURES INSTALLATION**

E75.1 Description

- E75.1.1 Further to clauses 3.6 and 3.7 of CW 1130-R3, the following shall apply for any overhead sign support structure works:
- (a) multiple lane closures, meaning the simultaneous closure of more than one (1) lane, shall be permitted as described herein, for the installation of overhead sign structures;
  - (b) multiple lane closures will not be permitted:
    - (i) 6:00 am to 8:00 pm Monday through Saturday, unless otherwise approved by the Contract Administrator.
  - (c) complete directional or full closures, for the purpose of installing the bridge-type steel overhead sign support structure (S785) shall be limited to a maximum of ten (10) minutes;
  - (d) the Contractor shall submit the online Regional Street Lane Closure Form at least three (3) Business Days prior to beginning Work on any particular street;
  - (e) pedestrian and ambulance/emergency vehicle access must be maintained at all times;



- (f) flagperson(s) shall be used to affect temporary lane closures during the lifting of structures over open lanes. Flagperson(s) shall meet all applicable Manitoba Workplace Safety and Health regulations; and,
- (g) all traffic control shall be implemented in accordance with the City of Winnipeg's latest edition of the Manual of Temporary Traffic Control on City Streets.

#### E75.2 Submittals

- E75.2.1 The Contractor shall submit detailed traffic management plans for each overhead sign structure location for review a minimum of fourteen (14) days prior to implementing the lane closure(s) or performing any work.
- E75.2.2 The detailed traffic management plans shall be prepared in accordance with the current edition of the City of Winnipeg's Manual of Temporary Traffic Control on City Streets.
- E75.2.3 The detailed traffic management plans shall:
  - (a) show a plan view of the area for each stage of construction or traffic control setup;
  - (b) show all applicable signage and traffic management devices to be used;
  - (c) provide all relevant dimensions and geometric layout of devices such as sign spacing, taper lengths, cone spacing, etc.;
  - (d) indicate the general sequence of device installation;
  - (e) indicate the date and time of implementation of the devices;
  - (f) indicate the expected date and time of the removal of the devices;
  - (g) confirm the work zones created by the closures are adequate for the operation of cranes, and other construction operations required for the work; and,
  - (h) all other information as deemed necessary by the Contract Administrator and/or other agencies reviewing the submitted traffic management plans.

#### E75.3 Measurement and Payment

- (a) No measurement or payment will be made for the work described in this Specification. Traffic Management for Overhead Sign Support Structure Installation shall be incidental to the works in E74.

### **RAIL WORKS**

#### **E76. RAILWAY PROPERTY CLEANING**

##### E76.1 Description

##### E76.1.1 General

- (a) Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
- (b) Store volatile wastes in covered metal containers and remove from premises daily.
- (c) Prevent accumulation of wastes which create hazardous conditions.
- (d) Provide adequate ventilation during use of volatile or noxious substances.

##### E76.2 Materials

- E76.2.1 Use only cleaning materials recommended by manufacturer of surface to be cleaned and as recommended by cleaning material manufacturer.

##### E76.3 Construction Methods

##### E76.3.1 Cleaning During Construction

- (a) On a daily basis maintain premises free from debris and waste material.

- (b) Maintain Project Site and public properties free from accumulations of waste materials and rubbish.
- (c) Remove waste materials and rubbish from Site.
- (d) Disposal of wastes on Railway property by burial or burning shall not be permitted.

#### E76.4 Measurement and Payment

##### E76.4.1 Cleaning

- (a) Cleaning and disposal operations are considered incidental to the Work and no separate measurement or payment will be made.

#### E77. **RAILWAY GRADING AND DRAINAGE**

##### E77.1 Description

###### E77.1.1 General

- (a) Further to City of Winnipeg Standard Specifications the following shall apply.

###### E77.1.2 Definitions

- (a) Embankment Fill: material placed above original ground or stripped surface to construct the sub-base for the rail bed or gravel pad.
- (b) Suitable site material: As per Specification CW 3170, Clause 9.2(b), Common Excavation – Suitable Site Material shall consist of any excavation (including ditch excavation) which yields suitable Site material, as determined by the Contract Administrator.
- (c) Sub-base elevation: elevation immediately below sub-ballast or road surface gravel.

###### E77.1.3 Requirements of Regulatory Agencies

- (a) Adhere to municipal, provincial and national government requirements relating to safety of excavations and protection of workers.

###### E77.1.4 Soil Conditions

- (a) A soil investigation has been carried out at the Site to determine soil conditions, soil characteristics and water levels.
  - (i) The Geotechnical Report is included in Appendix 'A'.
- (b) The City will not accept unfamiliarity with encountered soil conditions and water levels as a basis for a claim for additional payment.

##### E77.2 Materials

###### E77.2.1 Embankment materials require approval by Contract Administrator.

- (a) Material used for embankment shall not contain organic matter, frozen lumps, snow, ice, weeds, roots, logs, stumps or any other objectionable matter.

###### E77.2.2 Embankment Fill Material

- (a) Embankment fill material from off Railway property for the shoofly only shall consist of 100 mm crushed limestone sub-base materials with properties as specified in CW 3110.
- (b) The Contractor shall identify their proposed source of embankment fill material after award, no later than one week prior to commencement of construction.
- (c) The Contractor shall provide at no cost to the City representative samples to the Contract Administrator for approval in accordance with CW 3110.
- (d) Embankment fill material shall not be used for embankment construction prior to approval by the Contract Administrator.

### E77.3 Construction Methods

#### E77.3.1 Preparation of Areas for Earth Works

- (a) Strip fill areas of unsuitable materials as designated by Contract Administrator. As per Specification CW 3170, Clause 9.2a):
- (i) stripped material shall be classified as "Topsoil Excavation";
  - (ii) unless specified otherwise, this material is paid under "Topsoil Excavation";
  - (iii) strip organic material to necessary depth or as directed by the Contract Administrator;
  - (iv) salvage stripping material for later re-use on embankment side slopes;
  - (v) the maximum depth of stripping in ditches shall be the ditch invert unless subgrade material is deemed unsuitable by the Contract Administrator; and,
  - (vi) after completion of embankment, spread stripping uniformly against embankment cut and fill slopes or as directed by the Contract Administrator. Any excess material is to be disposed of in accordance with CW 1130.

#### E77.3.2 Excavating

(a) General

- (i) Advise Contract Administrator sufficiently in advance of excavation operations for initial cross-sections to be taken.
- (ii) Remove and dispose of material off Railway property in excess of requirements for embankment construction as directed in accordance with CW 1130.
- (iii) Take particular note of the following:
  - ◆ where necessary, the Contract Administrator may design cuts and fills especially for stability, which will affect dimensions indicated on the Drawings;
  - ◆ remove unsuitable materials encountered in cut sections to depth and extent directed;
  - ◆ replace with approved material and compact;
  - ◆ when slides occur in cuts after they are properly formed, remove the material, modify the slopes and adopt other precautions as directed;
  - ◆ the materials shall be classified as "Common Excavation" and Contractor will be paid for its removal at the Contract Unit Price for "Common Excavation";
  - ◆ complete all excavation as far in advance of fill construction as practical; and,
  - ◆ maintain all work in a well-drained condition, free of debris and other obstructions.
- (iv) The City will not pay for additional excavation (borrow or common) which the Contractor may require for their convenience or movement of equipment.

(b) Waste Material

- (i) Remove and dispose of unsuitable material as directed.
  - ◆ Refill depressions and holes from this work. This work shall be paid for at the Contract Unit Price for "Common Excavation".
- (ii) Remove and dispose of material off Railway property in excess of requirements for embankment construction as directed.

(c) Ditch Excavation

- (i) Complete ditch excavation as far in advance of embankment construction as practical, to the grades set by the Contract Administrator, to permit ready flow of surface water.
- (ii) Excavate ditches in cuts at the same time as the main cut in order that the excavated material can be used in adjacent embankments.
- (iii) Use suitable equipment to ensure cut slopes and sub-base sections are not undercut.

(iv) Maintain and keep ditches open and free from debris and other obstructions until final acceptance.

(d) Material Removal and Stockpiling

(i) Use suitable equipment to ensure cross contamination of nearby materials is kept to a minimum.

(ii) Maintain all work in a well-drained condition, free of debris and other obstructions.

(iii) Stockpile material at a location identified by the Contract Administrator.

E77.3.3

Embankments

(a) Where indicated or directed by Contract Administrator, bench into existing slopes to ensure a proper bond between new materials and existing surfaces.

(i) The City will not pay extra compensation for this operation.

(b) Prior to placement of fill material, compact subgrade to ninety-five percent (95%) of Standard Proctor maximum density, in accordance with this Specification and CW 3110.

(c) Do not place material which is frozen or place material on frozen surfaces.

(d) Maintain a crowned surface during construction to ensure ready run-off of surface water.

(e) Construction methods for placing suitable site material shall be as per Specification CW 3170, Clauses 9.6 and 9.7.

(f) Maintain fill to typical sections indicated on Drawings.

(g) Placement of Geotextile

(i) Place geotextile, if requested, in accordance with CW 3130 and this Specification.

(ii) The geotextile shall be installed full width for the required length of the embankment in accordance with the manufacturer's recommended procedure. Align machine direction parallel to the rail line, free of tension, stress, folds, wrinkles, or creases. Joints in the fabric shall be overlapped not less than 600 mm (2 feet).

(iii) The fabric shall be placed within a key in the existing embankment and secured as directed by the Contract Administrator.

(iv) The fabric shall be placed and wrapped back upon itself at the end away from the track as directed by the Contract Administrator.

(v) Dumping of material or equipment movement directly on the geotextile will not be allowed.

(vi) The geotextile shall not be exposed more than 48 hours before covering.

(h) Execution

(i) Compact all embankment fill material and excavations to a density of not less than ninety-five percent (95%) maximum dry density in accordance with Standard Proctor Compaction Test (ASTM D698).

(ii) Place and compact embankment fill to full width of section in uniform layers not exceeding 200 mm (8 inches) loose thickness. Contract Administrator may authorize thicker lifts if specified compaction can be achieved.

◆ Do not place boulders exceeding 200 mm (8 inches) in diameter in the fill.

◆ Do not place boulders exceeding 150 mm (6 inches) in size within 600 mm (2 feet) of sub-base level.

(iii) Scarify or disk and aerate fill material which is too wet, until proper water content for compaction is attained. With approval of Contract Administrator, blend drier material with wet material to achieve a water content satisfactory for compaction as specified in E77.3.3(h)(i).

- (iv) Remove material not thoroughly compacted at no cost to the City. The City of Winnipeg Specifications
- (v) Where compaction is not being obtained, cease placing material and give additional compaction to material in place.
- (vi) Operate sufficient compaction equipment to thoroughly compact the fill at the rate being placed.
- (vii) Place and compact side slopes of fills simultaneously with core of fill.
  - ◆ Do not construct fill by means of central core finished off by side dumping of materials to make up the section.
- (viii) In areas incapable of supporting earth moving equipment, increase the cover over the areas to sufficiently support equipment.
  - ◆ Place the layer over full width of embankment.
  - ◆ Thoroughly compact the surface.
  - ◆ Build remainder of fill in layers of specified normal thickness.
  - ◆ Use granular material for initial fill layer in soft swampy areas, as directed.
- (ix) Route all loaded earth-hauling equipment over entire width of embankment.
- (x) Construct and maintain embankments in a well-drained condition.

#### E77.3.4 Field Quality Control

- (a) To be completed in accordance with CW 3110.

#### E77.3.5 Finishing

- (a) Remove soft or other unstable material that will not compact properly and fill resulting depressions with approved material.
- (b) Shape and compact entire rail bed to design elevations within 13 mm (0.5 inch) of design but not uniformly high or low.
- (c) Do scarifying, blading, compacting or other methods of work as necessary to provide thoroughly compacted rail bed shaped to grades and cross-sections indicated or directed.
- (d) Finish back and side slopes of common material to neat condition, true to line and grade.
- (e) Trim all waste and stockpile areas neatly and maintain in a well-drained condition.
- (f) Maintain finished surfaces in a condition conforming to this section until acceptance and surveyed by the Contract Administrator.

#### E77.4 Measurement and Payment

##### E77.4.1 General

- (a) The Unit Prices, submitted in the Bid, shall include the entire cost of supplying all labour, material, equipment and tools for stripping, excavation and grading of all classes of material; all as required to construct final rail bed and embankment as shown on the Drawings and specified in this Specification.
- (b) The Unit Prices shall also include the cost of supplying all pumping, bailing, shoring and sheeting, etc. and also the furnishing of all necessary pumps, tools and equipment required to keep all excavations dry.
- (c) All measurement and payment will be in accordance with applicable City of Winnipeg Specifications.

#### E78. **RAILWAY GRANULAR MATERIALS**

##### E78.1 Description

- E78.1.1 Supply, placement and compaction of granular material for sub-ballast material.

**E78.2 Materials**

- E78.2.1 State on Form J: the source of granular materials to be incorporated into work.
  - (a) Contract Administrator will investigate quality of material after award of contract.
- E78.2.2 Materials require approval before being used in the Work.
- E78.2.3 Provide access for sampling.
- E78.2.4 The Contractor shall provide, at no cost to the City, necessary equipment to obtain samples of granular materials.
- E78.2.5 If requested, the Contractor shall submit samples of the proposed granular material for testing and evaluation.
- E78.2.6 If, in opinion of Contract Administrator, materials from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, locate an alternate source or demonstrate that material from source in question can be processed to meet specific requirements.
- E78.2.7 Should a change of material source be proposed during work, advise Contract Administrator two (2) weeks in advance of proposed change to allow sampling and testing.
- E78.2.8 Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.
- E78.2.9 When common excavation material is suitable for use as granular material, use such common excavation materials as granular material in preference to obtaining granular material from other sources.
- E78.2.10 Include in unit price for granular material entire cost of constructing and/or maintaining suitable access roads, opening work faces, clearing, grubbing and stripping of pit areas, and royalties.
- E78.2.11 Sub-ballast:
  - (a) Material to be crushed or screened pit run gravel, containing no more than three percent (3%) organics by weight as determined by ASTM C 123.
  - (b) Gradations to be within limits specified.

Sieve Size	Percent Passing
75 mm (3")	100
25 mm (1")	60 – 90
4.75 mm (#4)	35 – 60
425 micro m (#40)	10 -40
75 micro m (#200)	3 – 10

**E78.3 Construction Methods**

- E78.3.1 Placing
  - (a) Use granular material to construct sub-ballast course and other work as indicated or directed.
  - (b) Do not place granular material until finished sub-grade surface is inspected and approved by Contract Administrator.
  - (c) Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.
  - (d) Place, using methods which do not lead to segregation or degradation of material.

- (e) Place material to full width of section in uniform layers not exceeding 150 mm (6 inch) loose thickness and compact to specified density. Contract Administrator may authorize thicker lifts if specified compaction can be achieved.
- (f) Replace fouled material with approved material and compact, at no cost to the City.

#### E78.3.2 Compaction

- (a) Compact full width to density not less than ninety-five percent (95%) maximum dry density in accordance with Standard Proctor Compaction Test (ASTM D698).
  - (i) Sub-ballast – ninety-five percent (95%) Standard Proctor Maximum Dry Density.
- (b) Apply water as necessary during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
- (c) Apply water to reduce dust nuisance.
- (d) In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

#### E78.3.3 Field Quality Control

- (a) Contract Administrator shall take representative samples at expense of Contractor and submit them to laboratory tests for approval of its quality and nature prior and/or during its use.
  - (i) Provide necessary personnel and equipment to permit adequate investigation and sampling.
  - (ii) Advise Contract Administrator at least two weeks in advance of use of any material to allow sufficient time for sampling and testing.
  - (iii) The City will pay for testing of material.
- (b) Contract Administrator may perform density and other tests on site, to control construction.
  - (i) Facilitate such work and pay for any testing apparatus damaged from the operations.
  - (ii) Do not claim for delays to the operations resulting from field tests.
- (c) Final acceptance of materials made after materials dumped, spread and compacted in place.
  - (i) Contract Administrator may reject at source, on transportation vehicle or in place.
  - (ii) Contract Administrator will not consider for payment the removal and disposal of any rejected material.

#### E78.3.4 Finishing

- (a) Finished sub-ballast surface shall be within 15 mm (0.5 inches) of design elevations but not uniformly high or low.
- (b) Maintain surface in a clean condition, free draining and conforming to this Specification until final acceptance.

#### E78.4 Measurement And Payment

- E78.4.1 The Unit Price, submitted in the Bid, shall include the entire cost of supplying all labour, material and equipment to supply, load, haul, place and compact suitable granular materials in the Work as shown on the Drawings and specified in this Specification.

E78.4.2 Granular material will be measured in cubic metres of granular material compacted in place based on surveyed quantities and paid for at the Contract Unit Price per cubic metre for "Supply and Placing Sub-Ballast Material", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, accepted and measured by the Contract Administrator.

(a) Calculation of quantities will be based on granular material compacted/tamped in place based on surveyed quantities

E78.4.3 Granular material placed outside design sections as staked by the Contract Administrator will not be considered for payment.

## E79. CORRUGATED STEEL PIPES FOR RAILWAY EMBANKMENT

### E79.1 Description

E79.1.1 Further to CW 3610 and CW 3615, this section specifies requirements for supplying and installing corrugated steel pipes complete with riprap.

### E79.2 Materials

E79.2.1 Corrugated Steel Pipe (C.S.P.) size and gauge to be as indicated on Drawings.

E79.2.2 Manufacture all culverts to the CN Specification contained on Plan Number R7A-80\_2, dated September 29, 2003.

E79.2.3 Asphalt coating is not required.

E79.2.4 Coupling bands to be 600 mm (24 inches) wide and annularly corrugated unless indicated otherwise.

E79.2.5 Pipe ends to be annularly corrugated over length of 300 mm (12 inches).

#### E79.2.6 Granular Backfill

(a) Material to be pit-run gravel.

(b) Gradation to be a maximum of eight percent (8%) fines passing the 75 micrometer sieve size and maximum size not to exceed 100 mm.

(c) Liquid limit shall not exceed 25 and the plasticity index shall not exceed 6.

(d) The Contractor shall provide a sieve analysis of the granular backfill or provide samples of the granular backfill to the Contract Administrator for testing if requested.

#### E79.2.7 Bedding Sand

(a) Bedding material shall be clean sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

(b) Material shall meet the following gradation:

Sieve Size (mm)	Percent Passing (by weight)
12.5	100%
5.0	95%
0.63	2 - 10%
0.075	0 - 3%

(c) The Contractor shall provide a sieve analysis of the sand for the Contract Administrator's approval or provide samples of the sand to the Contract Administrator for testing if requested.

### E79.3 Construction Methods

#### E79.3.1 General

(a) Install culverts in accordance Drawings, CW 3610 and this Specification



#### E79.3.2 Placing of Pipes

(a) C.S.P.

- (i) Culverts are to be installed in the upgrade direction to allow flow of water at all times.

#### E79.3.3 Backfilling

(a) Do not place backfill until culverts are inspected and approved by the Contract Administrator.

(b) Place and compact approved granular backfill material in layers not exceeding 200 mm (8 inches) loose thickness.

- (i) Compact granular material in accordance with CW 3610.
- (ii) Place granular backfill material simultaneously on both sides of culvert to avoid eccentric loading.
  - ◆ For culverts not under railway tracks, carry material to height of  $\frac{1}{4}$  diameter of pipe but not less than 300 mm above top of culvert.
  - ◆ For culverts under railway tracks, carry compacted granular material to height equal to diameter of culvert above top of culvert, prior to constructing embankment over the culvert.
  - ◆ When placing culverts the minimum allowable distance below base of rail, carry the compacted granular material to sub-base level.
- (iii) Compacted granular backfill material is to extend horizontally from the outside of culvert, a distance equal to diameter of pipe but not less than 600 mm (24 inches), except where pipe is laid in excavated trenches, then backfill and compact to full width of trench.
- (iv) In areas not accessible to rolling equipment, place in lifts not exceeding 150 mm (6 inches) and compact to specified density with approved mechanical tampers.
- (v) Do not place large stones, rocks or other sharp objects within 1.2 m (4 feet) of culvert.
- (vi) (Do not damage nor distort the culvert).
  - ◆ Replace damaged culverts at no cost to the Contract Administrator.
- (vii) Do not place frozen material, ice and snow in backfill material.
- (viii) Use approved embankment fill (common excavation or borrow material) material to bring up the remaining backfill to sub-base and compact to required density as specified in Specification E77.

#### E79.3.4 Protection of Pipes During Construction

(a) Where applicable, place a sufficient depth of common material over the granular backfill to protect culverts against heavy construction equipment.

#### E79.3.5 Culvert Removal

- (a) Excavate, relocate/remove existing culverts indicated on the Drawings or as directed by the Contract Administrator.
- (b) Culverts removed that are not to be relocated are to be disposed of off-site.
  - (i) Shape the slopes around culverts to match the ditch and embankment lines and grades.
- (c) Riprap at Ends of Pipe
- (d) Shape and trim the slopes and ditch bottom neatly prior to placing riprap as indicated on the Drawings or as directed by the Contract Administrator.
  - (i) Fill all depressions and compact.
- (e) Place riprap in accordance with CN plan number R7A-80\_2 dated September 29, 2003.

- (f) Place riprap as indicated on typical sections, fill all voids and trim neatly prior to final acceptance by the Contract Administrator. The supply and installation of the riprap will be considered incidental to the Work and no separate measurement or payment will be made.

#### E79.4 Measurement and Payment

- E79.4.1 The Unit prices submitted in the Bid shall include the entire cost of supplying all labour, material and equipment to supply and place in the Work, corrugated steel pipes as shown on the Drawings and specified in this Specification.
- E79.4.2 Supply and installation of corrugated steel pipe culvert shall be measured and paid in accordance with CW 3610.
- E79.4.3 Connections to existing culverts shall be measured and paid for in accordance with CW 3610.
- E79.4.4 The removal of existing culverts shall be measured and paid for in accordance with CW 3610.

### UNDERGROUND WORKS

#### E80. MIDTOWN FEEDER MAIN AND WATERMAIN CASING PIPE

##### E80.1 Description

- E80.1.1 This Section details the installation of Midtown feeder main and watermain casing pipes beneath CN rail tracks.

##### E80.2 Definitions

- E80.2.1 CLSM means Controlled Low Strength Material

##### E80.3 Submittals

- E80.3.1 Submit Shop Drawings for the following in accordance with E4:
  - (a) casing spacers and hardware;
  - (b) casing pipe and hardware, including:
    - (i) Mill certificates for steel casing materials
  - (c) coating information including:
    - (i) coating and field repair materials;
    - (ii) blank quality control plan and data forms to be used by coating applicator;
    - (iii) coating manufacturer's recommendations for the coating and field repair products including surface preparation, required ambient conditions, wet and dry film limits per coat, time to recoat windows, recommended dry film thickness and holiday testing;
    - (iv) methods for performing surface preparation in a plant and in the field;
    - (v) methods for preparing factory welds and field welds for coating application; and,
    - (vi) completed quality control forms showing the actual recorded data for the plant and field coating applications performed for this Contract meet all manufacturer's requirements.
- E80.3.2 Submit a written Midtown Feeder Main casing installation procedure for review by the Contract Administrator in accordance with E4, a minimum of fifteen (15) Working Days prior to undertaking the work. The installation procedure shall include the following:
  - (a) feeder main trench dewatering locations, installation procedures, and pumping plans according to D22 Dewatering and Drainage during Construction;

- (b) excavation and shoring installation procedure. Include the following minimum information:
  - (i) pile installation procedures, including crane staging and pre-bore activities; and,
  - (ii) means of ensure embedment material remains stable outside of the excavation zone.
- (c) description of temporary supports for the Midtown feeder main complete with sketches;
- (d) casing spacer installation procedure;
- (e) casing pipe installation procedure;
- (f) means of supporting the casing pipe prior to placement of the CLSM;
- (g) CLSM placement procedure;
- (h) trench backfill procedure; and,
- (i) all information reasonably requested by Contract Administrator.

#### E80.3.3 Control Low Strength Material Submissions

- (a) Trial Mix:
  - (i) submit Mix Design to the Contract Administrator a minimum of five (5) Business Days prior to preparing Trial Mix; and,
  - (ii) submit Trial Mix Test results within five (5) Business Days of completion of testing.
- (b) Submit credentials of design, mixing and installation supervisors to the Contract Administrator.
- (c) Submit placement plan and Quality Control Plan to Contract Administrator for review a minimum of five (5) Business Days prior to placement. The plan shall describe the system layout, material verification procedures, and lift heights.

#### E80.4 Materials

##### E80.4.1 Steel Casing Pipe

- (a) Casing pipe shall conform to the following standards:
  - (i) AREMA Manual for Railway Engineering, 2016; and,
  - (ii) Railway Association of Canada – TC-E-10.
- (b) Steel and steel pipe products shall conform to ASTM A36 or ASTM A525 with a minimum yield strength of 241 MPa.
- (c) Minimum wall thickness:
  - (i) 1372 mm Casing: 20.7 mm.
- (d) Welded Casings:
  - (i) All joints shall be fully welded in accordance with E80.5.4.
- (e) Flanged Split Sleeve Casings:
  - (i) all joints shall be assembled with a gasket to provide a water tight joint;
  - (ii) longitudinal joints shall be flanged and bolted;
  - (iii) circumferential Joints:
    - ◆ Joints shall be staggered; and,
    - ◆ Where butt joints are used, an external joint band shall be utilized.
  - (iv) minimum flange width: 88.9 mm;
  - (v) flange shall be constructed from material of equal thickness to that of the pipe itself. If welded it shall be completed with a full penetration butt weld or fillet weld with a leg length equal to that of the material thickness;
  - (vi) minimum flange bolt spacing: 305 mm;
  - (vii) hardware shall conform to the following:

- ◆ Bolts: ASTM F593 or ASTM F738M, type 316 stainless steel. Minimum diameter: 19 mm (3/4"); and,
- ◆ Nuts: ASTM F594 or ASTM F836M, type 316 stainless steel.

(f) Gaskets

- (i) non crystalline a-polar viscous elastic solid polyolefin coating. Approved product: Viscowrap-ST produced by Visotaq or approved in accordance with B7;
- (ii) maximum segment length 3.05 m;

(g) Approved Products:

- (i) Flanged Maintenance Pipe – Heavy Walled Split Casing produced by Ironhed LLC; and,
- (ii) or approved equal in accordance with B8.

(h) Coatings:

- (i) Casing pipe (interior and exterior) shall be coated with an epoxy coating system conforming to E80.4.5 or E80.4.8 and E80.5.6; and,
- (ii) Repair exterior coatings at all weld locations in accordance with the manufactures recommendations and the specifications contained herein.

E80.4.2

Metallic Casing Spacers

- (a) Casing spacers shall be constructed from type 304 stainless steel.
- (b) Casing spacers shall be supplied complete with glass reinforced polyester or nylon runners, capable of providing di-electric insulation between the casing pipe and runner.
- (c) Minimum band thickness: 14 Gauge
- (d) Minimum band thickness: 305 mm
- (e) Minimum riser thickness: 10 gauge
- (f) Steel casing spacers shall be coated with a fusion bonded epoxy.
- (g) Hardware shall be 304 stainless steel.
- (h) Midtown Feeder Main:
  - (i) estimated Pipe Weight: 12.92 kN/m;
  - (ii) max casing spacer separation: 1.2 man,
  - (iii) the casing spacer supplier shall confirm the load carrying capacity of the spacer and provide maximum spacing recommendations based on the applied loads and capacity of the casing spacer.
- (i) Approved Products:
  - (i) Model S Metallic Casing Spacer produced by Pipeline Seal and Insulator, Inc.
  - (ii) or approved equal in accordance with B8.

E80.4.3

Casing End Seals

- (a) Ends of the casing shall be sealed against the carrier pipe to prevent water and soil transfer in to the annulus.
- (b) End seal shall be a wraparound style complete with stainless steel bands for both the casing and carrier pipe connections.
- (c) Seal shall be manufactured from 3.175 mm (1/8") thick EPDM 60 rubber.
- (d) The overlap portions of the rubber shall be sealed to provide a water tight membrane.
- (e) Approved products:
  - (i) Model M Wrap Around End Seal produced by Pipeline Seal and Insulator, Inc.; and,
  - (ii) or approved equal in accordance with B8.

- E80.4.4            Controlled Low Strength Material
- (a) Portland cement conform to CSA A3001 Type HS
  - (b) Flyash shall conform to CSA A3001 Class CI Fly Ash
  - (c) Foaming Agents:
    - (i) shall conform to ASTM C869-11 and be tested in accordance to ASTM C796-04; and,
    - (ii) foaming agents shall be closed cell non pervious foams
  - (d) Density:  $1430 \text{ kg/m}^3 \pm 50 \text{ kg/m}^3$
  - (e) Compressive Strength: 4 to 5 MPa
  - (f) Design mix proportions to meet specified performance requirements, in accordance to ACI 523.3R
  - (g) Quality Control
    - (i) Prepare Quality Control samples for compressive strength. One sample should be taken for each placement, or every  $100 \text{ m}^3$ , whichever is more frequent. Prepare in accordance with ASTM C330.
    - (ii) Prepare Quality Control samples for density. Cellular concrete density shall be measured and recorded once per production run, or once for every 50 cubic metres, or once per 30 minutes, whichever is more frequent. The density shall be maintained within  $\pm$  ten percent (10 %) of the design density. Test samples in accordance to ASTM C495.
- E80.4.5            Continuity Bonding
- (a) Wires for continuity bonding shall be No.10 American Wire Gauge (AWG) 7-strand copper conductor with black TWU insulation.
  - (b) Thermite weld products shall be properly selected based on the wire size, pipe size and material.
  - (c) Thermite weld caps shall be constructed from 20 mil high-density polyethylene and may be either pre filled or field filled with a bituminous mastic coating or approved equal in accordance with B8.
- E80.4.6            Galvanic Anodes
- (a) Galvanic anodes for cathodic protection of buried ferrous pipes and fittings shall be 11.5 kg pre-packaged zinc anodes to City of Winnipeg specification.
- E80.4.7            Liquid Epoxy Coatings
- (a) Liquid epoxy coatings shall conform to AWWA C210.
  - (b) All coatings shall be applied in a minimum of two (2) or more layers (5 mils dry film thickness minimum each coat) for a minimum final coating dry film thickness of the greater of 16 mils or as recommended by the manufacturer for buried applications.
  - (c) Coatings for all exposed steel, piping, valves, and actuators shall be Polyamide Epoxy.
  - (d) Approved products: Enviroline 230, Bar-Rust 234P, Specialty Polymer Coatings SP-7888, Tnemec Series 140F Pota-Pox Plus, Amerlock 2 or approved equal in accordance with B8.
- E80.4.8            Fusion Bonded Epoxy Coatings
- (a) Fusion bonded epoxy coatings shall conform to AWWA C213.
  - (b) The final minimum coating thickness shall be greater than 10 mils or as recommended by the manufacturer for buried applications.
- E80.4.9            Polystyrene Insulation
- (a) Rigid polystyrene insulation shall conform to this specification.

- (b) Type 1 polystyrene insulation shall conform to CSA S307 Type 1. High density polystyrene insulation will not be permitted for use where Type 1 polystyrene insulation is specified.

#### E80.4.10 Trench Backfill Material

- (a) Backfill material used for backfill of the Midtown Feeder Main casing excavation shall meet the requirements of CW2030 Type 1 Material except as modified herein:
  - (i) material must be thawed. Frozen material will not be permitted;
  - (ii) material shall be a well graded and readily compactable granular material. Open graded material (clean stone) will not be permitted;
  - (iii) limestone material will not be permitted; and,
  - (iv) material shall not contain more than five percent (5%) passing a 80 µm sieve

### E80.5 Methods

#### E80.5.1 Groundwater and Excavation Dewatering

- (a) The Contractor is to be aware that the presence of clay cut off collars along the length of the Midtown Feeder Main is unknown and as a result there is the potential to see high levels of groundwater flow from the existing feeder main pipe bedding.
- (b) Further to Clause 3.1.4 of CW 2030 and D22, water from dewatering systems shall be directed to the LDS system and adequate steps put into place to ensure sediment is intercepted prior to entering the LDS system.

#### E80.5.2 Trenchless Casing Pipe

- (a) Install casing pipe by jacking methods. The casing pipe must be advanced to maintain a 0.5 m soil plug behind the head of the casing at all times until the casing reaches the receiving pit.
- (b) Casing pipes shall be installed with a bore diameter equal to that of the casing pipe's outside diameter.
- (c) Pressure grouting or approved alternative methods shall be used to fill voids caused by the installation or if the bored hole diameter is greater than the outside diameter of the pipe by more than 25 mm.

#### E80.5.3 Open Cut Casing Pipe

- (a) Contractor shall carefully expose the existing feeder main and casing pipe.
- (b) Support of feeder main:
  - (i) the existing feeder main cannot withstand horizontal or vertical movement or axial deflection at joints from where the pipe exists upon exposure. Contractor shall ensure the feeder main is adequately supported at all times during the Work as specified herein and to prevent all horizontal and vertical movements and axial joint deflections that would jeopardize the feeder main structure and hydrostatic integrity as a pressure pipe. Exercise caution that excessive forces are not applied to the pipe;
  - (ii) limit the portion of exposed and unsupported feeder main to not more than 2.4 m (8') of continuous pipe between joints;
  - (iii) provide temporary support to the feeder main at intervals not more than 2.4 m (8') and not more than 1.2 m (4') on either side of each feeder main joint; and,
  - (iv) pipe support in the terms of temporary jacking or beams and pipe slings are acceptable.
- (c) Install casing spacers as per the manufactures recommendations. Shim casing spacers and casing pipe to ensure contact between the casing spacer and casing at and near the invert of the pipe.
- (d) Install CLSM embedment material in lifts to prevent floatation of the casing pipe.

- (e) Temporarily support casing pipes after installation and prior to placement of CLSM embedment material to ensure support for the existing feeder main.

E80.5.4 Field Welding

- (a) Field welding of steel pipes shall conform to AWWA C206.
- (b) All field and shop welding shall be performed by certified welder.
- (c) Welding of casing pipes shall be accomplished with a full penetration butt weld or fillet weld where appropriate.
- (d) All fillet welds shall have minimum leg lengths equal to the thickness of the material being welded.
- (e) All welds shall be inspected using magnetic particle testing methods by a qualified inspector in accordance with ASTM E1444.

E80.5.5 Connection to Existing Casing Pipe

- (a) Existing casing:
  - (i) 1372 mm flanged steel split ring casing;
  - (ii) Internal Diameter: 1372 mm;
  - (iii) Minimum Wall thickness: 20.7 mm; and,
  - (iv) Epoxy Coating.
- (b) Remove existing external split ring and repair internal and external coating on the existing casing pipe.
- (c) Complete connection to existing split sleeve casing as per the manufacturer's recommendation.

E80.5.6 Casing End Seals

- (a) Install casing end seal in accordance with the manufactures recommendation.
- (b) Pipe and casing shall be carefully bedded and backfilled with sand to 150 mm above the casing as shown on the Drawings taking extra care to not damage the end seal.

E80.5.7 Installation of Lead Wires, Continuity Bonding and Galvanic Anodes

- (a) Anodes and continuity bonding shall be installed on new and existing pipes and fittings where shown on the Drawings or as directed by the Contract Administrator.
- (b) Thermitite Welding Procedure:
  - (i) prepare steel surface to bare metal by grinding or filing. Remove all coatings, dirt, mill scale, oxide, grease, moisture, and other foreign matter from weld areas in an area required to complete the weld;
  - (ii) before welding, remove wire insulation as required to fit mold, avoiding damage to the exposed copper wire. If wire is cut or nicked over halfway through its diameter, cut off and strip new end. If manufacturer requires the use of a copper sleeve, crimp it securely to wire and remove excess wire protruding from the end of the sleeve;
  - (iii) after charge is set, remove mold and slag from weld area with welder's hammer. Strike top and sides of weld with hammer to test secureness of connection. If weld does not hold, remove scrap weld material, clean, and begin weld process again; and,
  - (iv) after welding and before coating the cleaned weld area, the Contract Administrator may test the joint bond for and wires for electrical continuity.
- (c) When the weld passes test for soundness and electrical continuity, repair the coating in the weld area with mastic and weld cap placed over the weld. Clean weld area to remove any loose material, and welding residuals. Cover exposed metal on the pipe and wire with mastic filled weld cap. Ensure weld cap covers the entire area of coating removed for installation of the thermitite weld. If not, repair coating as per the coating manufactures recommendations prior to installing weld cap.

- (d) Anodes shall be installed below the base of the excavation and fully encapsulated with native clay backfill material. Installation of anodes with the CLSM material is not permitted.

#### E80.5.8 Coatings

- (a) Apply liquid epoxies of prepared surfaces in accordance with AWWA C210, E80.4.7, and the manufactures recommendations.
- (b) Apply fusion bonded epoxies of prepared surfaces in accordance with AWWA C213, E80.4.8, and the manufactures recommendations.
- (c) Notwithstanding the manufactures recommendations, metal surfaces shall be prepped for coating as follows:
  - (i) Steel - Prepare steel surfaces for recoating by blast cleaning to near-white metal as specified by Joint Surface Preparation Standard NACE No.2/SSPC-SP10; and,
  - (ii) remove all dust and loose residues from the prepared surfaces and chamber floor. The surface shall be roughened to a degree suitable for the coating system employed.
- (d) For liquid epoxies, a primer coat shall follow immediately after completion of sandblasting and prep.
- (e) Provide adequate ventilation and heat to facilitate curing of coatings prior to expose to freezing temperatures or installation.

#### E80.5.9 Trench Backfill

- (a) The Contractor shall backfill trenches using material conforming to the requirements of E80.4.9.
- (b) Backfill material shall be compacted to ninety-five percent (95%) SPMDD.
- (c) Compaction effort is limited to static methods or the use of small walk behind plate packers using vibratory action.
- (d) Granular material shall be placed in lifts not exceeding 150 mm.

#### E80.6 Measurement and Payment

E80.6.1 Installation of the Midtown Feeder Main casing will be paid on a Lump Sum basis as listed in the Form B Prices.

E80.6.2 Payment will be made at the Contract Unit Price for "Midtown Feeder Main Casing" as listed in the Form B Prices.

E80.6.3 Payment for feeder main casing installation shall include the following:

- (a) supply, installation, and removal of shoring;
- (b) excavation and disposal of all unused excavated material;
- (c) trench and feeder main bedding dewatering;
- (d) supply and installation of casing spacers;
- (e) supply and installation of casing pipe;
- (f) connection to the existing casing pipe;
- (g) supply and placement of CLSM;
- (h) supply and installation of casing end seals;
- (i) supply and placement of backfill; and,
- (j) any and all other work and materials specified herein and required to complete the work as specified.



## **E81. HYDRO EXCAVATION**

### **E81.1 Description**

#### **E81.1.1 General**

- (a) This Specification covers all operations relating to 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 in accordance with B8.
- (b) The Work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies, and all things necessary for and incidental to the satisfactory performance and completion of all Works as hereinafter specified.

#### **E81.2 Equipment**

- E81.2.1 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. The unit should be adjustable, so as to provide adequate pressure to remove earthen material.
- E81.2.2 Spray head shall be equipped with a rotating type nozzle, in order to provide a wider path of cut.

#### **E81.3 Construction Methods**

##### **E81.3.1 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.

##### **E81.3.2 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) Dispose of material in accordance with Section 3.4 of CW 1130.

##### **E81.3.3 Backfill of Hydro Excavated Hole**

- (a) The Contractor shall be responsible for the backfill of the hydro excavated hole with flowable cement-stabilized fill or sand backfill upon completion of the work described herein, to the approval of the Contract Administrator.

#### **E81.4 Measurement and Payment**

##### **E81.4.1 Hydro Excavation**

- (a) There will be no measurement and payment for Hydro Excavation as it will be considered incidental to the Contract.

##### **E81.4.2 Backfill**

- (a) Cement-Stabilized fill or sand backfill is considered incidental to Hydro Excavation and no separate measurement or payment will be made.

## **E82. REINFORCED CONCRETE PIPE**

### **E82.1 Description**

- (a) This specification covers the requirements where reinforced concrete pipe is installed using jacking methods and in a trench.

## E82.2 Materials

### E82.2.1 Reinforced Concrete Pipe

- (a) Reinforced concrete pipe shall conform to CW 2130, ASTM C76 and CSA A257;
- (b) Minimum pipe class as shown on Drawings;
- (c) Pipe classes for jacking pipe and pipe in a trench shall be as shown on the Drawings and are for long term design conditions and loading. The Contractor shall verify that the pipe class, strength, reinforcing and joint design are suitable for their proposed installation methods and procedures. Design of any pipe to suit installation methods is the responsibility of the Contractor. Axial load carrying capacity shall be designed in accordance with ASCE 27; for trenchless installations and ASCE 15 of trench installations as detailed on Drawings;
- (d) Reinforcement for pipe intended for trenchless installations must take into account the potential for the pipe to rotate during installation. The design of stirrups and circumferential reinforcement must not result in a preferential installation orientation for the pipe unless appropriate controls are put in place, precluding rotation of the pipe during installation;
- (e) External joint bands of jacking pipe shall conform to CW 2130 and ASTM A36;
- (f) Perform a minimum of one (1) three-edge bearing test in accordance with ASTM C76 and C497 for each size and class of pipe installed. Test shall confirm both the service cracking and ultimate load capacity of the pipe. Test shall be performed in the presence of the Contract Administrator. The pipe supplier shall provide a minimum of seven (7) Calendar Days advance notice to the Contract Administrator prior to undertaking the test.

### E82.3 Submittals

#### E82.3.1 Submit Shop Drawings for reinforced concrete jacking pipe in accordance with ASTM C76 and CW 2160. Shop Drawings shall include the following:

- (a) all pipe and joint dimensions;
- (b) steel reinforcement configuration.

#### E82.3.2 Submit quality control documentation in accordance with ASTM C76 and CW 2160. Quality control documents shall include the following:

- (a) mill tests for reinforcing steel;
- (b) concrete test results;
- (c) results from three-edge bearing test(s).

### E82.4 Construction Methods

- (a) Land drainage sewers shall be installed in accordance with CW 2130 except as specified herein.
- (b) Verification of Utility Elevations as indicated in E83.

### E82.5 Measurement and Payment

- (a) Measurement and payment for sewer installation shall be in accordance with CW 2130 as specified except as modified in E83.13;

## E83. TRENCHLESS EXCAVATION

### E83.1 Further to Clause 3.4.1 of CW 2130, all pipes below the features listed below, shall be installed by trenchless methods only:

- (a) Any existing or proposed railway;
- (b) Any existing or proposed shoofly; and,

- (c) existing parking lots and all privately owned land.
- E83.2 Further to Clause 3.4.1 of CW 2130 and depending on Contractor's chosen schedule and staging of construction, all pipes below the features listed below, shall be installed by trenchless methods only:
- (a) existing streets and roadways that are to remain in service according to E11 Traffic Management and the Staging Drawings; and,
  - (b) existing curbs and walks that are to remain in service according to E11 Traffic Management and the Staging Drawings.
- E83.3 Pipes that do not fall under any of the descriptions of E83.1 and E83.2, may be installed in a trench or by trenchless methods.
- E83.4 Contractor shall Submit to the Contract Administrator a pipe installation method list indicating Contractor's proposed pipe segments planned to be installed by trenchless methods and include a short description of the proposed trenchless method for each segment.
- E83.5 Pressure grouting or approved alternative methods shall be used to fill voids caused by the installation or if the bored hole diameter is greater than the outside diameter of the pipe by more than 25 mm.
- E83.6 Verification of Utility Elevations
- (a) Prior to construction, the Contractor shall verify at their own cost all buried utility elevations. Verification shall occur in a minimum of fourteen (14) Calendar Days prior to any construction on the land drainage sewer such that any required grade adjustments can be made. Contractor shall arrange for all required utility locations, safety watches and other required notifications. Contractor shall provide a minimum of five (5) Calendar Days' notice to the Contract Administrator of conducting utility exposures.
- E83.7 Minimize the time period associated with trenchless installations.
- E83.8 Selection of excavation equipment for installation of sewers by trenchless methods shall be the responsibility of the Contractor and shall be made based on the basis of expected soil conditions outlined in the Geotechnical Report as per Appendix 'A' and as detailed on the soil logs. The Contractor shall make allowances in the choice of equipment to account for reasonable and minor deviations in ground conditions and shall have contingency plans for the removal of boulders and other minor changes in ground conditions. Contractor shall continuously visually monitor trenchless excavations for increases in silt content and soft clay in the excavated material. Notify Contract Administrator if silt contents or soft clay in excavated material increase.
- E83.9 In the event that there is a substantial change in the character or nature of the subsurface conditions or that obstructions are encountered, which adversely impact the Contractor's production or construction procedure, the Contractor shall immediately notify the Contract Administrator.
- E83.10 The notice shall provide details of the change in subsurface soil conditions or obstructions encountered, any proposed construction procedure revision that the Contractor intends to undertake, as well as any other relevant supporting information.
- E83.11 The Contract Administrator shall review the notice as expeditiously as possible to assess whether the change in conditions and revised construction procedures amount to a Change in Work. In the case of obstructions due to boulders in the silt/till or hardpan strata where that stratum is evident in the soils logs, no consideration will be made for a Change in Work as boulder obstructions can be reasonably anticipated when working in this stratum. Obstructions such as "random boulders" in the clay strata well above the till interface may be considered as a Change in Work dependent on the level of effort required to facilitate their removal.

E83.12 Where the Contract Administration deems that a Change in Work is necessary, it shall be valued in accordance with the provisions of C7 and the supplementary requirements.

E83.13 Measurement and Payment

- (a) Measurement and payment for sewer installations where the Contractor has a choice between trenchless methods or in a trench, will be made according to CW2130 4.1.5 for trenchless installations regardless of the installation method used. Sewers will not be separated for measurement and payment according to depth.

**E84. TRENCHLESS EXCAVATION OBSTRUCTIONS**

E84.1 Contingency plans for removal of the obstructions encountered in trenchless excavations shall be submitted and reviewed without issue by the Contract Administrator and may consist of, but not limited to, one (1) of the following:

- (a) drill or excavate a shaft at the location of the obstruction and remove the obstruction;
- (b) remove the obstruction through the jacking head or core hole following drilling, splitting or breaking the obstruction into smaller components as required; and,
- (c) other removal methods approved by Contract Administrator.

E84.2 Where the Contract Administrator deems that the obstruction encountered represents a Change in Work, it shall be valued in accordance with C7.4 (c) and the following supplemental requirements.

E84.3 The first four (4) hours of handling obstructions for each occurrence shall be the responsibility of the Contractor.

E84.4 Equipment rates for equipment required in support of the obstruction removal shall be compensated at the MHCA rental rates. Equipment not listed in the MHCA rate schedule shall have their rates established by the Contractor prior to the commencement of Work in accordance with the procedure documented in the MHCA rental guide for establishing equipment rental rates and shall be subject to the approval of the Contract Administrator.

E84.5 Standby equipment that cannot reasonably be deployed elsewhere during the duration of the obstruction removal shall be compensated at fifty percent (50%) of its established rate as noted in E84.4 above.

E84.6 Labour rates and material costs associated with obstruction removal shall be compensated as per C7.4 (c) and C7.4.1 with the provision that any removal and replacement of pavements shall be compensated at the Contract Unit Price for such Work.

**E85. EXCAVATION, BEDDING AND BACKFILL**

E85.1 Submittals

- (a) Submit shoring designs, in accordance to CW 2030.

E85.2 Existing Utilities

- (a) Arrange and pay for any required safety watches around existing utilities as per CW1120.

E85.3 Disposal of Unsuitable or Surplus Excavated Material

- (a) The Contractor is responsible for arranging for a temporary stockpile and disposal site for all excavated material off of Site, including all associated works including transportation and payment of tipping fees. Temporary stockpiling and disposal of all excavated material shall be considered incidental to the Works.

E85.4 Pipe in a Trench Foundation, Bedding, Haunching, Initial Backfill and Final Backfill

- (a) Pipe foundation, bedding, haunching and initial backfill shall be constructed with non-frozen materials according to Drawing details for rigid and flexible pipe;

- (b) When construction proceeds during freezing conditions, Contractor shall either heat and protect all materials from freezing or use open graded Type 3 materials that do not require free moisture for compaction for constructing foundation, bedding and initial backfill for pipes in a trench. Type 3 material shall be fully wrapped and encapsulated in a non-woven geotextile with sufficient overlap at edges;
- (c) Cement-Stabilized Fill shall be used below the pipe in the foundation zone extending to undisturbed soil where the pipe infringes on the open shaft or manhole excavation;
- (d) Final backfill for all pipe in a trench shall be Class 2 according to CW 2030 using non-frozen materials except as specified herein:
  - (i) placing frozen final backfill material during final backfilling operations will result in considerable consolidation of the final backfill material when it thaws;
  - (ii) Contractor is solely responsible for repairing the final backfill to the necessary depth determined by the Contract Administrator as subsequent damage due to excessive consolidation of the material;
  - (iii) Contractor shall take all reasonable precautions to prevent the use of frozen backfill material and not contaminate or mix non-frozen final backfill with frozen materials; and,
  - (iv) Contract Administrator will withhold a deficiency amount consistent with the estimated value of subsequent damage repair required of Contractor.

#### E85.5 Shaft and Manhole Foundation and Final Backfill

- (a) All shaft and manhole foundation and final backfill shall be constructed with non-frozen materials.
- (b) All shafts shall be backfilled with Class 2 backfill as per SD-002 except as modified herein including shafts for watermains.
- (c) When construction proceeds during freezing conditions, Contractor shall choose one of the following two options for backfilling the shafts:
  - (i) Class 2 backfill according to SD-002 using a non-frozen Type 1 material; and,
  - (ii) Class 2 backfill according to SD-002 using an open graded Type 3 material, free of moisture and/or ice that does not require free moisture for compaction. The Type 3 material shall be used instead of the Type 1 material.
- (d) Cement-Stabilized Fill shall be used below the pipe in the foundation zone extending to undisturbed soil at the bottom and sides of the shaft where the pipe infringes on the open shaft excavation.
- (e) Shafts to accommodate a tunnelling or jacking machine shall be constructed with a concrete foundation of sufficient cross section and trueness to adequately support and align the machine during tunnelling operations.

#### E85.6 Measurement and Payment

- (a) Excavation, shoring, and backfilling for pipe installation will not be measured for payment. Costs for excavation and shoring shall be included in the price for installation of the pipe. No separate measurement or payment will be made.
- (b) There will be no separate measurement and payment for Pavement Removals according to CW 2030 or removals according to CW 2130. All Pavement Removals shall be considered incidental to the Contract.

### E86. **CONNECTING TO EXISTING SEWERS**

#### E86.1 Description

- (a) This Specification supplements and amends City of Winnipeg Standard Construction Specification CW 2130 Gravity Sewers, and shall cover connect to existing sewers.

#### E86.2 Materials

- E86.2.1 Formwork, Reinforcing Steel and Concrete  
(a) As per City of Winnipeg CW 2160.
- E86.2.2 Concrete Mix Design  
(a) Concrete Mix Design as per Table CW 2160, Type A mix.
- E86.3 Submittals
- E86.3.1 Submit shoring design, reinforcing steel Shop Drawings and concrete mix design in accordance to CW 2160.
- E86.4 Construction Methods
- E86.4.1 Cast-in-place concrete as per CW 2160.
- E86.5 Method of Measurement and Basis of Payment
- E86.5.1 Connections to existing sewers shall be measured on a unit basis and paid for at the Contract Unit Price for "Connecting to Existing Sewer". The unit price shall include but not be limited to locating and excavating the existing pipe, cutting or coring the existing pipe opening, required new piping and connecting to the existing sewer, shoring, backfill, cast-in-place concrete works and performing all operations necessary to complete the Works as specified and as indicated on the Drawings including all items incidental to the Works.
- E87. MAINTAINING EXISTING SEWER FLOWS, FLOW CONTROL, DIVERSIONS AND BYPASS PUMPING**
- E87.1 Maintaining Existing Sewer Flows, Flow Control, Diversions and Bypass Pumping required to complete the Works in the Contract shall be incidental to the Contract as per Clause 4.16.1 of CW 2130
- E88. ADJUSTMENT AND RELOCATION OF EXISTING HYDRANTS**
- E88.1 Description
- E88.1.1 This Specification shall supplement CW 2110 for the adjustment and relocation of existing hydrants.
- E88.2 Construction Methods
- E88.2.1 Hydrant adjustments and re-locations shall be Type A according to CW 2110 but could require a lead extension or shortening and there will be no measurement and payment for lead extensions less than 3.0 m or shortening of any length.
- E88.2.2 Contractor shall also plug the drain on all hydrants indicated on the Drawings to be adjusted and relocated.
- E88.2.3 Contractor shall vertically adjust the position of the hydrant such that the bottom flange is 50-150 mm above the proposed surface elevation or as indicated by Contract Administrator.
- E88.2.4 Contractor shall horizontally re-locate the hydrant to the position as shown on the Drawings.
- E88.2.5 Contractor shall review the final position of the lead valve with the Contract Administrator and agree on a suitable valve location prior to executing the re-location.
- E88.3 Measurement and Payment
- E88.3.1 Measurement and payment shall be according to CW 2110 and also include all work necessary to plug the existing hydrant drain, excavation, Class 2 backfill, re-location of the valve, existing pipe cutting and removal, pipe extensions, fittings, restrained couplers and all work required to re-locate the valve and hydrant as specified.

**E89. NEW HYDRANT ASSEMBLY ON EXISTING WATERMAIN**

**E89.1 Description**

E89.1.1 This Specification shall supplement CW 2110 as it pertains to installing a new hydrant assembly on an existing watermain along Waverley Street between 1+540 and 1+750.

**E89.2 Construction Methods**

E89.2.1 The existing watermain was installed in Contract 1.

E89.2.2 A tee and a plug as specified in CW 2110 were installed in Contract 1 to accommodate the new hydrant assemblies on existing watermain indicated in Contract 2.

E89.2.3 Contractor shall locate and expose existing tee and plug.

**E89.3 Measurement and Payment**

E89.3.1 Measurement and payment shall be according to CW 2110 for New Hydrant Assembly on Existing Watermain except the supply and installation of the tee is not required and location and exposure of the existing tee and removal of the plug and any restrainers shall be included.

**E90. VERTICAL RE-ALIGNMENT OF WATERMAINS**

**E90.1 Description**

(a) This Specification shall supplement CW 2110 for the vertical re-alignment of watermains.

**E90.2 Construction Methods**

(a) Contractor shall vertically re-align watermains where shown on the Drawings and where the proposed LDS infringe on City of Winnipeg UGS minimum clearance requirements;

(b) Contractor shall perform the vertical re-alignment as detailed on the Drawings.

(c) Prior to performing the vertical re-alignment of a watermain, Contractor shall hydro-excavation and determine the location of the existing watermain and review the three-dimensional location of the watermain with the Contract Administrator. If the location of the existing watermain infringes on the clearance limits required by UGS, the Contractor shall perform the vertical re-alignment of the watermain.

**E90.3 Measurement and Payment**

(a) Measurement and payment for Watermain Vertical Re-Alignment shall be a Lump Sum and include hydro-excavation, excavation, embedment, compaction, backfill, all fittings and restraints, all pipe and labour required to construct the vertical re-alignment as detailed.

**E91. WATERMAIN CASING**

E91.1 This Specification shall supplement CW 2110 and Drawings for the proposed cased 200 mm diameter watermain crossing the CN rail and shoofly. There is a separate specification for the Midtown Feeder Main work.

E91.2 Submit a written watermain casing installation procedure for review by the Contract Administrator in accordance with E4, a minimum of fifteen (15) Working Days prior to undertaking the work. The installation procedure shall include the following:

(a) excavation dewatering locations, installation procedures, and pumping plans according to D22 Dewatering and Drainage during Construction;

(b) casing spacer installation procedure;

(c) casing pipe installation procedure;

(d) trench backfill procedure; and,

- (e) all information reasonably requested by Contract Administrator.

### E91.3 Materials

E91.3.1 Materials as specified on the Drawings and specified herein.

#### E91.3.2 Steel Casing Pipe

- (a) Casing pipe shall conform to the following standards:
  - (i) AREMA Manual for Railway Engineering, 2016; and,
  - (ii) Railway Association of Canada – TC-E-10.
- (b) Steel and steel pipe products shall conform to ASTM A36 or ASTM A525 with a minimum yield strength of 241 MPa.
- (c) Minimum wall thickness:
  - (i) 350 mm Diameter Casing: 7.2 mm.
- (d) Welded Casings:
  - (i) All joints shall be fully welded in accordance with E91.4.4.
- (e) Coatings:
  - (i) Casing pipe (interior and exterior) shall be coated with an epoxy coating system conforming to E91.3.8, E91.3.9 and E91.4.7; and,
  - (ii) Repair exterior coatings at all weld locations in accordance with the manufactures recommendations and the specifications contained herein.

#### E91.3.3 Non-Metallic Casing Spacers

- (a) Injection moulded polyethylene spacers shall meet the following requirements:
  - (i) Polypropylene spacers shall be non-metallic and moulded in segments for field assembly. The spacers shall have integrally moulded runners. Spacers shall be sized to fit snugly within casing piper or as recommended by the manufacturer.
- (b) 200 mm Watermain:
  - (i) estimated Pipe Weight: 0.44 kN/m;
  - (ii) max spacing of 1.2 m;
  - (iii) casing spacers shall be installed within 0.6 m of a joint on each pipe; and,
  - (iv) the casing spacer supplier shall confirm the load carrying capacity of the spacer and provide maximum spacing recommendations based on the applied loads and capacity of the casing spacer.
- (c) Approved product: Ranger II Non-metallic Casing Spacer produced by Pipeline Seal and Insulator, Inc. or approved equal in accordance with B8.

#### E91.3.4 Casing End Seals

- (a) Ends of the casing shall be sealed against the carrier pipe to prevent water and soil transfer in to the annulus.
- (b) End seal shall be a wraparound style complete with stainless steel bands for both the casing and carrier pipe connections.
- (c) Seal shall be manufactured from 3.175 mm (1/8") thick EPDM 60 rubber.
- (d) The overlap portions of the rubber shall be sealed to provide a water tight membrane.
- (e) Approved products:
  - (i) Model M Wrap Around End Seal produced by Pipeline Seal and Insulator, Inc.; and,
  - (ii) or approved equal in accordance with B8.

#### E91.3.5 Controlled Low Strength Material

- (a) Portland cement conform to CSA A3001 Type HS



- (b) Flyash shall conform to CSA A3001 Class CI Fly Ash
- (c) Foaming Agents:
  - (i) shall conform to ASTM C869-11 and be tested in accordance to ASTM C796-04; and,
  - (ii) foaming agents shall be closed cell non pervious foams
- (d) Density:  $1430 \text{ kg/m}^3 \pm 50 \text{ kg/m}^3$
- (e) Compressive Strength: 4 to 5 MPa
- (f) Design mix proportions to meet specified performance requirements, in accordance to ACI 523.3R
- (g) Quality Control
  - (i) Prepare Quality Control samples for compressive strength. One sample should be taken for each placement, or every  $100 \text{ m}^3$ , whichever is more frequent. Prepare in accordance with ASTM C330
  - (ii) Prepare Quality Control samples for density. Cellular concrete density shall be measured and recorded once per production run, or once for every 50 cubic metres, or once per 30 minutes, whichever is more frequent. The density shall be maintained within  $\pm$  ten percent (10%) of the design density. Test samples in accordance to ASTM C495.

E91.3.6 Continuity Bonding

- (a) Wires for continuity bonding shall be No.10 American Wire Gauge (AWG) 7-strand copper conductor with black TWU insulation.
- (b) Thermite weld products shall be properly selected based on the wire size, pipe size and material.
- (c) Thermite weld caps shall be constructed from 20 mil high-density polyethylene and may be either pre filled or field filled with a bituminous mastic coating or approved equal in accordance with B8.

E91.3.7 Galvanic Anodes

- (a) Galvanic anodes for cathodic protection of buried ferrous pipes and fittings shall be 11.5 kg pre-packaged zinc anodes to City of Winnipeg specification.

E91.3.8 Liquid Epoxy Coatings

- (a) Liquid epoxy coatings shall conform to AWWA C210.
- (b) All coatings shall be applied in a minimum of two (2) or more layers (5 mils dry film thickness minimum each coat) for a minimum final coating dry film thickness of the greater of 16 mils or as recommended by the manufacturer for buried applications.
- (c) Coatings for all exposed steel, piping, valves, and actuators shall be Polyamide Epoxy.
- (d) Approved products: Enviroline 230, Bar-Rust 234P, Specialty Polymer Coatings SP-7888, Tnemec Series 140F Pota-Pox Plus, Amerlock 2 or approved equal in accordance with B8.

E91.3.9 Fusion Bonded Epoxy Coatings

- (a) Fusion bonded epoxy coatings shall conform to AWWA C213.
- (b) The final minimum coating thickness shall be the greater of 10 mils or as recommended by the manufacturer for buried applications.

E91.3.10 Polystyrene Insulation

- (a) Rigid polystyrene insulation shall conform to this specification.
- (b) Type 1 polystyrene insulation shall conform to CSA S307 Type 1. High density polystyrene insulation will not be permitted for use where Type 1 polystyrene insulation is specified.

E91.3.11 Trench Backfill Material

- (a) Backfill material used for backfill of the 200 mm watermain crossing excavations shall meet the requirements of CW2030 except as modified in E85.

E91.4 Construction Methods

E91.4.1 Casing shall be installed by trenchless methods.

E91.4.2 Groundwater and Excavation Dewatering

- (a) Further to Clause 3.1.4 of CW 2030 and D22, water from dewatering systems shall be directed to the LDS system and adequate steps put into place to ensure sediment is intercepted prior to entering the LDS system.

E91.4.3 Trenchless Casing Pipe

- (a) Install casing pipe by jacking methods. The casing pipe must be advanced to maintain a 0.5 m soil plug behind the head of the casing at all times until the casing reaches the receiving pit.
- (b) Casing pipes shall be installed with a bore diameter equal to that of the casing pipe's outside diameter.
- (c) Pressure grouting or approved alternative methods shall be used to fill voids caused by the installation or if the bored hole diameter is greater than the outside diameter of the pipe by more than 25 mm.

E91.4.4 Field Welding

- (a) Field welding of steel pipes shall conform to AWWA C206.
- (b) All field and shop welding shall be performed by certified welder.
- (c) Welding of casing pipes shall be accomplished with a full penetration butt weld or fillet weld where appropriate.
- (d) All fillet welds shall have minimum leg lengths equal to the thickness of the material being welded.
- (e) All welds shall be inspected using magnetic particle testing methods by a qualified inspector in accordance with ASTM E1444.

E91.4.5 Casing End Seals

- (a) Install casing end seal in accordance with the manufactures recommendation.
- (b) Pipe and casing shall be carefully bedded and backfilled with sand to 150 mm above the casing as shown on the Drawings taking extra care to not damage the end seal.

E91.4.6 Installation of Lead Wires, Continuity Bonding and Galvanic Anodes

- (a) Anodes and continuity bonding shall be installed on new and existing pipes and fittings where shown on the Drawings or as directed by the Contract Administrator.
- (b) Thermite Welding Procedure:
  - (i) prepare steel surface to bare metal by grinding or filing. Remove all coatings, dirt, mill scale, oxide, grease, moisture, and other foreign matter from weld areas in an area required to complete the weld;
  - (ii) before welding, remove wire insulation as required to fit mold, avoiding damage to the exposed copper wire. If wire is cut or nicked over halfway through its diameter, cut off and strip new end. If manufacturer requires the use of a copper sleeve, crimp it securely to wire and remove excess wire protruding from the end of the sleeve;
  - (iii) after charge is set, remove mold and slag from weld area with welder's hammer. Strike top and sides of weld with hammer to test secureness of connection. If weld does not hold, remove scrap weld material, clean, and begin weld process again; and,

(iv) after welding and before coating the cleaned weld area, the Contract Administrator may test the joint bond for and wires for electrical continuity.

(c) When the weld passes test for soundness and electrical continuity, repair the coating in the weld area with mastic and weld cap placed over the weld. Clean weld area to remove any loose material, and welding residuals. Cover exposed metal on the pipe and wire with mastic filled weld cap. Ensure weld cap covers the entire area of coating removed for installation of the thermite weld. If not, repair coating as per the coating manufactures recommendations prior to installing weld cap.

(d) Anodes shall be installed below the base of the excavation and fully encapsulated with native clay backfill material. Installation of anodes with the CLSM material is not permitted.

#### E91.4.7 Coatings

(a) Apply liquid epoxies of prepared surfaces in accordance with AWWA C210, E91.3.8, and the manufactures recommendations.

(b) Apply fusion bonded epoxies of prepared surfaces in accordance with AWWA C213, E91.3.9, and the manufactures recommendations.

(c) Notwithstanding the manufactures recommendations, metal surfaces shall be prepped for coating as follows:

(i) Steel - Prepare steel surfaces for recoating by blast cleaning to near-white metal as specified by Joint Surface Preparation Standard NACE No.2/SSPC-SP10; and,

(ii) remove all dust and loose residues from the prepared surfaces and chamber floor. The surface shall be roughened to a degree suitable for the coating system employed.

(d) For liquid epoxies, a primer coat shall follow immediately after completion of sandblasting and prep.

(e) Provide adequate ventilation and heat to facilitate curing of coatings prior to expose to freezing temperatures or installation.

#### E91.4.8 Backfill

(a) Backfill material used for backfill of the 200 mm watermain crossing excavations shall meet the requirements of CW2030 except as modified in E85.

### E92. RE-GRADING OF EXISTING SEWER SERVICES

#### E92.1 Description

E92.1.1 This Specification shall supplement CW 2110 for the re-grading of existing sewer services that may be required for existing sewer service connections that are in conflict with the proposed LDS alignment.

#### E92.2 Construction Methods

E92.2.1 Contractor shall vertically re-align gravity sewers where shown on the Drawings and where the proposed LDS infringe on City of Winnipeg UGS minimum clearance requirements.

E92.2.2 Contractor shall perform the vertical re-alignment as detailed on the Drawings.

E92.2.3 Prior to performing the vertical re-alignment of a gravity sewer, Contractor shall perform all hydro-excavation according to E80 and determine the location of the existing gravity main and review the three-dimensional location of the gravity main with the Contract Administrator. If the location of the gravity main is within the clearance limits required by UGS, the Contractor shall perform the vertical re-alignment of the gravity main.

#### E92.3 Measurement and Payment

E92.3.1 Measurement and payment for Gravity Sewer Vertical Re-Alignment shall be a Lump Sum and include hydro-excavation, excavation, embedment, compaction, backfill, all fittings, all pipe and labour required to construct the vertical re-alignment as detailed.

### **E93. PLUGGING AND ABANDONING EXISTING SEWERS AND SEWER SERVICES**

#### **E93.1 Description**

E93.1.1 This Specification shall add to CW 2130 for plugging and abandoning existing sewers and sewer services.

#### **E93.2 Construction Methods**

E93.2.1 Abandon all sewers and sewer services where indicated on the Drawings.

E93.2.2 Where indicated on the Drawings, Contractor shall abandon all sewers and sewer services, regardless of diameter, with cement-stabilized flowable fill.

E93.2.3 Be aware, there are proposed LDS pipes that will be in direct conflict at the same elevation with existing sewers and sewer services to be abandoned in accordance with Contract. Contractor is solely responsible for staging their installations and developing their means and methods to meet the requirements of the Contract for successfully installing the proposed LDS and as well as the requirements associated with abandoning the existing sewers and sewer services.

#### **E93.3 Measurement and Payment**

E93.3.1 Abandoning existing sewers and sewer services with cement-stabilized flowable fill for all diameters and materials will be measured for payment on a volume basis and paid for at the Contract unit Price for "Abandoning Existing Sewers with Cement-Stabilized Flowable Fill" according to CW 2130 4.14.2.

### **E94. REMOVAL OF MANHOLES, CATCHBASINS AND CATCH PITS**

#### **E94.1 Description**

E94.1.1 This Specification shall supplement CW 2130 for the complete removal of existing manholes, catchbasins and catch pits from the ground.

#### **E94.2 Construction Methods**

E94.2.1 Final backfill shall be Class 2 backfill according to CW 2030.

#### **E94.3 Measurement and Payment**

E94.3.1 Measurement and payment shall be according to CW 2130 and also include all work necessary to perform the removal.

### **E95. CATCHBASINS**

#### **E95.1 Description**

E95.1.1 This Specification shall supplement CW 2130 for catchbasins as it pertains to the detail for Beehive Ditch Inlet.

#### **E95.2 Construction Methods**

E95.2.1 Install Beehive Ditch Inlet according to SD-025 except as modified in C2-CU-028 detail for Beehive Ditch Inlet.

E95.2.2 Install grouted stone rip rap according to CW 3615.

E95.2.3 Install fiber roll according to manufacturer's recommendations.

### E95.3 Measurement and Payment

- E95.3.1 Measurement and payment for Beehive Ditch Inlet shall be according to CW 2130 4.4 except payment shall also include the grouted stone rip rap and fibre roll. There will be no separate measurement and payment for grouted stone rip rap and fibre roll associated with Beehive Ditch Inlets.
- E95.3.2 Measurement and payment for Beehive Ditch Inlet shall be according to CW 2130 4.4 except payment shall also include the grouted stone rip rap and fibre roll. There will be no separate measurement and payment for grouted stone rip rap and fibre roll associated with Beehive Ditch Inlets.
- E95.3.3 Measurement and payment for "Insulate Catch Basin" will be for each unit supplied and installed as detailed.
- E95.3.4 Measurement and payment for "U-Box Around LDS" will be for each unit supplied and installed as detailed.

### E96. **MANHOLES**

#### E96.1 Description

- E96.1.1 This Specification shall supplement CW 2130 for manholes.

#### E96.2 Materials

- E96.2.1 Some manholes shown on the Drawings require a beehive inlet cover as a substitute for a standard frame and cover, grouted stone rip rap and fiber roll as shown on C2-CU-028 detail for Beehive Ditch Inlet.

#### E96.3 Measurement and Payment

- E96.3.1 Measurement and payment for manholes with a base diameter of 2,400 mm and larger will be paid for each unit. Measurement and payment for all other manholes will be based on CW 2130.
- E96.3.2 Measurement and payment for manholes shall include the base diameter and height, transition slabs, all stubs, connections and plugs as indicated on the Drawings. No separate measurement and payment will be made for these components.
- E96.3.3 Measurement and payment for Beehive Inlet Cover for Manholes will be made per unit for each manhole where the beehive lid, grouted rip rap and fiber roll are installed as detailed to a manhole. Measurement and payment shall include substituting a standard manhole lid and frame with a beehive lid and frame and include supply and installation of the grouted stone rip rap and fiber roll and all other features detailed.

### E97. **PRE-INSULATED HEAT TRACED PIPE**

#### E97.1 Description

- E97.1.1 This Specification supplements City of Winnipeg Standard Construction Specification CW 2130 Gravity Sewers for PVC LDS leads that are shown on the Drawings to be pre-insulated and heat traced.

#### E97.2 Materials

##### E97.2.1 Pre-insulated pipe

###### (a) Factory Applied Insulation

- (i) Rigid polyurethane foam, factory applied.
- (ii) Thickness: 50.8 mm (2 in) or as required.
- (iii) Density: (ASTM D1622) 35 to 48 kg/m<sup>3</sup> (2.2 to 3.0 lbs/ft<sup>3</sup>).
- (iv) Closed cell content: (ASTM D6226) ninety percent (90%), minimum.

- (v) Water absorption: (ASTM D2842) maximum four percent (4%) by volume.
- (vi) Thermal conductivity: (ASTM C518) 0.020 to 0.025 W/m°C (0.14 to 0.17 Btu in/ft<sup>2</sup> hr °F).
- (vii) Temperature range: Cryogenic to 93.3 °C (200 °F).

(b) Outer Jacket

- (i) Jacket material: Extruded black high density polyethylene copolymer, UV inhibited and factory applied.
- (ii) 1.90 mm thick
- (iii) Minimum cell classification 435560A for PE as per ASTM D3350.
- (iv) Minimum two percent (2%) carbon black, well dispersed.
- (v) Density 0.953 g/cm<sup>3</sup> (59.5 lbs/ft<sup>3</sup>) ASTM D4883.
- (vi) Tensile Strength at yield (50.8 mm (2 in) /min) 26 MPa (3700 psi), ASTM D638.

(c) Bell and Spigot Joints

- (i) Heat shrink sleeve of sufficient width for pipe size for heat traced pipe.

E97.2.2 Thermocable

- (a) C13-240-COJ Constant Watt Trace Cable (13 W/m)

E97.3 Construction Methods

- E97.3.1 Installation shall be according to specifications and manufacturer's recommendations and specifications.

E97.4 Method of Measurement and Basis of Payment

- E97.4.1 Measurement and payment for Pre-Insulated Heat Traced Leads will be on a length basis measured from catchbasin/manhole to catchbasin/manhole and shall include supply and installation of all materials specified and detailed on the Drawings. Measurement and payment for heat trace elements to be supplied and installed outside of the limits of the manhole/catchbasin segments of pre-insulated pipe such as the connecting cables to the Pumping Station, junction boxes, control panel shall be included in the Pumping Station price.

**E98. LDS INLET HEADWALL WITH GRATE**

E98.1 Description

- E98.1.1 This Specification covers the supply and installation of pre-fabricated inlet headwall and grate as an end treatment where otherwise open-ended LDS leads daylight to ground surface.

E98.2 Materials

- E98.2.1 Headwall product shall be compatible with pipe material

E98.2.2 Headwall

- (a) Composite reinforced polymer concrete
- (b) 45 degree head slope
- (c) Galvanized security grid grate
- (d) Acceptable products: Pro-Eco-Lite Series 1.5 Standard Headwall or approved equal in according to B8.

E98.3 Submittals

- E98.3.1 Submit headwall and grate material to Contract Administrator.

E98.4 Construction Methods

- E98.4.1 The pipe termination and end treatments are located on private property.
- E98.4.2 A temporary construction easement will be put in place by the City.
- E98.4.3 Contractor shall schedule and stage construction so that the installation of the pipe termination and end treatment on private land is performed only when the temporary easement is in place.
- E98.4.4 Install in accordance with manufacturer's recommendations, bedding according to CW 2030 and Class 2 backfill according to CW 2030.
- E98.4.5 Perform surface restorations according to CW 1130.
- E98.5 Method of Measurement and Basis of Payment
- E98.5.1 Measurement and payment for "LDS Headwall with Grate" will be made on a unit basis and include supply and installation of the headwall and grate as well as all excavation, backfill and surface restorations.

## **PUMPING STATION**

### **E99. SUB STRUCTURE**

#### **E99.1 Description**

- E99.1.1 Sub Structure shall include all Work related to the construction of the cast in place concrete Pumping Station sub structure as shown on the Drawings and described herein including formwork, reinforcement, concrete, water stop, concrete accessories, concrete testing, backfilling, caissons and miscellaneous items.
- E99.1.2 Construction of cast in place concrete wet well and substructure to be completed in accordance with the Drawings and the relevant Specifications outlined in E61 and E62.
- E99.1.3 Construction of the monorail located in the sub structure is to be completed in accordance with the Drawings and Division 41 of the National Master Specification (NMS) format listed herein.

#### **E99.2 Measurement and Payment**

##### **E99.2.1 Sub Structure**

- (a) Sub Structure shall not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for "Sub Structure", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.

### **E100. SUPER STRUCTURE**

#### **E100.1 Description**

- E100.1.1 Super Structure shall include all work related to the construction of the building super structure as shown on the Drawings and described herein. Included as a part of this work is masonry, metals, wood products, thermal and moisture protection, doors, finishes and miscellaneous items. Include all relevant work whether identified, implied, or required to perform the Work and provide a complete and functional Pumping Station building.
- E100.1.2 Construction of the Super Structure is to be completed in accordance with the Drawings and Divisions 04, 05, 06, 07, 08 and 09 of the National Master Specification (NMS) format listed herein.

#### **E100.2 Measurement and Payment**

E100.2.1 Super Structure

- (a) Super Structure shall not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for "Super Structure", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.

E101. **PROCESS MECHANICAL SYSTEMS**

E101.1 Description

E101.1.1 Process Mechanical Systems shall include all work described herein and as shown on the Drawings. Included as a part of this work are vertical submersible pumps, submersible solids handling pumps, wet well accessories, process mechanical piping, gates, valves, electric valve actuators, testing and miscellaneous items. Include all relevant work whether identified, implied, or required to perform the Work and provide a complete and functional process mechanical system.

E101.1.2 Process Mechanical System works is to be completed in accordance with the Drawings and Divisions 40, Sections 40 05 90.01 to 40 23 19.01, and Division 43 of the National Master Specification (NMS) format listed herein.

E101.2 Measurement and Payment

E101.2.1 Process Mechanical Systems

- (a) Process Mechanical Systems shall not be measured. This Item of Work will be paid for at the Contract Unit Price for "Process Mechanical Systems", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.

E102. **PLUMBING AND HVAC MECHANICAL SYSTEMS**

E102.1 Description

E102.1.1 Plumbing and HVAC Mechanical Systems shall include all work identified herein and as shown on the Drawings. Included as a part of this work is domestic plumbing water piping, valves, air handling units, exhaust fans, unit heaters, louvers, dampers, ducting, duct insulation and coverings, vibration isolation, testing and miscellaneous items. Include all relevant work whether identified, implied, or required to perform the Work and provide a complete and functional HVAC and domestic plumbing system.

E102.1.2 Plumbing and HVAC Mechanical works is to be completed in accordance with the Drawings and Divisions 10, 21, 22 and 23 of the National Master Specification (NMS) format listed herein.

E102.2 Measurement and Payment

E102.2.1 Plumbing and HVAC Mechanical Systems

- (a) Plumbing and HVAC Mechanical Systems shall not be measured. This Item of Work will be paid at the Contract Lump Sum Price for "Plumbing and HVAC Mechanical Systems", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.

E103. **ELECTRICAL, INSTRUMENTATION AND CONTROL SYSTEMS**

E103.1 Description



- E103.1.1 Electrical Systems shall include all work identified herein and as shown on the Drawings. Included as a part of this work is natural gas generator, the motor control center, panels, conduit, wire, cable, box connectors, fastenings and support, wiring devices, switches, grounding, transformers, panel boards, circuit breakers, surge suppressors, terminations, mounting and wiring of the emergency generator transfer switch, lighting, testing and miscellaneous items. Include all relevant work whether identified, implied, or required to perform the Work and provide a complete and functional electrical system.
- E103.1.2 Instrumentation and Control Systems shall include all work identified herein and as shown on the Drawings. Included as a part of this work is the programmable logic controller, SCADA equipment, telephone line, ultrasonic level sensors, programming, testing and miscellaneous items. Include all relevant work whether identified, implied, or required to perform the Work and provide a complete and functional instrumentation and control system
- E103.1.3 Electrical works is to be completed in accordance with the Drawings and Division 26 of the National Master Specification (NMS) format listed herein.
- E103.1.4 Instrumentation and Control Systems works is to be completed in accordance with the Drawings and Division 40, Section 40 90 00 to 40 96 50 of the National Master Specification (NMS) format listed herein.

E103.2 Measurement and Payment

E103.2.1 Electrical, Instrumentation and Control Systems

- (a) Electrical, Instrumentation and Control Systems shall not be measured. This Item of Work will be paid at the Contract Lump Sum Price for "Electrical, Instrumentation and Control Systems", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.

E104. **GROUNDWATER DEPRESSURIZATION FOR PUMPING STATION**

E104.4 General

- (a) This specification covers drawdown and depressurization of the bedrock groundwater pressures to facilitate construction of the Pumping Station.

E104.5 Groundwater Management Plan for Pumping Station

- (a) Provide the Contract Administrator with a Groundwater Management Plan for the Pumping Station works at least twenty (20) Business Days prior to the scheduled commencement of groundwater depressurization works.
- (b) The Plan shall be prepared and submitted in a format that clearly identifies how the Contractor will undertake the works, specifically to address the requirements for bedrock groundwater depressurization and dewatering, including:
- (i) the supply, installation and testing of pumping wells;
  - (ii) the supply, installation, testing and commissioning of a bedrock groundwater depressurization pumping system;
  - (iii) bedrock groundwater depressurization system operation;
  - (iv) bedrock groundwater depressurization system decommissioning; and,
  - (v) well decommissioning.
- (c) Hydrogeological investigations were undertaken by W. L. Gibbons and Associates. The report is available in in Appendix 'I'.

- (d) The Groundwater Management Plan for Pumping Station shall include provisions for drawing down the bedrock pressures sufficient to lower the pressure to 1 m below the base of the excavation. This will require the use of wells. The Groundwater Management Plan for Pumping Station shall be further updated or altered as dictated by Site conditions. The Groundwater Management Plan for Pumping Station shall remain in effect until all construction and backfill activities are completed. Note the following regarding the Plan:
  - (i) conformance to D22 Dewatering and Drainage during Construction.
- (e) Subject to the approval of the Contract Administrator, water with negligible suspended solids may be pumped into the LDS.
- (f) For water containing suspended solids, provide alternative means to remove the water from the Site.
- (g) 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.

#### E104.6 Construction Methods

##### E104.6.1 General

- (a) The Contract Administrator will obtain the permit(s) required for groundwater withdrawal and discharge. Comply with the terms and conditions associated with these permits.
- (b) Contractor to provide access to the wells and groundwater depressurization system.
- (c) Operate the full groundwater depressurization system continuously for at least 48 hours before initiation of excavation in the affected areas. Increase this duration as required based on monitoring of field groundwater conditions.
- (d) The Contractor is advised that the Contract Administrator will observe the installation, operation, monitoring, and decommissioning of the groundwater depressurization system and all associated works.
- (e) Maintain all pumping and monitoring wells within the construction area for the duration of the Work. Repair or replace any well damaged during the course of the Work.
- (f) Be responsible for damage to any groundwater depressurization or monitoring system components during construction activities. Repair or replace damaged components to the satisfaction of the Contract Administrator.

##### E104.6.2 Pumping Well Installation and Testing

- (a) The work includes the furnishing of all labour, materials, supplies, equipment, tools, transportation and appurtenances necessary to complete the satisfactory drilling, casing construction, disinfection, logging, development, pumping tests and submittals of logs and test results for nominal 200 mm (8 inch) diameter steel cased bedrock pumping wells.
- (b) Previous test work at the Waverley Underpass site has indicated that sufficient bedrock groundwater depressurization can likely be achieved by pumping groundwater at rates on the order of 18.9 Lps (250 lgpm). The actual flow rates required to achieve the required bedrock groundwater depressurization will be determined by the Contract Administrator based on the results from pumping tests completed after each pumping well has been installed. The number of pumping wells needed to achieve the required depressurization will also be determined by the Contract Administrator based on the results from pumping testing completed after each pumping well has been installed. A minimum of two 200 mm (8 inch) pumping wells will be required, and potentially up to 4 pumping wells.
- (c) The location of the pumping wells will be determined by the Contractor in consultation with the Contract Administrator. The pumping wells are to be placed as close as practical to the excavation without adversely affecting access to the excavation and construction operations. The minimum setback from the excavation limits will be 3 m.

The maximum setback from the excavation limits will be 30 m, or as approved by the Contract Administrator. For a two well pumping system, the wells are to be placed on opposite sides of the excavation. For a four well pumping system, the wells are to be placed one each on the four sides. Setback from the edge of the excavation will be determined by the Contract Administrator in consultation with the Contractor and the proposed construction methodology, including shoring locations, equipment and material access and egress requirements.

- (d) The following is a summary of the work to be completed for each pumping well required:
- (i) drill borehole to the top portion of the bedrock and set 200 mm (8 inch) steel casing into competent bedrock in a three tier step down socket. The steel casing is to be grouted in place with cement, placed with a tremie line, to surface. Pneumatic grout pumps shall be used to pump the grout from bottom to top;
  - (ii) drill open hole in bedrock to a maximum depth of 36.6 m (120 feet). Drilling beyond a depth of 36.6 m will only be done with the approval of the Contract Administrator. Drilling of open borehole beyond a depth of 36.6 m will be paid separately from the Lump Sum cost for each pumping well;
  - (iii) develop the well to remove cuttings and fine sediment using airlift pumping, surge blocks and jetting as required to remove the particulate and produce a well that pumps free and clear of sediment. An eight (8) hour level of effort for development of each pumping well is to be assumed. Development, as required and approved by the Contract Administrator, beyond the eight (8) hour level of effort will be paid separately from the Lump Sum cost for each pumping well;
  - (iv) perform a four (4) hour pumping and recovery test on each pumping well following completion. Water levels in the pumping well are to be measured during the test using a depth sounder. Flow rates are to be checked regularly. Provide the Contract Administrator with the results of the pumping test. Recovery is to be recorded until eighty percent (80%) recovery has been achieved. The Contract Administrator will be monitoring the groundwater level response to pumping in other on-site wells. Coordinate all activities with the Contract Administrator;
- (e) Existing Stratigraphy – See geotechnical and hydrogeologic logs for details of the stratigraphy. In general, there is clay and glacial till overburden to a depth below grade of approximately 16.8 m below grade followed by limestone carbonate bedrock.
- (f) Water For Well Drilling – Make arrangements to obtain fresh clean water and transport to site.
- (g) Definitions
- (i) Cement Grout – Mixture of high sulfate Portland cement (Type 50) and water mixed at a ratio of one 40 kg bag of cement to 20 litres of fresh clean water. Do not add any aggregate or stone.
  - (ii) Tremie Pipe – A small diameter placed inside the well annulus through which grout is piped down and used to carry grout to the bottom of the well annulus and to eliminate air pockets. Tremie pipes prevent bridging of materials and diluting of liquid grouts.
  - (iii) Drilling Mud – A suspension of finely divided heavy material, such as bentonite and barite, pumped through the drill pipe during rotary drilling to seal off porous zones and flush out cuttings, and to lubricate and cool the bit. Drilling fluids must be mixed thick (viscous) enough to bring cuttings up from the bottom of the hole to the surface, yet not so viscous as to prevent their settling out in the mud pits.

- (h) Quality Assurance
  - (i) Contractor shall have been engaged in the business of test pumping, construction of test holes and wells of diameter, depth, and equivalent production equivalent to the proposed pumping wells for a period of at least ten (10) years. Well driller on site to have at least 10 years' experience.
  - (ii) Be thoroughly familiar with governing regulations having jurisdiction on this project. The driller shall be a licensed Water Well Driller by the Province of Manitoba.
  - (iii) Use qualified workmen who are fully familiar with this work and perform all work under the direct supervision of an experienced well driller with a minimum of 10 years' experience.

#### E104.6.3 Groundwater Depressurization System Installation

- (a) Supply and install pumps, drop pipes, well head connections, valves and flow metres as required to meet manufactures specifications and to provide a fully functioning system. Verify the design and sizing of the pumps including power supply requirements, drop piping and other appurtenances to be used within the overall groundwater depressurization system. The combined pumping flow rate required is anticipated to be in the 18.9 Lps (250 lpm, +/-) range. The actual combined total pump flow rate requirement and the individual well flow requirement will be determined by the Contract Administrator following the installation and testing of the pumping wells.
- (b) Supply and install all appurtenances related to electrical components, including but not limited to transformers, wiring, electrical disconnect and motor starter, to meet the enclosures. Configure the electrical system to allow pumps to be operated concurrently or independently as required.
- (c) Provide a back-up power supply complete with automatic transfer switch to engage back-up power in the event of a failure of the primary power supply. Back-up power supply to be rated to supply sufficient power to operate all pumps. As part of the system performance verification testing, the Contractor will be required to demonstrate that the back-up power supply will automatically engage and operation of the pumps will resume.
- (d) Install discharge hoses from the well heads to the point of discharge. Direct discharge to energy dissipation mats for surface discharge or directly to an approved land drainage system manhole. If pumping is conducted in winter conditions, protect the discharge lines from freezing. Lay discharge hoses so as not to interfere with access or activities at the site, or provide suitable crossing structures to maintain access. Be responsible for all site preparation at the end of each discharge pipe.

#### E104.6.4 System Performance Verification Testing

- (a) Undertake groundwater depressurization system performance verification testing and monitoring following installation and commissioning of the groundwater depressurization system. This testing will involve simultaneous operation and monitoring of all system wells (or as directed by the Contract Administrator) for a minimum period of forty-eight (48) hours.
- (b) Monitor flow rates and groundwater levels within the on-site pumping and monitoring wells during performance verification testing. The Contract Administrator shall additionally monitor instrumentation in the areas relative to possible groundwater depressurization impacts to local domestic well users.

#### E104.6.5 Groundwater Depressurization System Operation

- (a) Notify the Contract Administrator as least forty-eight (48) hours prior to any dewatering activities.
- (b) Operate and maintain the groundwater depressurization system on a twenty-four (24) hour per day basis for the duration of construction activity that requires lowered groundwater levels.

- (c) The required discharge rate will depend on groundwater elevations at the time of construction and the elevation at the base of the excavation and will be specified by the Contract Administrator at the start of construction and revised periodically during construction based on the monitoring results provided and on the final depth of excavation required.
- (d) Monitor and record the flow rate at each pumping well once every hour. Measure and record ground water levels in the pumping wells once every twenty-four (24) hours. Provide copies of the field data sheets to the Contract Administrator daily.
- (e) Monitor and record groundwater levels in all of the monitoring wells at the site once every twenty-four (24) hours. Provide copies of the field data sheets to the Contract Administrator daily.
- (f) The Contract Administrator will be monitoring the depressurization system throughout the duration of the Work. Cooperate and provide the Contract Administrator with assistance upon request.
- (g) Non-Operating Periods: The wells shall be equipped with well seals to prevent infiltration of surface water into the underlying bedrock aquifer or the discharge of groundwater from the wells. Ensure that these components are in place and maintained during non-operating periods. Remove and reinstall equipment if necessary during non-operating periods.
- (h) Do not make changes to the set up or operation of the groundwater depressurization system without prior written acceptance by the Contract Administrator. Where emergency changes are required to maintain the system in a fully functioning manner, take the appropriate action and then immediately advise the Contract Administrator of the actions taken and the reasons therefore. If requested by the Contract Administrator, provide a written report of the source of the problem, the actions taken to rectify the issue and the steps taken to ensure the problem does not occur.

E104.6.6 Groundwater Depressurization System Decommissioning

- (a) Remove all pumps, back-up pumps, drop piping, connections, control valves, flow metres, discharge hose, energy dissipation mats and other appurtenances.

E104.6.7 Well Decommissioning

- (a) Decommissioning all pumping and observation wells at the end of construction.
- (b) For open bedrock holes, backfill the lower portion of the wells that extend into the carbonate bedrock aquifer with clean sand. Tremie backfill the remaining casing with bentonite /cement grout to ground surface. Cut the casing off a minimum of 1 m below grade.
- (c) For screened monitoring wells, tremie back the entire length with bentonite / cement grout up to ground surface. Cut the casing off a minimum of 1 m below grade.

E104.6.8 Construction Sequence

- (a) In order to minimize any potential impacts of pumping on nearby domestic wells, the construction sequence shall be such that the excavations for which depressurization is required are completed either simultaneously or within the shortest possible overall time frame. Coordinate and schedule the work in a manner that minimizes the duration that groundwater depressurization is required.

E104.7 Quality Control / Quality Assurance

- E104.7.1 All materials supplied under this Specification will be subject to inspection and testing by the Contract Administrator or by a certified testing laboratory designated by the Contract Administrator.

E104.8 Method of Measurement

- E104.8.1 Pumping Well Installation and Testing

- (a) The supply, installation and testing of the pumping wells will be measured on a per well basis for the installation and testing of the pumping wells to the specified requirements.
- (b) Additional costs for drilling beyond the specified depth will be measured on a per metre basis beyond the specified depth.
- (c) Well development beyond the specified time will be measured on a per hour basis beyond the specified time.

E104.8.2 Groundwater Depressurization System Installation

- (a) The supply and installation of the groundwater depressurization system (including system performance verification testing) will be measured on a Lump Sum basis.

E104.8.3 Groundwater Depressurization System Operation

- (a) Operation of the groundwater depressurization system will be measured on a Lump Sum basis.

E104.8.4 Groundwater Depressurization System Decommissioning

- (a) The groundwater depressurization system decommissioning will be measured on a Lump Sum basis.

E104.8.5 Well Decommissioning

- (a) Well decommissioning will be measured on a per well basis for pumping and monitoring wells.

E104.9 Basis of Payment

E104.9.1 Pumping Well Installation and Testing

- (a) The supply, installation and testing of the pumping wells will be paid for at the Contract Unit Price for "Pumping Well Installation" measured as specified herein, which will be payment in full for the installation, development and testing of the pumping well to the specifications.
- (b) The drilling of pumping wells beyond the specified depth will be paid for at the Contract Unit Price for "Additional Pumping Well Drilling Depth" measured as specified herein, which will be payment in full for drilling beyond the specified depth.
- (c) The development of wells beyond the specified time will be paid for at the Contract Unit Price for "Additional Well Development" measured as specified herein, which will be payment in full for development beyond the specified time.

E104.9.2 Groundwater Depressurization System Installation

- (a) The supply, installation and performance verification testing of the groundwater depressurization system will be paid for at the Contract Lump Sum Price for "System Installation" measured as specified herein, which will be payment in full for performing all operations herein described and all other items incidental to the Work to provide a fully functioning groundwater depressurization system.

E104.9.3 Groundwater Depressurization System Operation

- (a) Operation of the groundwater depressurization system will be paid for at the Contract Unit Price for "System Operation" measured as specified herein, which will be payment in full for performing all operations herein described and all other items incidental to the Work.

E104.9.4 Groundwater Depressurization System Decommissioning

- (a) The groundwater depressurization system decommissioning will be paid for at the Contract Lump Sum Price for "System Decommissioning" measured as specified herein, which will be payment in full for performing all operations herein described and all other items incidental to the Work.

E104.9.5 Well Decommissioning

- (a) Pumping well decommissioning will be paid for at the Contract Unit Price for “Pumping Well Decommissioning” measured as specified herein, which will be payment in full for performing all operations herein described and all other items incidental to the Work.
- (b) Monitoring well decommissioning will be paid for at the Contract Unit Price for “Monitoring Well Decommissioning” measured as specified herein, which will be payment in full for performing all operations herein described and all other items incidental to the Work.

## **E105. REGULATORY REQUIREMENTS**

### **E105.1 General**

- E105.1.1 If the National Building Code of Canada applies to the Work, the standards of the Work shall conform to or exceed the minimum standards of the National Building Code of Canada.

### **E105.2 Regulations, Standards and Codes**

- E105.2.1 Codes, Standards and Regulations are specified in other sections of the Specifications and the Work shall be done in accordance with those Codes, Standards and Regulations where applicable.

### **E105.3 Permits**

- E105.3.1 The Contractor is required to obtain all Permits for the Pumping Station component of this project.

### **E105.4 Measurement and Payment**

- E105.4.1 Regulatory Requirements shall not be measured for payment and will be considered incidental to the construction of the Pumping Station.

## **E106. DRAWINGS OF RECORD**

### **E106.1 Record During Construction**

- E106.1.1 The Contractor shall keep one complete set of all construction drawings on the Site.
- E106.1.2 On the site set of Contract Drawings, the Contractor shall record any changes that are made during the actual construction of the Work. The purpose of recording these changes is to provide drawings of record at the end of the Pumping Station work. The Contractor shall be responsible for the adequacy and the reliability of the information recorded on the Drawings of Record
- E106.1.3 At the completion of Pumping Station construction, the Contractor shall turn over the set of construction drawings that have been marked up with changes during the course of work to the Contract Administrator to permit the Contract Administrator to prepare the Drawings of Record of the Work.

### **E106.2 Measurement and Payment**

- E106.2.1 Drawings of Record shall not be measured for payment and will be considered incidental to the construction of the Pumping Station.

## **E107. MATERIAL AND INSTALLATION**

### **E107.1 General**

- E107.1.1 This Specification covers all operations relating to material and installation.

E107.1.2 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.

#### E107.2 Quality

E107.2.1 Material and Product supplied and installed shall be new. Material and Product supplied shall conform to these Specifications and to specified standards.

E107.2.2 Workmanship shall be the best quality, executed by workmen experienced and skilled in their respective trades

E107.2.3 Ensure full cooperation among all trades and coordination of the Work with continuous supervision.

E107.2.4 Use Material of one manufacturer for Material of the same type or classification. Do not mix different manufacturer's Material in the Work or in parts of the Work.

#### E107.3 Manufacturer's Instructions

E107.3.1 Unless otherwise specified, comply with the manufacturer's/supplier's instructions for Material or Product and installation methods.

E107.3.2 Notify the Contract Administrator in writing of any conflict between these Contract Specifications and the instructions of the manufacturer/supplier.

#### E107.4 Fastenings

E107.4.1 Provide metal fastenings and accessories in the same texture, Colour and finish as the base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use noncorrosive fasteners, anchors and spacers for securing exterior work, or work that may be located in a corrosive atmosphere.

E107.4.2 Space anchors within limits of load bearing or shear capacity and ensure that they provide positive permanent anchorage.

E107.4.3 Space fastening evenly and lay out neatly.

#### E107.5 Delivery and Storage

E107.5.1 Deliver, store and maintain packaged Material and Product with manufacturer's seals and labels intact.

E107.5.2 Prevent damage and soiling of Material and Product.

E107.5.3 Store Material and Product in accordance with instructions of the manufacturer/supplier.

E107.5.4 Provide suitable area or buildings where storage is weatherproof, if dry area are recommended by the manufacturer/supplier.

E107.5.5 Material shall have name plates displaying Material data and serial numbers.

E107.5.6 Measurement and Payment

E107.5.7 Material and Installation shall not be measured for payment and will be considered incidental to the construction of the Pumping Station.

### E108. COORDINATION OF SECTIONS/TRADES

#### E108.1 General

E108.1.1 This Specification covers all operations relating to the co-ordination of the sections/trades.



- E108.1.2 Although the Specifications set forth the Work of various trades under separate Sections or Clauses, it is not intended that the Work of that trade is limited to or includes all Work set forth in that particular Section or Clause. The Contractor shall delegate the extent of the Work to be done by the various trades and shall coordinate execution of the Work by all trades.
- E108.1.3 Neither the Contract Administrator nor the City will be an arbitrator to establish limits of any agreements between the Contractor and their Subcontractors.
- E108.2 Mechanical, Electrical Process and Instrumentation and Controls Coordination
- E108.2.1 The Contractor shall examine the electrical, HVAC, plumbing, sub structure, superstructure, process and instrumentation and controls Drawings before beginning the Work and report to the Contract Administrator any discrepancies or interferences.
- E108.2.2 Electrical, HVAC, plumbing and process mechanical system layouts shown on the Drawings may be diagrammatic and locations of outlets, fittings and equipment are approximate. Exact routing of conduits, wiring, pipes and tables shall be determined and coordinated by the Contractor to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- E108.2.3 Obtain the Contract Administrator's approval for locations of outlets, fittings and equipment.
- E108.3 Cutting and Patching
- E108.3.1 The Contractor shall do all cutting, fitting, or patching of the Work that may be required to make its several parts come together properly and fit it to receive or be received by work of the Contract.
- E108.3.2 Any cost caused by cutting and patching due to ill-timed work shall be borne by the Contractor.
- E108.3.3 The Contractor shall not endanger any adjacent property or portion of the Work by cutting, digging or any other method, and shall be responsible for any damages caused by him.
- E108.3.4 Coordinate the Work to minimize the amount of cutting and patching required.
- E108.3.5 Do no cutting that may impair the strength of structures. Obtain the Contract Administrator's approval before cutting, boring or sleeving load-bearing members.
- E108.3.6 Make cuts clean and smooth and make patches equivalent to new work. Provide openings, holes and sleeves as required for process mechanical, building mechanical, electrical and all other components of the Work. Provide openings in pre-cast work and cast-in-place work.
- E108.3.7 Drill or field cut smaller openings or holes and cast openings larger than 100 mm diameter.
- E108.4 Concealment
- E108.4.1 Conceal pipes, ducts, conduits within walls and ceilings of finished areas, as required by the Contract.
- E108.5 Measurement and Payment
- E108.5.1 Coordination of Sections/Trades shall not be measured for payment and will be considered incidental to the construction of the Pumping Station.

## E109. **CONSTRUCTION FACILITIES**

- E109.1 General

- E109.1.1 This Specification covers all operations relating to the construction facilities.
- E109.1.2 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.
- E109.2 Temporary Utilities
- E109.2.1 The Contractor shall be responsible for the cost of all temporary utilities.
- E109.2.2 Natural Gas, Gasoline and Other Fuels
- (a) Provide and pay all costs for natural gas, gasoline and other fuels required for the performance of the Work, in accordance with governing regulations and ordinances, and the Contract.
  - (b) Furnish and install all necessary temporary piping and upon completion of the Work remove all such temporary piping.
- E109.2.3 Water
- (a) See Specification E5 – Water Obtained from the City regarding use of City water.
  - (b) Furnish and install all necessary temporary piping and upon completion of the Work remove all such temporary piping.
- E109.2.4 Electricity and Lighting
- (a) Provide and pay all costs for electricity and artificial lighting required for the performance of the Work, in accordance with governing regulations and ordinances, and the Contract.
  - (b) Furnish and install all necessary temporary wiring, distribution boxes, panels, etc., and upon completion of the Work, remove all such temporary installations.
- E109.2.5 Heating and Ventilation
- (a) Provide and pay all costs for heating and ventilating, coverings, and enclosures as necessary to protect and perform the Work.
  - (b) Furnish and install all necessary temporary equipment, piping, wiring, ducting, and other materials to perform the Work and upon completion of the Work, remove all such temporary equipment.
  - (c) Temporary heating and ventilating shall be in accordance with all governing regulations and ordinances, and the Contract.
  - (d) Temporary heating and ventilating shall be provided to:
    - (i) Facilitate progress of the Work
    - (ii) Protect the Work and Product and Material against dampness
    - (iii) Prevent moisture condensation on surfaces
    - (iv) Provide an atmosphere for curing Material as required
    - (v) Provide adequate ventilation to meet safety regulations
    - (vi) Prevent hazardous accumulation of dust, fumes, mist, vapours or gases in areas occupied during construction
    - (vii) Ventilate storage spaces containing hazardous or volatile materials.
- E109.2.6 Fire Protection
- (a) Provide and pay all costs for adequate fire protection of the Work and adjacent property.
  - (b) Furnish and install temporary extinguishers, hydrants and other equipment, and upon completion of the Work remove all such temporary equipment.
- E109.3 Construction Aids

#### E109.3.1 Temporary Plant

- (a) Provide, arrange for, maintain and pay for all temporary items such as, but not limited to, stairs, ladders, scaffolding, ramps, transportation of labour and material, runways, chutes, hoists, elevators, tools, templates, as required for the completion of the Work.
- (b) The location of such items shall be such as to prevent inference with, marking of, or damages to any portion of the Work.
- (c) All such items shall conform to all applicable national and local ordinances regulating safety and to the National Building Code of Canada, and to the requirements of the Contract.

#### E109.3.2 Temporary Enclosures

- (a) Furnish, install and maintain for the duration of construction all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms and other temporary construction necessary for proper completion of the Work in compliance with all pertinent safety and other regulations.
- (b) During the construction of Pumping Station, a temporary chain link fence 1.8 m in height shall be erected around the perimeter of the Work. The Contractor shall be responsible for maintaining the chain link fence in a proper working condition. Provide a 6 m wide lockable gate. The cost of this work shall be incidental to the Contract.

#### E109.3.3 Falsework and Temporary Construction Supports

- (a) The Contractor shall be responsible for means and methods used for the falsework and temporary construction supports.
- (b) The Contract requires that the Contractor employ a qualified Registered Professional Engineer for the design of temporary works, and design in accordance with CSA S269.1.
- (c) Record design calculations and Drawings to show that temporary works are adequate. Provide design loads, material details, and dimensions. Sign and seal design calculations and Drawings, and revisions thereto.
- (d) The Contract Administrator's approval to proceed with falsework and temporary construction supports shall not relieve the Contractor of their responsibility under the Contract. The Contract Administrator's review shall be for general conformance to the intent of design and for permanent effects on the Site, or areas adjacent to the Site.

#### E109.3.4 Temporary Excavation

- (a) The Contractor is responsible for the means and methods of making temporary excavations in order to install components of the Work.

#### E109.3.5 Winter Construction

- (a) Special construction methods required to perform the Work in severe weather shall be the responsibility of the Contractor.
- (b) Where the Specifications call for work to be performed within a given temperature range or above a minimum temperature. It shall be the Contractor's responsibility to provide all temporary enclosures and heat necessary to provide the conditions specified.
- (c) Where compaction of backfill is specified, the Contractor shall perform the Work in a manner such that compaction can be achieved.
- (d) Where weather conditions are such that compaction of backfill consisting of excavated materials is not possible, the Contractor shall provide unfrozen granular material for backfill, at the Contractor's expense.

#### E109.3.6 Access Roads

- (a) Construct temporary access roads as necessary to perform the Work, and maintain temporary access roads until construction is over or until permanent access is established.

- (b) Locations and drainage facilities for temporary access roads are subject to the approval of the Contract Administrator.
- (c) No direct payment will be made to the Contractor for construction of temporary access roads.

E109.4 Measurement and Payment

- E109.4.1 Construction Facilities shall not be measured for payment and will be considered incidental to the construction of the Pumping Station.

E110. **STRUCTURAL EXCAVATION AND SHORING FOR PUMPING STATION**

E110.1 General

- E110.1.1 This Specification shall amend and supplement City of Winnipeg Standard Specification CW 2030 "Excavation Bedding and Backfill" and covers all requirements for structural excavation and shoring of the Pumping Station substructure
- E110.1.2 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.

E110.2 Submittals

- E110.2.1 Shoring designs shall be submitted in accordance with CW 2030.

E110.3 Measurement and Payment

- E110.3.1 Structural Excavation and Shoring for Pumping Station shall not be measured. This Item of Work will be paid for at the Contract Lump Sum Price for "Structural Excavation and Shoring for Pumping Station", which price shall be payment in full for supplying all materials and for completing all operations herein described and all other items incidental to the work included in this Specification, and accepted by the Contract Administrator.

E111. **ROADSIDE SAFETY IN CLOSE PROXIMITY TO PUMPING STATION EXCAVATION**

E111.1 General

- E111.1.1 Contractor to review roadside safety for the detour road in the vicinity of the Pumping Station in accordance with AASHTO Roadside Design Guide 4<sup>th</sup> Edition 2011 and based on a detour design speed of 60 km/h (posted 50 km/h). Contractor to implement mitigation measures, as required, in accordance with the City of Winnipeg Manual of Temporary Traffic Control on City Streets 2016. Provide a submittal, stamped by a Professional Engineer registered in the Province of Manitoba, summarizing the roadside safety review and any proposed mitigation measures.

E111.2 Measurement and Payment

- E111.2.1 This item shall not be measured for payment and will be considered incidental to the construction of the Pumping Station.

## PART F - SECURITY CLEARANCE

### F1. SECURITY CLEARANCE

- F1.1 Each individual proposed to perform the following portions of the Work:
- (a) any Work on private property, excluding lands expropriated by the City for the purposes of Contract 1 or Contract 2;
  - (b) any Work within City facilities other than:
    - (i) an underground structure such as a manhole;
    - (ii) the Pumping Station; and,
    - (iii) in areas and at times normally open to the public.
  - (c) communicating with residents and homeowners in person or by telephone.
- F1.1.1 Each Individual shall be required to obtain a Criminal Record Search Certificate from the police service having jurisdiction at their place of residence. Or
- (a) BackCheck, forms to be completed can be found on the website at: <http://www.backcheck.net/>; or
  - (b) Commissionaires (Manitoba Division), forms to be completed can be found on the website at: <https://www.commissionaires.ca/en/manitoba/home> .
- F1.2 The following is a link to information for obtaining the Criminal Record Search certificate from the City of Winnipeg Police Service. [http://winnipeg.ca/police/pr/info\\_request.stm](http://winnipeg.ca/police/pr/info_request.stm)
- F1.2.1 The Criminal Record Search shall include a Vulnerable Sector Screening. This can be obtained by following the link below [http://winnipeg.ca/police/pr/info\\_request.stm](http://winnipeg.ca/police/pr/info_request.stm)
- (a) individuals will need to state in the form, that they may be working in City of Winnipeg pools, libraries and community centres.
- F1.2.2 The original Criminal Record Search Certificate (Form P-253) will be provided by the Winnipeg Police Service to the individual applicant. The original has a validation sticker from the Winnipeg Police Service in the top right hand corner. The applicant shall:
- (a) provide the original Criminal Record Search Certificate (Form P-253) to the Contract Administrator.
- F1.3 Prior to the award of Contract, and during the term of the Contract if additional or replacement individuals are proposed to perform Work, the Contractor shall supply the Contract Administrator with a Criminal Record Search Certificate obtained not earlier than one (1) year prior to the Submission Deadline, or a certified true copy thereof, for each individual proposed to perform such Work.
- F1.4 Any individual for whom a Criminal Record Search Certificate is not provided, or for whom a Criminal Record Search Certificate indicates any convictions or pending charges related to property offences or crimes against another person will not be permitted to perform any Work specified in F1.1.
- F1.5 Any Criminal Record Search Certificate obtained thereby will be deemed valid for the duration of the Contract subject to a repeated records search as hereinafter specified.
- F1.6 Notwithstanding the foregoing, at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated criminal records search. Any individual who fails to provide a satisfactory Criminal Record Search Certificate as a result of a repeated criminal records search will not be permitted to continue to perform any Work specified in F1.1.